

PD-AAF-735

B1 ②

278-0243

UNITED STATES GOVERNMENT
2780243004201
memorandum
also 2780243005801

DATE: September 23, 1980
REPLY TO ATTN OF: Stanley A. Stalla, CD/E, A.I.D.

SUBJECT: Project Authorization

TO: Edgar C. Harrell, Director, USAID/Jordan

Your approval is required for a grant of \$ 5,000,000 from the Economic Support Fund appropriation to Jordan for the Ground Water Resources Investigation Project, 278-0243.

Discussion: The project consists of developing and gathering reliable data by means of drilling wells to various depths, conducting aquifer, geophysical and related tests for determining water quantity and quality from individual aquifers and developing a data storage and retrieval system.

Waivers: No waivers are contemplated at this time.

Justification to the Congress: The Congressional Notification, Advice of Program Change for this project was submitted to the Congress on September 12, 1980, and the waiting period expires on September 26, 1980.

Recommendation: That you sign the attached Project Authorization.

Clearance:

<u>NAME</u>		<u>INITIAL</u>	<u>DATE</u>
TPearson	CD	<u>TP</u>	<u>9/24/80</u>
DLeaty	PROG	<u>D</u>	<u>9/24/80</u>
EGiza	CONT	<u>EG</u>	<u>9/27/80</u>
GDavidson	RLA	<u>GD</u>	<u>9/23</u>
LRichards	DD	<u>LR</u>	<u>9/29/80</u>



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OPTIONAL FORM NO. 10
(REV. 7-78)
GSA FPMR (41 CFR) 101-11.6
5010-112

PROJECT AUTHORIZATION

Name of Country : Hashemite Kingdom of Jordan
Name of Project : Groundwater Resources Investigation
Number of Project: 278-0243

1. Pursuant to Section 532 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Groundwater Resources Investigation Project for Jordan involving planned obligations of not to exceed \$5,000,000 in grant funds over a two year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project.

2. The project consists of developing and carrying out a systematic investigation of the availability of groundwater in Northern Jordan.

3. The Project Agreement which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Goods and Services

Goods and services, except for ocean shipping, financed by A.I.D. under the Project shall have their source and origin in the United States and the cooperating country, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States.

b. Conditions Precedent to Disbursement

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement, the Cooperating Country shall furnish, in addition to the standard legal opinion and specimen signature(s), in form and substance satisfactory to A.I.D., evidence that a Project Manager has been designated for the Project.

c. The Cooperating Country Shall Covenant:

(i) to allow full and ready access to all well drilling sites and other places required for implementing the Project and to assure, to the extent that may be required, that such sites are free of mines and other explosive devices;

(ii) that all the organizations involved in the water sector will cooperate with the NRA in the implementation of the Project and will provide all hydrologic and other data presently available and which may become available, to the NRA for the purpose of achieving the objectives of the Project;

(iii) suitable NRA equipment and personnel, which are available at the time of this Agreement and are required to carry out the Project activities, will be assigned to the Project;

(iv) that the additional staff required to operate and maintain the equipment procured for the Project will be employed and trained; and that the equipment and qualified, trained staff will be used to carry out this similar Project.

Typed Name

Office Symbol

Date

Initials

Signature



Edgar C. Harrell
Typed Name of Authorization
Officer

AGENCY FOR INTERNATIONAL DEVELOPMENT PROJECT PAPER FACESHEET	1. TRANSACTION CODE <input type="checkbox"/> A A: ADD <input type="checkbox"/> C C: CHANGE <input type="checkbox"/> D D: DELETE	PP 2. DOCUMENT CODE 3
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3. COUNTRY/ENTITY Jordan	4. DOCUMENT REVISION NUMBER <input type="checkbox"/>
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5. PROJECT NUMBER (7 digits) <input type="text" value="278-0243"/>	6. BUREAU/OFFICE A. SYMBOL: NE B. CODE: <input type="text" value="3"/>	7. PROJECT TITLE (Maximum 40 characters) <input type="text" value="Groundwater Resources Investigation"/>
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8. ESTIMATED FY OF PROJECT COMPLETION FY <input type="text" value="84"/>	9. ESTIMATED DATE OF OBLIGATION A. INITIAL FY <input type="text" value="80"/> B. QUARTER <input type="text" value="4"/> C. FINAL FY <input type="text" value="81"/> (Enter 1, 2, 3, or 4)
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A. FUNDING SOURCE	FIRST FY			LIFE OF PROJECT		
	B. FX	C. L/C	D. TOTAL	E. FX	F. L/C	G. TOTAL
AID APPROPRIATED TOTAL	1,620		1,620	5,000		5,000
(GRANT)	(1,620)	()	(1,620)	(5,000)	()	(5,000)
(LOAN)	()	()	()	()	()	()
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY				000	3,765	3,765
OTHER DONOR(S)						
TOTALS	1,620		1,620	5,000	3,765	8,765

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		E. 1ST FY <u>80</u>		H. 2ND FY <u>81</u>		K. 3RD FY	
		C. GRANT	D. LOAN	F. GRANT	G. LOAN	I. GRANT	J. LOAN	L. GRANT	M. LOAN
(1) ESF	729	876		1,620		3,380			
(2)									
(3)									
(4)									
TOTALS				1,620		3,380			

A. APPROPRIATION	N. 4TH FY		Q. 5TH FY		LIFE OF PROJECT		12. IN-DEPTH EVALUATION SCHEDULED <input type="text" value="MM"/> <input type="text" value="YY"/> <input type="text" value="07"/> <input type="text" value="85"/>
	O. GRANT	P. LOAN	R. GRANT	S. LOAN	T. GRANT	U. LOAN	
(1) ESF					5,000		
(2)							
(3)							
(4)							
TOTALS					5,000		

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

1=NO
2=YES

14. ORIGINATING OFFICE CLEARANCE SIGNATURE: Edgar C. Harrell <i>Edgar C. Harrell</i> TITLE: Director, USAID/Jordan		15. DATE SIGNED <input type="text" value="09"/> <input type="text" value="30"/> <input type="text" value="80"/>	16. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION <input type="text" value="MM"/> <input type="text" value="DD"/> <input type="text" value="YY"/>
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**AGENCY FOR INTERNATIONAL DEVELOPMENT
PROJECT IDENTIFICATION DOCUMENT
FACESHEET (PID)**

1. TRANSACTION CODE
 A = Add
 C = Change
 D = Delete
 Revision No. _____

DOCUMENT CODE
1

2. COUNTRY/ENTITY
Jordan

3. PROJECT NUMBER
278-0243

4. BUREAU/OFFICE
 Near East/Capital Dev't
 A. Symbol: NE
 B. Code: 03

5. PROJECT TITLE (maximum 40 characters)
Ground Water Resources Investigation

6. ESTIMATED FY OF AUTHORIZATION/OBLIGATION/COMPLETION
 A. Initial FY: 80
 B. Final FY: 81
 C. PACD: 84

7. ESTIMATED COSTS (\$000 OR EQUIVALENT, \$1 =)

FUNDING SOURCE		LIFE OF PROJECT
A. AID		5,000
B. Other U.S.	1.	---
	2.	---
C. Host Country		3,765
D. Other Donor(s)		---
TOTAL		8,765

8. PROPOSED BUDGET AID FUNDS (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE		D. 1ST FY 80		E. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) ESF	729	876		1,620	---	5,000	---
(2)							
(3)							
(4)							
TOTALS				1,620	---	5,000	---

9. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)
 826 | 545 | 091

10. SECONDARY PURPOSE CODE

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

A. Code	B. Amount						
BR		BE					

12. PROJECT PURPOSE (maximum 480 characters)

To assist the GOJ in developing and carrying out a systematic and comprehensive study to assess the availability of water in the ground water systems of Northern Jordan, while developing the capability of the NRA to continue such investigations in other areas of Jordan.

13. RESOURCES REQUIRED FOR PROJECT DEVELOPMENT

Staff:

Funds

14. ORIGINATING OFFICE CLEARANCE	Signature		15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
	Title	Date Signed MM DD YY 09 30 80	

16. PROJECT DOCUMENT ACTION TAKEN
 S = Suspended
 A = Approved
 D = Disapproved
 CA = Conditionally Approved
 DD = Decision Deferred

17. COMMENTS

18. ACTION APPROVED BY
 Signature: [Signature]
 Title:

19. ACTION REFERENCE
20. ACTION DATE
 MM DD YY

AGENCY FOR INTERNATIONAL DEVELOPMENT
PROJECT IDENTIFICATION DOCUMENT FACESHEET
 TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE
 A = ADD
 C = CHANGE
 D = DELETE

PID
 U.S. DOCUMENT CODE 1

3. COUNTRY/ENTITY
 JORDAN

4. DOCUMENT REVISION NUMBER

5. PROJECT NUMBER (7 DIGITS) [278-0243]

6. BUREAU/OFFICE
 A. SYMBOL NE B. CODE 63

7. PROJECT TITLE (MAXIMUM 40 CHARACTERS)
 GROUNDWATER RESOURCES INVESTIGATION

8. PROPOSED NEXT DOCUMENT
 A. 3 = PAP B. DATE 12 60

10. ESTIMATED COSTS (\$000 OR EQUIVALENT, \$1 = U.S. \$1,000)

FUNDS SOURCE		BASIS
A. AID APPROPRIATED		8,000
B. OTHER U.S.	1.	
	2.	
C. HOST COUNTRY		
D. OTHER DONOR(S)		
TOTAL		8,000

9. ESTIMATED FY OF AUTHORIZATION/OBLIGATION
 A. INITIAL FY 61 B. FINAL FY 81

11. PROPOSED BUDGET AID APPROPRIATED FUNDS (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		E. FIRST FY 81		LIFE OF PROJECT	
		C. GRANT	D. LOAN	F. GRANT	G. LOAN	H. GRANT	I. LOAN
(1) ISF	780 *	876		8,000		8,000	
(2)							
(3)							
(4)							
TOTAL				8,000		8,000	

12. SECONDARY TECHNICAL CODES (maximum six codes of three positions each)
 026 545 091

13. SPECIAL CONCERNS CODES (MAXIMUM SIX CODES OF FOUR POSITIONS EACH)
 BR BE

14. SECONDARY PURPOSE CODE

3. PROJECT GOAL (MAXIMUM 240 CHARACTERS)
 To ascertain potential water resources, their locations and classification.
 (HKS-SYR. Plan 1976-1980)

16. PROJECT PURPOSE (MAXIMUM 400 CHARACTERS)
 To explore for and verify or disprove the existence of groundwater resources in areas identified and believed to contain potentially exploitable water.
 * Water Resources Development (NEC).

17. PLANNING RESOURCE REQUIREMENTS (staff/funds)

Water Resources Engineer, 4 weeks, Oct. 1980

18. ORIGINATING OFFICE CLEARANCE
 Signature: *Edward J. Howell* Date: *June 13, 1979*

19. DATE DOCUMENT RECEIVED BY AID/W. OR FOR AID/W DOCUMENTS. DATE OF DISTRIBUTION

AGENCY FOR INTERNATIONAL DEVELOPMENT		1. TRANSACTION CODE A = Add C = Change D = Delete		Amendment Number	DOCUMENT CODE 3
PROJECT DATA SHEET		<input type="checkbox"/> A			
2. COUNTRY/ENTITY JORDAN		3. PROJECT NUMBER 278-0243			
4. BUREAU/OFFICE Near East/Capital Development		5. PROJECT TITLE (maximum 40 characters) Ground Water Resources Investigation			
6. PROJECT ASSISTANCE COMPLETION DATE (PACD) MM DD YY 09 30 81		7. ESTIMATED DATE OF OBLIGATION (Under 'B' below, enter 1, 2, 3, or 4) A. Initial FY 810 B. Quarter 4 C. Final FY 811			

8. COSTS (\$000 OR EQUIVALENT \$1 =)						
A. FUNDING SOURCE	FIRST FY			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total	1,620	---	1,620	5,000	---	5,000
(Grant)	(1,620)	(---)	(1,620)	(5,000)	(---)	(5,000)
(Loan)	()	()	()	()	()	()
Other U.S.						
1.						
2.						
Host Country				3,765	3,765	
Other Donor(s)						
TOTALS	1,620	---	1,620	5,000	3,765	8,765

9. SCHEDULE OF AID FUNDING (\$000)									
A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE		D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) ESF	729	876		---	---	1,620	---	5,000	---
(2)									
(3)									
(4)									
TOTALS				---	---	1,620	---	5,000	---

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each) 826 545 091						11. SECONDARY PURPOSE CODE			
12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)									
A. Code		BR		BE					
B. Amount									

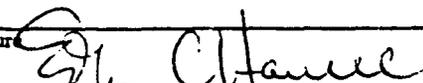
13. PROJECT PURPOSE (maximum 480 characters)

To assist the GOJ in developing and carrying out a systematic and comprehensive study to assess the availability of water in the ground water systems of Northern Jordan, while developing the capability of the NRA to continue such investigations in other areas of Jordan.

14. SCHEDULED EVALUATIONS				15. SOURCE/ORIGIN OF GOODS AND SERVICES			
Interim	MM YY	MM YY	Final	MM YY			
01	18	3	01	18			
				<input checked="" type="checkbox"/> 000 <input type="checkbox"/> 941 <input checked="" type="checkbox"/> Local <input type="checkbox"/> Other (Specify)			

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

N/A

17. APPROVED BY	Signature: 	18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
	Title: Edgar C. Harrell, Director, USAID/Jordan	
	Date Signed: MM DD YY 09 30 81	MM DD YY

GROUND WATER RESOURCES INVESTIGATION PROJECT PAPER

TABLE OF CONTENTS

	<u>Page</u>
Summary and Recommendations	1
I. Project Background	3
A. Overview	3
B. Other Studies	3
C. Lack of Usable Data	4
D. Rationale for U.S. Assistance	4
E. Other Donor Coordination	5
II. Project Description	6
A. General Description	6
B. Project Summary Budget and Projected Disbursement Schedule	8
III. Project Analysis	9
A. Technical Feasibility	9
1. General	9
2. Technical Issues	9
3. Project Cost	10
4. Statutory Criteria	10
B. Administrative Analysis	10
1. The Natural Resources Authority	10
2. Administrative Capability of the NRA	11
C. Social Soundness Analysis	12
D. Environmental Considerations	12
IV. Project Implementation and Evaluation	13
A. Project Implementation	13
B. Disbursements	14
C. Recurrent Costs	15
D. Implementing Responsibilities	16
1. NRA Responsibilities	16
2. AID Responsibilities	17
E. Project Monitoring	17
F. Project Evaluation	17
G. Selection of Contractors	17
V. Project Negotiating Status	19
A. PID Issues	19
B. Negotiating Status	19

TABLE OF CONTENTS (Cont'd)

Annexes

- A. A Proposed Program for Systematically Assessing the Ground Water Resources of Northern Jordan, by C.L.R.Holt, jr.
- B. Statutory Criteria Checklist
- C. Grant Request
- D. Draft Grant Agreement
- E. Congressional Notification - Advice of Program Change
- F. Action Memorandum for Project Authorization
- G. Draft Project Authorization
- H. PID Approval Cable.
- I. NRA Organizational Chart
- J. Logical Framework.

GROUND WATER RESOURCES INVESTIGATION

SUMMARY AND RECOMMENDATIONS

- A. Grantee: The Hashemite Kingdom of Jordan.
- B. Implementing Agency: The Natural Resources Authority (NRA).
- C. Amount: U.S. \$ 5.0 million to be financed from economic support funds, authorization, all of which is requested for approval and \$1.62 million of which is requested for incremental funding in 1980.
- D. Total Project Cost: Total project cost is \$8.765 million, of which \$1.620 million is requested for obligation in FY 1980 and \$3.380 million, if funds are available, in FY 1981. The Government of Jordan (GOJ) contribution is estimated at 43% of the project cost, or \$3.765 million.
- E. Project Purpose: To assist the GOJ in developing and carrying out a systematic and comprehensive study to assess the availability of water in the ground water systems of Northern Jordan, while developing the capability of the NRA to continue such investigations in other areas of Jordan.
- F. Project Description: The project consists of developing and gathering reliable data by means of drilling wells to various depths, conducting aquifer, geophysical and related tests for determining quantity and quality of water available from individual aquifers and developing a data storage and retrieval system.
- G. Project Justification: The Country Development Strategy Statement (CDSS) for Jordan stresses the need to concentrate on development of water resources to meet basic human needs. The needs for potable water in Jordan require that maximum knowledge be obtained regarding its total water resources. The currently known water resources cannot meet the needs of the present population, much less provide for a population estimated to double in size by the end of the century or meet the concomitant increase in agricultural production required to feed that population. The proposed project will provide timely data pertaining to the quality and quantity of the country's water resources.

Because of the severe lack of water for all uses, there are no alternatives to an accelerated effort to verify the extent and quality of currently unused or unproven ground water resources, and related surface water resources. Failure to vigorously pursue the proposed investigation may result in:

(a) a reduction in the amount of water allocable for agriculture, with subsequent negative effects on the balance of payments;

(b) a continued and accelerated depletion of the currently used aquifers to the extent that they will be severely damaged by saline migration and/or excessive mining;

(c) a search for more expensive alternate water sources.

H. Grantee Contribution: The GOJ will contribute staff, equipment and equipment operating costs, and logistics -- equaling approximately 43 percent of the total project cost.

I. Statutory Checklist: All statutory criteria have been met (See Annex B).

J. Issues: None.

K. Recommendation: That a Grant be approved for the purposes described herein in an amount not to exceed U.S. \$ 5.0 million.

L. Mission Authority: '79 State 196625 (see Annex H) delegated authority to USAID/Jordan to approve the project paper, authorize the project, and to obligate funds under the project.

Project Review Committee

CD/E, Mr. Stanley A. Stalla, Chairman
CD/E, Mr. Royal R. Cline
CD/E, Mr. Aied Sweis
PROG, Mr. Daniel Leaty
CONT, Mr. Douglas Sheldon
OTP, Dr. Sami Khoury

Mission Senior Advisory Committee

DD/USAID, Ms. Lois Richards, Chairperson
CD/E, Mr. Thomas A. Pearson
PROG, Mr. Daniel Leaty
CONT, Mr. Edward Giza
OTP, Dr. James Turman.
RLA, Mr. Garber Davidson

I. PROJECT BACKGROUND

A. Overview

Because of its extreme scarcity in relation to needs, water takes on a pre-eminent importance as a constraint on development in Jordan. In the coming decades, more water will be required in Jordan for all three demand components, i.e., for domestic uses, agriculture (irrigation) and industry. Unless a major program is initiated to explore and develop as yet unexploited or partially exploited surface and ground water resources, current projections indicate that high rates of growth for both the population and the economy will generate increasing demands for domestic water, which will force Jordan either to develop extremely expensive alternate sources, such as desalination, or to reduce the amount of water available for irrigation. Refer to USAID/Jordan's "Water Sector Strategy FY 82-86" paper (January, 1980), included as an attachment to the FY 1982 CDSS and available in NE/PD, for a concise description of the magnitude of water related problems, both current and projected, to be confronted by the country in the coming years.

Development of Jordan's surface water sources, e.g. the King Talal Reservoir on the Zarqa River and the proposed Maqarin Dam on the Yarmouk River, will play an important role in meeting the country's increasing demand for water. Yet it should be noted that water quality, rainfall variability and evapo-transpiration are major constraints to the dependability of surface water resources; ground water is less subject to seasonal variations. The ground water data made available to the NRA under the proposed project will enable the GQJ to begin to think in terms of balanced management of all its water resources and may serve as a positive step in the direction of unifying all water-related activities under a single agency.

This project will finance the investigation of all major ground water sources in the northern part of the country. The geographic limits of the study area are primarily determined by the hydrologic boundaries of four drainage basins: the Jordan Valley, Zarqa, Yarmouk and Azraq Basins. Although the study area comprises approximately 20 percent of Jordan's total land area, it contains over 80 percent of the country's inhabitants, including the main population centers of Irbid and the Amman/Zarqa conurbation. See Annex A for more details on the project background, including Figures 1 and 2 for maps of the study area.

B. Other Studies

Except for the complementary study being undertaken by the Jordan Valley Authority (JVA) in the Rift Valley (A.I.D. Loan 278-K-022), there are no other studies underway of the type proposed.

C. Lack of Usable Data

Extensive and accurate data in a readily retrievable format are a prerequisite for rational formulation of a national utilization policy for the water sector. However, despite the fact that some earlier exploration work has been done in Jordan, there is still a lack of detailed and complete knowledge on the availability of replenishable water resources, particularly of ground water resources. Little is known about the occurrence, magnitude and quality of ground water at depths below 150 meters, primarily due to the lack of equipment and expertise for collecting the essential data at those depths. An additional problem is that much of the data already collected on ground water is currently unusable, unreliable and/or widely scattered among the various organizations involved in the water sector. Information from past studies may be available, but is not readily retrievable, and some data are suspect because of faulty or outdated methodology. The general paucity and unreliability of data are referred to time and again in the various analyses or studies of the water sector. What is needed is the establishment of an accurate and reliable data base for the entire country, based on a systematic and comprehensive approach to the investigation of Jordan's water potential.

D. Rationale for U.S. Assistance: A.I.D. has assisted the GOJ in financing major irrigation schemes in the Jordan Valley, primarily from surface water sources, for increasing agricultural production. The GOJ, USAID, international and other bilateral donors are currently providing financing to increase distribution of available water and improve collection and disposal of sewage in several major urban and rural areas throughout the country. Many of these water systems have been designed to accommodate the anticipated high population growth rate over the next few decades. As the population expands and as the quality of life improves, additional sources of water will have to be developed to meet the basic human needs requirements of achieving acceptable levels of daily per capita water consumption and of increasing food production. In order to plan for meeting these growing expectations, the GOJ will need a reliable and complete data bank at its disposal, containing information on the country's different water systems and the ways they interact. An accurate investigation and assessment of ground water potential sources and an effective means of storing the results will be important step in contributing to the GOJ's basic objectives of meeting all sectors rising demand on available water resources.

A.I.D. is currently financing, through A.I.D. Loan 278-K-022, a ground water investigation project with the JVA in the Rift Valley^{1/} to determine the quantity and quality of the water available for safe, sustained exploitation. The data collected during the Rift Valley project will be converted to computer programs and will be inserted in the data storage and retrieval system to be purchased by the NRA under the proposed project. The computer equipment and related training to be acquired under the proposed project will be complementary to the work currently being undertaken under the Rift Valley project.

E. Other Donor Coordination: At present there are no other donor projects directly related to the investigation of ground water resources in the proposed study area.

1/. The NRA is responsible for the exploration of all potential sources of water throughout the country's land area located at an elevation of 500 meters or more above sea level. Since the Rift Valley project is located below 500 meters, it is being implemented by the Jordan Valley Authority (JVA).

II. PROJECT DESCRIPTION

A. General Description

This project will assist the GOJ in developing and carrying out a systematic and comprehensive study to assess the availability of water in the ground water systems of northern Jordan. This assistance will also develop the capability of the NRA to conduct similar investigations in other areas of the country.

The NRA will drill a predetermined network of grouped exploratory/observation/test wells to fully appraise the quantity and quality of water in the shallow, middle-level and deep aquifers of the study area. Aquifer tests will be made at individual wells and at groups of wells to determine the interrelationship of the different aquifers, as well as the hydraulic characteristics and boundaries of the aquifers. Other tests will determine the types of rocks being penetrated, the chemical properties of the water at various depths of the aquifers, and the vertical and horizontal directions and rates of movement. Concurrently, tests will be conducted on the study area's surface waters to determine stream and spring flows and the effects of rainfall and run-off on surface water supplies. The interrelationships between ground and surface water will be studied, particularly the effects of developing aquifers on surface water supplies, e.g. at the Azraq springs, and the effects of contaminated surface water reaching ground water. The recharge potential for storing surplus surface water discharge in ground water reservoirs will also be addressed.

The NRA collects data of various kinds, including climatological, surface water, ground water and water quality data. However, only the daily and seasonal rainfall data are published on a regular basis. The lack of established routines for regular data processing and publication reflects adversely on the long-term quality of the field work. Unless records are computed routinely and promptly it is very difficult to collect the field data that adequately define the extreme hydrologic events. The inconvenience to the NRA and to outside users of hydrologic data of not having processed data available to meet demand is considerable and is increasing. Some projects which involve water resource planning are severely hampered, and studies, which have restricted time frames, are being forced to use incomplete data which, at times, may be in error. Thus, it is imperative to develop a computer

system which will provide information collected from all over the country about water resources in a timely and accurate manner. This conclusion is supported by two recent reports on the need for "computerization" in the NRA.^{1/}

The project is designed to provide comprehensive data on the availability, extent and make-up of the study area's water resources. A water resources information storage and retrieval system will be established to systematically store existing, as well as newly collected data, and to provide timely data to answer questions on water resources. The methods used for data collection and the experience gained through project implementation will be readily transferable to other geographical regions of Jordan. The computer system to be operated by the NRA will have the potential for storing water resources data for the entire country. Other GOJ agencies involved in the water sector will cooperate with the NRA in furnishing pertinent data from their files and from future studies. The computer system established under this project will eventually be an excellent tool for the GOJ in planning the optimum management of the country's water resources.

The project involves the following elements of technical assistance:

(1) Consulting services and equipment to assist the NRA in developing a water resources information storage and retrieval system, to include developing computer programs to record existing and newly-discovered data, the training of NRA personnel to operate the computer system, and preparation of a final report.

(2) Consulting services and equipment for a drilling program of test wells in the four drainage basins of the investigation, including the appraisal of available data, the drilling of new test wells to obtain new data, and the preparation of a final report.

(3) Consulting services and equipment to define aquifers and analyze the hydrologic characteristics of ground water systems in the study area, including the appraisal of available data, the testing and monitoring of water quality and quantity for all wells, the development of computer programs for simulation modeling of the ground water systems and the preparation of a final report.

^{1/} Eicher, Ralph N. A Computer Development Capability for the Natural Resources Authority Hashemite Kingdom of Jordan, U.S.G.S. , 1980.
Shoben, Charles R., Computerization of Water Resources Data, UNESCO, 1978.

(4) Consulting services and equipment to define streamflow systems (surface water) and their relationship to ground water, including the appraisal of available data, the testing and monitoring of water quality and quantity in surface water systems (streamflow, spring flow and rainfall), the measurement of inter action with ground water, and the preparation of a final report.

(5) Consulting services to assess water use (withdrawals) in the study area, including the appraisal of all available water data, the development of procedures for inventorying quantities of water being withdrawn from wells, springs, streams, and aquifers, and the publication of an annual report.

A more complete description of the project is found in Annex A.

B. Project Summary Budget and Projected Disbursement Schedule
See Table II-1

Notes: Exchange rate: \$1.00 = J.D. 0.291
AID's contribution to the project will be provided in increments, the initial one being \$1,620 million in FY 1980. The subsequent increment will be subject to availability of funds to AID for the purpose and the mutual agreement of the parties, at the time of each subsequent increment, to proceed.

The foreign exchange costs will be contributed by A.I.D. and the local currency costs by the GOJ. The local currency costs represent costs already recurring in the NRA's budget insofar as they support current NRA employees, while the costs involved in paying for new personnel under the proposed project will be new, recurring costs in the NRA's budget increasing it by approximately \$700,000 per year.

The details supporting the above cost estimates are provided in Annex A, Tables 4, 5 and 6. Costs were estimated jointly by the NRA, USAID and a U.S.Geological Survey hydrologist. They are, therefore, considered reasonable and consistent with the data available.

TABLE II-1

SUMMARY BUDGET AND PROJECTED DISBURSEMENT SCHEDULE

(x 1,000)

INPUT	GOJ (LC)	USAID (FX)	PROJECT TOTAL	PROJECTED DISBURSEMENTS			
				FY 81	FY 82	FY 83	FY 84
<u>Commodities 1/ 2/</u>	(-)	(4,153)	(4,153)	(1,009)	(3,144)	(-)	(-)
Mini digital computer, related and peripheral equipment	-	163	163	163	-	-	-
Drilling rigs	-	1,300	1,300	-	1,300	-	-
Pumps	-	295	295	295	-	-	-
Vehicles	-	275	275	275	-	-	-
Related drilling equipment	-	1,565	1,565	-	1,565	-	-
Water testing and related equipment	-	276	276	276	-	-	-
Surface water recording and related equipment	-	279	276	-	279	-	-
<u>Personnel</u>	(3,765)	(507)	(4,272)	(441)	(1,300)	(1,265)	(1,266)
<u>GOJ Personnel 3/</u>	(3,677)	(-)	(3,677)	(208)	(1,049)	(1,154)	(1,266)
Staff-on-hand	1,593	(-)	1,593	192	423	466	512
Additional Staff 4/	2,084	-	2,084	16	626	688	754
<u>Technical Assistance 5/</u>	(85)	(507)	(595)	(233)	(251)	(111)	(-)
ADP Advisor (1 advisor, (12 person months)	17	93	110	83	27	-	-
Drilling Advisor (1 adv., (6 p/m)	8	47	55	55	-	-	-
Hydrology (5 adv, 46 p/m)	63	367	430	95	224	111	-
<u>Overseas Training for GOJ Personnel 6/</u>	-	(340)	(340)	(200)	(140)	(-)	-
98 p/m short term training							
<u>Total Budget</u>	(3,765)	(5,000)	(8,765)	(1,650)	(4,584)	(1,265)	(1,266)
USAID	-	5,000	5,000	1,408	3,498	94	-
GOJ	3,765	-	3,765	242	1,086	1,171	1,266

- 1/ See itemized commodity listing in Annex A.
- 2/ GOJ is fully responsible for all clearance/in land freight costs for delivery of commodities to project site. This information is not detailed in the budget.
- 3/ See Annex A Table 5. Note use of available staff on hand provides cost for 3 years instead of 4 years of project life. Budget considers cost of 1,593,000 spread over 3 1/2 years.
- 4/ Additional staff required per Table 5 of Annex A. For time phasing of new GOJ personnel see implementation section.
- 5/ See Table 6, Annex A for breakdown of technical assistance requirements. USAID will fund technical assistance contracts; GOJ local currency portions (JD 88,000) is for local operational and administration support of technicians.
- 6/ See Table 6, Annex A, for training requirements. Note Holt estimate in Annex A was reduced to 340,000 to correspond to USAID estimates of short term training costs of approximately \$3,500 plans. As detailed in Annex A, GOJ will be responsible for overseas travel pertaining to training. This has been omitted from the GOJ budget contribution.

III. PROJECT ANALYSIS

A. Technical Feasibility

1. General

This project paper is based largely on a report entitled "A Proposed Program for Systematically Assessing the Ground Water Resources of Northern Jordan" by C.L.R. Holt, jr., (Annex A). Mr. Holt is a hydrologist who recently retired from the U.S. Geological Survey and was hired in August 1980 to assist the Government of Jordan and USAID/Jordan in the development of a program of ground water resources investigation. The report was prepared with full cooperation and assistance from the NRA and other interested agencies in Jordan. It was discussed in draft with the NRA and the National Planning Council.

This project is consistent with the national economic development program of Jordan that was set forth in the First Five-Year Plan (1976-1980) and that will be included in the Second Five-Year Plan now under preparation. One of the goals of the first plan was to "ascertain potential water resources, their location and classification." It cited the "insufficiency of accurate technical data on the availability of underground water in most regions, due to the incompleteness of previous studies" and proposed to "complete hydrological studies already under way and initiate studies on regions that have not yet been investigated." Two excellent studies completed during the first plan period (the National Water Plan and the Water Strategy for North Jordan by Howard Humphries and Son) identified more clearly than ever the inadequacies of existing data. This project, which includes facilities and technical assistance for storage and retrieval of hydrologic data and equipment and advisory services for a systematic drilling program, is intended to correct the deficiencies noted in the Five-Year Plan, the National Water Plan and the Humphries study.

2. Technical Issues

Annex A presents a thorough, in-depth analysis of the problems and an attainable program of solving them using relatively simple, standard techniques that are easily transferable to the NRA. The present antiquated, inefficient method of manual storage of a large mass of hydrologic data makes retrieval difficult. The task can be accomplished with a small computer costing less than \$200,000. The benefits far outweigh the costs. NRA staff can be taught to operate the equipment and to maintain it, with the help of the manufacturer's local

representatives. Except for the computer, the NRA already owns and operates equipment of the type proposed for purchase under this project, including drilling rigs and related drilling equipment, pumps, vehicles and water-testing and water-recording equipment. The project provides funds for an increase in NRA staff, advisory services and training. It is concluded that there are no significant technical issues.

3. Project Cost.

Most of the equipment required for the project will be purchased in the first year of the project. The estimated costs include an allowance for inflation during that period. Estimated costs of advisory services and training have been similarly escalated. It is concluded that the costs are reasonable.

4. Statutory Criteria

(a) Section 611(a)(1). The consultant's report provides the planning necessary to carry out the assistance and contains reasonably firm estimates of the cost to the U.S.

(b) Section 611(a)(2): The NRA is empowered by law to assess the water resources of Jordan (See Para III,B.(1) below). No further legislative action is required to permit orderly accomplishment of the purpose of the project.

(c) Section 611(b): The project will systematically assess the ground water resources of Northern Jordan. The basic data gathered by the project will be available for use in the preparation or modification of Jordan's national economic development plans such as the Second Five-Year Plan (1981-1985), in the preparation of regional and river basin studies and in specific project feasibility studies. Thus the project falls within the category of "Level A - Framework Studies and Assessments," as defined by the Water Resources Council in Section 7.10.4 of Principles and Standards for Planning Water and Related Water Resources. Section 710.101 of the Principles and Standards states that any appropriate planning process may be chosen for Level A Studies. The planning process proposed for this project is deemed to be appropriate.

B. Administrative Analysis

1. The Natural Resources Authority: The project will be implemented by the NRA, which was founded in 1966 to integrate the East Ghor Canal Authority, the Central Water Authority and the Geological Survey and Bureau of Mines. It is functioning under the Organization of Natural Resources Law No. 12 of 1968, which entrusted NRA with broad responsibilities for water policy and planning, control of well drilling and construction operation and maintenance of irrigation and domestic water supply projects.

Since 1973, when the Water Supply Corporation was detached from the NRA, and 1977, when the Jordan Valley Authority was established, the NRA has not been concerned with the domestic water supply problems in the country except for well drilling nor has it been concerned with the water studies and irrigation schemes in the Rift Valley region up to the 500 meter level above the sea.

At present, the NRA, besides its functions outside the water sector, is effectively responsible for the following duties:

- a. All hydrological and hydrogeological data collecting in the country, aside from the area under the jurisdiction of the Jordan Valley Authority.
- b. Drilling of water wells for exploratory and public purposes.
- c. Designing, constructing, operating and maintaining irrigation projects in the Plateau and Desert.
- d. Developing and maintaining of water springs, and Roman pools and cisterns.
- e. Designing, constructing, operating and maintaining earth dams for purposes of irrigation and ground water recharge in the Plateau.
- f. Licensing and control of private water wells, water rigs and rig operators.

To achieve these objectives, the NRA maintains three directorates, one for water development, one for drilling and one for irrigation. It operates 16 water rigs (6 rotary and 10 percussion) and a national network of hydrometric and hydrometeorological stations for flood measurements, precipitation, temperature and humidity observations.

2. Administrative Capability of the NRA:

The organization of the NRA is shown in Annex I. The implementing unit for this project are the Directorates of Water Resources Development (WRD) and Drilling which have a nucleus of highly-qualified senior staff who received academic training in the United States and practical training in Jordan under the supervision of AID-financed geologists and engineers in the 1960s. Under the Director General, who is an able administrator, the directorate and division heads of WRD and Drilling have the capability to manage this project.

During the past several years, however, NRA has lost a large number of its professional employees, drillers and technicians who accepted jobs in the private sector, both in Jordan and in neighboring countries because of the low pay rates in Jordan's public sector. There is thus a shortage of qualified people at the lower levels of NRA's organization.

Semi-autonomous agencies such as NRA are now entitled to pay higher rates if their proposed employment regulations are approved by the Government. NRA has drafted such regulations. If the regulations are approved by the Council of Ministers, recruitment of new employees and retention of trained and experience staff should be easier.

C. Social Soundness Analysis: Since this is an investigative activity, no social soundness analysis is required for this project.

D. Environmental Considerations: The proposed project will have no adverse effect on the environment. This project falls within the categorical exclusions of 22 CFR 216.2(c)(2) as a technical assistance project not subject to further environmental analysis. The Environmental Officer, Near East Bureau, has concurred in this determination (see State 242824).

IV PROJECT IMPLEMENTATION AND EVALUATION

A. Project Implementation. Because of the important need to gather and have available as soon as possible reliable information on the Azraq area and Zarqa Basin, implementation of the project will begin in the Azraq area. As soon as equipment and personnel are available, the investigation will begin in the Zarqa Basin as well. It is anticipated that the investigation may be conducted in both regions concurrently on a first priority basis.

Proposed Project Schedule

Negotiation and execution of Project Agreement	September, 1980
Implementation Letter No. 1	October, 1980
Conditions Precedent met	December, 1980
NRA personnel available to carry out project activities	December, 1980
Computer specialist arrives in Jordan	January, 1981
Drilling specialist arrives in Jordan	February, 1981
Phase I of study begins (See Annex A, Table I)	February, 1981
Procurement of project financed equipment begins	March, 1981
Ground Water Hydrologist arrives in Jordan.	March, 1981
Senior Hydrologist (Team Leader) arrives in Jordan	June, 1981
Computer, water-testing, laboratory equipment arrive in Jordan	September, 1981
Water Quality Hydrologist arrives in Jordan	January, 1982
Project financed drilling equipment arrives in Jordan	March, 1982

Phase II of study begins (see Annex A, Table II)	April, 1982
Surface Water Hydrologist arrives in Jordan	April, 1982
Interim project evaluation	January, 1983
Phase III of study begins (see Annex A, Table III)	April, 1983
Recharge Hydrologist arrives in Jordan	April, 1983
Completion of drilling program	May, 1983
Final reports submitted	September, 1984
Final project evaluation	January, 1985

The NRA will be responsible for recruiting and hiring its new personnel in a timely manner in order to be on schedule with the implementation activities of the project. The new computer staff should be on board by June of 1981 in order to begin compiling and transferring data to a format that can be programmed into the computer. The additional engineering, geology, hydrology, technicians and support staff should be hired by October through December of 1981 to begin training on available NRA equipment, to act as back-up for those being sent overseas for training, and to anticipate the additional staff requirements of the new equipment due to arrive by March or April of 1982.

A more detailed implementation schedule is found in Annex A, Figure 3.

B. Disbursements: Grant funds will be used to finance consultant services and the contracts for drilling, water testing, laboratory and computer equipment of A.I.D. Geographic Code 000 and Jordanian source and origin. Jordan has been procuring drilling mud from Cyprus and Kuwait. Because of differences in transportation costs, drilling mud from these sources delivered in Jordan is estimated to cost \$400,000, or less than 50 percent of what it would cost to bring it from the U.S. and approximately 8 percent of A.I.D.'s total grant. A waiver to permit Code 935 procurement may be necessary. The Project Activities Completion Date (PACD) will be September 30, 1984. Grant funds for

foreign exchange costs will be disbursed either under direct letter of commitment or by the letter of commitment/letter of credit procedure. Jordanian dinar expenditures will be made in accordance with the terms and conditions of contracts and/or agreements as approved by A.I.D. The estimated disbursement schedule follows:

ESTIMATED DISBURSEMENT SCHEDULE
(U. S. \$ X 1,000)

	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>	<u>Total</u>
A.I.D.	0	1,408	3,498	94	0	5,000
G.O.J.	0	242	1,086	1,171	1,266	3,765

C. Recurrent Costs: As stated above, this project has a dual purpose: (1) a comprehensive study of ground water availability in North Jordan, and (2) development of the capacity of the NRA to continue ground water investigations. The latter poses recurrent cost implications for the GOJ.

Annex A, which details project resource requirements, indicates that 136 additional employees will be required for the expanded scope of the NRA as envisioned under the project. Most of the additional staff will be utilized in the strenghtening of the following NRA functions: (1) drilling and pumping; (2) ground water systems; (3) surface water systems; and (4) water use. The development of an ADP function, i.e. a national water information storage and retrieval system, will require nine additional employees. Recurrent costs for the GOJ are generally the personnel and operational support costs for the additional staff.

The Holt study places an annual personnel cost, of approximately \$695,000 or JD 202,940 for the new staff. The 1980 NRA personnel budget is JD 757,300. The proposed increase in personnel costs, scaled back to 1980,^{1/} would therefore represent an increase of 24% over the 1980 budgeted personnel level. The overall NRA budget, exclusive of capital cost, for 1980 is JD 1,580,000. If a proportionate

^{1/} Personnel costs for 1981, detailed in the Holt Study, have been scaled back 10% to approximate an overall cost of living adjustment, for comparison with 1980 budget figures. (x)(1.1) = JD 202,940 x184,490.

increase of administrative support cost to personnel cost is assumed, the total increase in personnel and operational support costs, scaled back to 1980 would be JD 344,560, or 22% of the total NRA budget.^{2/} Personnel expenditures have already increased 136% between 1976 and 1980.^{3/}

The GOJ provision of additional personnel is obviously essential to the achievement of the project purpose and the GOJ indicated a willingness to increase budgetary allocations for personnel costs. The Grant Agreement accordingly includes a covenant concerning the timely provision of additional staff.

D. Implementing Responsibilities: The Grantee will be the Hashemite Kingdom of Jordan; the implementing agency will be the Natural Resources Authority (NRA). An organization chart of the NRA is contained in Annex I. The project will be under the Head of the Water Resources Development Department of the NRA, a man who is experienced and well-qualified in conducting hydrological studies.

(1) NRA Responsibilities:

NRA obligations will include, but not be limited to: (a) providing approximately \$3.765 million equivalent in local currency; (b) providing all the necessary financing beyond the financial plan which may be required for completion of the project; (c) selection or aid in selection of consultants and contractors and execution of their

2/ Assume that dept. of administration increases to some extent as proposed personnel cost increase and that non salary portion of Water Resource Development Division increases to some extent as personnel cost increase:

Admin	(JD 653,000) (.24)	= 156,720
Water Resource Development	(JD 14,000) (.24)	= 3,350
Total increase for admin & Operational Support		= JD 160,070
Personnel Cost Increase		JD 184,490
Admin & Operational Support		JD 160.070
	TOTAL	JD 344,560

3/ Normal cost of living adjustments of the salary scale of 10% per annum would compound to 40% of the increase between 1976-1980.

contracts; (d) providing all available background information and data required to carry out the project; (e) supervision of activities; (f) allocating drilling, test and laboratory equipment to the project, (g) providing facilities and personnel required for the project.

(2) AID Responsibilities: AID/obligations will include, but not be limited to: (a) review and approval of the scopes of work and contract documents for consultants and contractors; (b) approval of the selected consultants for supervision of the program and of the selected contractors for supply of the equipment; (c) review and approval of requests for disbursement; (d) follow-up on project progress and reporting; and (e) review of draft and final reports.

E. Project Monitoring: USAID/J will be responsible for AID project monitoring. Within the Mission, primary monitoring responsibility will rest with the Office of Capital Development. The Project Manager will be the Mission's Chief Engineer. It is now anticipated that a consulting hydrologist will be required to assist USAID/J, on an intermittent basis, in carrying out its project monitoring activities.

F. Project Evaluation: AID and NRA will prepare an interim evaluation of the project in January 1983 and a final evaluation after completion of the project (January 1985). The interim evaluation will not only review physical implementation in the first two years, but will also evaluate progress toward satisfying special covenants and identify any apparent shortcomings in equipment, human resources or training, which may inhibit achievement of the project purpose. It will recommend how shortcomings can be remedied and, to the extent feasible at that time, also evaluate the development impact of the project. The final evaluation will evaluate in depth the accomplishments of the project and, to the degree feasible, evaluate the overall development impact of the project. Refer to the Logical Framework, Annex J, for indicators against which an evaluation can be made.

G. Selection of Contractors:

(1) Equipment: The selection of the contractors to provide the necessary drilling, water testing, laboratory, and computer equipment will be accomplished in accordance with the procedures set forth in Handbook 11, Country Contracting, Chapter 3, "Procurement of Equipment and Materials". Dates for completion of the solicitations, their approval by USAID and advertising in the Commerce Business Daily and the A.I.D. Export Opportunities Bulletin, deadlines for receipt of proposals and bids, and award of contracts will be worked out with the NRA and their consultants upon their arrival in Jordan.

(2) Consultants: The selection of consultants to provide the necessary services may be accomplished in accordance with the procedures set forth in Handbook 11, Country Contracting, Chapter 1, "Procurement of Professional and Technical Services." However, it is more likely that A.I.D. or host country personal services contracts and/or Participating Agency Services Agreement (PASA) arrangements with the U.S. Geological Survey will be used. The contracting procedure(s) used for obtaining consultants' services will be determined by A.I.D. and NRA during project implementation, in the manner deemed most appropriate in providing the requisite services within the project's time limitations.

V. PROJECT NEGOTIATING STATUS

A. PID Issues: During the NEAC review and approval of the Ground Water PID on July 19, 1979 (See Annex H), it was requested that the project paper address the following issues raised by the NEAC:

(i) Skills Audit: The GOJ has now established a committee to determine the availability of trained persons in the water and wastewater sector and to estimate the training needs. The training to be conducted under this project will help meet a part of the GOJ's needs.

(ii) GOJ Water Program: The GOJ is in the process of developing its Second Five-Year Plan (covering 1981-1985). While we believe that the financial requirements for development of the water sector will be substantial, it is still premature for USAID/J to establish the amounts of these finances or the sources of funding which may be available to the GOJ. The proposed project will contribute to the framework for assessing such projects.

(iii) Demand Management: The data to be obtained under the proposed project will help the GOJ reach management decisions regarding overall demand for the resource.

(iv) Retention of skilled GOJ employees: During design of the proposed project, this subject was discussed with officials of the NRA, who explained that they are actively seeking ways to ameliorate the situation.

(v) Source and Origin: The Grant Agreement will provide for U.S. Geographic Code 000 and Jordanian source and origin in the procurement of equipment and services. Waivers may be considered on an individual case basis.

B. Negotiation Status: USAID officers have discussed the preparation of this Project Paper with appropriate officials of the GOJ at various stages during its development, and have made them aware of the conditions precedent and the special covenants that are being included in the Project Grant Agreement, which is attached in draft, along with the authorization, as Annexes D and G respectively. No difficulty is foreseen in negotiation of the Agreement or the conditions precedent and covenants.

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Annex A

A PROPOSED PROGRAM FOR SYSTEMATICALLY
ASSESSING THE GROUND WATER RESOURCES
OF NORTHERN JORDAN

by

C.L.R. Holt, jr.
U.S. Geological Survey

Prepared in cooperation with
The Hashemite Kingdom of Jordan
Natural Resources Authority

Under the auspices

of the

United States Agency for International Development

Administrative Report

September, 1980

TABLE OF CONTENTS

	<u>Page</u>
Summary	1
Introduction	1
Background - Needs for Study	3
Objectives	
Technical	4
Management	5
Scope	5
Technical Approach	
Phase of Study	6
Aquifer data available and needed for study	7
Networks of observation wells.	10
Work Plan For the Systematic Investigation of Ground Water Resources	10
Equipment needs and recommendations	14
Personnel needs and recommendations	15
Training needs and recommendations	
Organizational	15
On-the-project	16
Overseas, short term	16
Academic	17
Advisory services	17
Report products	18
Selected references	19
Figures 1 through 3	
Tables 1 through 6	

TABLES

1. Data collection and evaluation - Phase one of study.
2. Systems analysis and testing - Phase two of study.
3. Water data management - Phase three of study.
4. Equipment needed to obtain and analyze data.
5. Personnel needed for study.
6. Training needs for study and advisors needed.

FIGURES

1. Index map of proposed project area in the Hashemite Kingdom of Jordan.
2. Proposed sites for groups of wells in the Kornub-Zarqa aquifer, the Amman - Wadi Sir aquifer, and the shallow aquifers underlying the northern drainage basin of Jordan.
3. Work plan for the systematic investigation of ground water resources of North Jordan.

SUMMARY

The urgent need for developing the ground water resources of Jordan requires comprehensive, reliable, and timely information on the quantity and quality of water in the major aquifers - and their interrelationships to surface water. To obtain such information for efficient management of the resource, it is proposed that the Natural Resources Authority (NRA) conduct a systematic study of several basins in the most populated area of Jordan (See Figure 1). The experience and training acquired by its staff, through the assistance of advisors and overseas training, would be transferable to other areas of water need in Jordan. A computerized system for water resources data is recommended to provide timely data readily analyzed and available for answering questions pertaining to the water resources and to alternatives for its management.

INTRODUCTION

The proposed program and recommendations described in this report were prepared under the auspices of the Agency for International Development (A.I.D.) to assist the Hashemite Kingdom of Jordan in developing a systematic plan to assess, manage, and utilize the ground water resources of Jordan. The plan includes requirements for equipment, training, and technical assistance.

This plan of study evolved from an original request to the U.S. Geological Survey to assist the NRA and A.I.D. in planning a ground water development program and to assist also in drafting a scope of work and services relating to the Zarqa and Azraq Basins. Early meetings with officials of the NRA and the National Planning Council (NPC) focused on the need for a "model" ground water study, whereby the NRA could apply systematic methods for comprehensively assessing the availability of the ground water systems in Jordan. Because of the pressing need to obtain water in the populated area of northwestern Jordan and in the Great Azraq Basin and to train the NRA staff in techniques and skills to conduct a comprehensive study, these areas were selected as a "pilot" ground water study (Figure 1). A detailed study of problem areas in the Zarqa Basin and in the northern part of the Great Azraq Basin is included in the scope of this program. The experience acquired in this study would have immediate transfer value to similar studies of other areas in Jordan.

The Azraq basin has been included for immediate study in order to gain factual information on the ground water resource and its relation to the Azraq springs. The need for this study has been accelerated because ten contract wells are scheduled to be drilled in the near future and because the Azraq spring is to be pumped on a

The assignment was carried out during the period August 16 to Sept. 17, 1980.

BACKGROUND-NEEDS FOR STUDY

The water resources of Jordan are very limited because of the relative scarcity and unequal distribution of rainfall. Increasing demands for water, especially in the North Jordan region, to meet the needs of rapidly expanding municipalities and industries as well as for the need for irrigated farming, are a prime restraint to socio-economic development. It has been estimated that these demands for water resources will exceed the known water supplies by the mid 1980's. Of equal concern is the reduction of potable water sources, e.g. by pollution and by the migration of saline water.

The water resources of Jordan have been the subject of numerous detailed and reconnaissance studies as well as of broad regional analyses, the most recent being the North Jordan Water Use Strategy (Humphreys and Sons, 1978). In addition, the Natural Resources Authority and several other agencies have collected voluminous quantities of data on all aspects of the water system. Monitoring of changes in climate, surface water, ground water, and water quality is being done on a nationwide basis for rainfall, streamflow, and evaporation, with the other parameters being measured only in areas of greatest need. Only rainfall and evaporation data are published on a regular basis. The majority of all data is neither thoroughly analyzed, readily retrievable from storage, nor made available to users in a timely manner.

Recognizing the urgent need for a survey of Jordan's water resources and needs and a plan on how best to manage the water, a National Water Master Plan (Agrar-und Hydrotechnik GmbH, 1977) was prepared from a detailed review of existing information. This study underscored the insufficiency of water data and pointed out the inaccuracies of much of the data for planning purposes.

None of the above mentioned inadequacies of water data are due to any basic lack of technical competence or energy and time expended by the NRA in seeking reliable data. Instead, most of the insufficiencies in water data are because of the pressing need of the NRA to use its resources in obtaining local water supplies and in making studies of specific problem areas. As a result, many pieces of useful data are available for interpretation, but this data is limited in use because of its fragmentary nature and its inadequate storage.

Because most of Jordan's surface water resources are known, ground water resources are being looked to for their potential in relieving water shortages. In addition, ground water is sought because it is more evenly distributed than surface water (which runs off the surface rapidly), it has generally good quality, and it is less subject to immediate pollution.

To obtain the ground water information necessary to knowledgeably plan for the wise management of the total water resources of northern Jordan, it is necessary to have accurate and timely knowledge of the availability of the entire ground water resource, from the land surface to its deepest depth. It is also necessary to understand its relationship to surface water - its recharge from precipitation and surface flow - and its ability to store surplus waters.

Because water quality and its increasing deterioration by pollution are expected to be the greatest new deterrents to ground water development, a major effort is needed in relating ground water quality to its lost cores and the rate and direction of ground water movement.

PROGRAM OBJECTIVES

Technical Objectives

A general objective of the program is to systematically assess the availability of water in Jordan's major ground water systems. Specific objectives, given in Tables 1 and 2, are as follows:

1. Define the hydrologic and geochemical characteristics and the geohydrologic boundaries of the aquifer systems;
2. Determine the chemical quality of the water, including sources and extent of pollution, both natural and man-made;
3. Determine the available storage of fresh water and saline water and the rates of depletion of storage;
4. Estimate when serious reductions in yield may begin to occur in different parts of the systems;
5. Evaluate alternative methods for extending the useful life of the systems including redistribution of withdrawals, conjunctive use of surface water both as a source of direct supply and for aquifer recharge, salvage of natural discharge, and reduction of evaporation and transpiration losses;

6. Estimate the impact of future withdrawals on water quality and land-surface conditions, including vertical and lateral saline water migration and land-surface subsidence;
7. Define the role of ground water in extreme hydrologic events, especially sustained drought.

Management Objectives

1. The planned integration and coordination of all units of the NRA operationally involved in conducting the proposed project. A team philosophy is essential to meet the technical objectives of this comprehensive study (see Table 1).
2. Development of a National Water Resources Data Unit in the NRA. This unit would have the responsibility for development of a water data information retrieval system. For details see Work Plan, Part A.
3. The techniques and experience acquired in the comprehensive and systematic study will have maximum transfer value for conducting similar studies of other basins in Jordan (see Figure 1).
4. To train the project participants of the NRA in current and practical procedures, techniques, and skills necessary for managing the project and to achieve the technical objectives of the study. (For details see Table 7).
5. It is essential for meeting project objectives to maintain a continuity of personnel assigned to this project. Every effort needs to be made to assure that salaries are commensurate with the jobs.
6. To assist in the planning of similar systematic studies of the other basins of Jordan.

SCOPE

The proposed project conforms to the National Water Master Plan of Jordan (July 1977). Full use should be made in the study of this source of information, as well as such sources as 1) the data files of the NRA, 2) the reports on Water Use Strategy, North Jordan (Humphreys and Sons, 1978), and 3) other reports listed in the references.

The project will include all aspects of the hydrologic system which have impacts on the ground water aquifers.

The project is considered to be a pilot study with experience, equipment and a systematic approach to be transferred to other basins in Jordan.

The study of northern Jordan will be limited to the effective recharge and drainage areas of the Yarmouk, Zarqa and Yarmouk Basins, the northern part of the Great Azraq Basin, and the Jordan Valley. The Wala, and the Dead Basins have priority for study, after the completion of this project (See Figure 1).

All water-bearing rocks within the study area will be considered, with major emphasis placed on the principal aquifers: the Amman-Wadi Sir aquifer, the Kornub-Zarqa aquifer, and the shallow aquifers.

TECHNICAL APPROACH

Phases of Study

The work will be done in the following phases and as described on Table 1:

1. Data collection and evaluation phase -- existing file and published information will be gathered from the NRA and other institutions. The types of available data are given in Table 1. Also included in this Table are the recommended design and spacing for the networks of hydrologic monitoring sites - observation wells in each major aquifer, stream flow stations on all significant wadis, rainfall stations, springflow stations, and quality of water stations for each of these water parameters. The hydrologic data now available to the NRA and the data needed to be collected for the proposed study are also given in Table 1. During this phase, data will be tabulated and examined for validity and accuracy. In addition, an evaluation will be made of the adequacy of data for simulation modeling of all or part of the regional ground water system.

2. System analysis and testing phase -- conditioned by the adequacy of data, conceptual models of the regional aquifer system will be analyzed with the aid of computer simulation to test first-trial values for aquifer characteristics and the regional synthesis of water-quality fabrics (See Table 2). Sensitivity analyses will be made to define data-network needs.

3. Water data management phase -- develop individualized programs for monitoring system response to changing patterns and trends of resource development (See Table 3). The continuing feedback of supplemental data will enable refinement of the system models and upgrading of the monitoring programs. Data from the system-simulation models will be published with an accompanying analysis of their significance of planning for optimum use of each ground water system.

AQUIFER DATA AVAILABLE AND NEEDED IN STUDY AREA

I. Kornub-Zerqa Aquifer

This "deep sandstone aquifer", which consists of fine-grained sandstone with some limestone of Cretaceous age, represents a potential major ground water reservoir in the study area; it crops out in the lower Zarqa Wadi and along the escarpment, and underlies the entire area east of the escarpment. Direct recharge occurs in the outcrop area and leakage from the overlying units may contribute recharge to eastern parts of the buried aquifer. Good yields of good quality water are known in the outcrop area with the potential for mineralization increasing with depth of occurrence. This aquifer is confined below a thick series of limestones and marls of the Ajlun group.

A. Aquifer data available

Although at least 17 wells have tapped this aquifer, most of the wells are located in the middle Zarqa Basin. Few of these wells penetrate the full depth of the aquifer, nor are they developed exclusively in the aquifer. Specific capacity, specific yield, water quality and lithologic data are available from most wells.

B. Aquifer data needed

At least 10 test wells tapping the full thickness of the aquifer and sealed from the overlying aquifers should be drilled in the general areas indicated on Figure 2 and as follows:

Yarmouk Basin Jordan Valley - 1 in highlands of the Jordan Valley, 1 in northern part and 1 in eastern part (near the divide) of the Yarmouk Valley;

Zarqa basin - 1 in highlands, 1 in the Northern part (near divide), 1 in eastern (basalt) area, and 1 in southeast area.

Great Azraq Basin (N) - The approximate locations are shown on Figure 2.

The test wells need to be located, insofar as possible, at sites which would aid in defining ground water recharge, movement, saline occurrence, changes in quality, and boundary conditions. Locating test wells in the Amman-Wadi Sir aquifer and in the shallow aquifer near each Kornub-Zerqa test well would give data on leakance between each aquifer.

II. Amman-Wadi Sir Aquifer

This aquifer, consisting primarily of limestone rocks of Upper Cretaceous ages, is the most important, and most used, aquifer in the study area. It occurs throughout the study area except in the Jordan Valley. It crops out in most of the western highlands. Flowing artesian wells may be developed in eastern parts of the area, and are confined to the east by thick layers of overlying marl. Direct recharge occurs in the outcrop area. However local leakance through fractures and limestone layers may occur to an unknown extent. Good quality water prevails in the outcrop area, with mineralization increasing eastward.

A. Aquifer Data Available.

Numerous wells have been drilled into the aquifer, with the greatest number being in areas of high population density. A majority of the wells are in the middle and upper parts of the Zarqa Basin with 40 or more wells scattered in the remaining areas. However, less than one-fourth of all of these wells penetrate the full thickness of the aquifer. Many of the wells tap more than one aquifer and therefore cannot be used to define aquifer characteristics, unless each aquifer is separated by well packers or seals. Specific capacity, specific yield, water quality, and lithologic data are available from most wells.

B. Aquifer Data needed

At least 38 test wells tapping the full thickness of this aquifer, with the well sealed above and below the aquifer, should be drilled in the following areas:

A test well of the Amman-Wadi Sir aquifer should be drilled in the vicinity of each well tapping the Kornub-Zarqa

aquifer (see Figure 2). In addition, 8 wells should be spaced in the Yarmouk-Jordan Basins, 5 wells in the Zarqa Basin, and 9 wells in the Great Azraq Basin(N).

All test wells and their relationship to existing wells should be spaced insofar as possible to aid in defining ground water recharge, movement, changes in water quality, location of boundaries, and relations to surface water. Slim hole test wells drilled near selected Amman-Wadi Sir test wells may be necessary for aquifer tests, if existing wells are not nearby or of adequate aquifer penetration.

III. Shallow Aquifers

Alluvial deposits in the Jordan Valley, relatively thin deposits of limestone and chalk of the Wadi Shallala formation in the Yarmouk Basin, and basalt in the easternmost part of the Zarqa Basin and the northern part of the Azraq Basin make up locally important aquifers. Recharge to these aquifers is thought to be by direct infiltration, underground flow from ground water draining from adjacent aquifers, or by recharge from flood waters. The quality of the ground water varies widely, depending on recharge and its relationship to surface water. Pollution is the greatest threat to the quality of water in these shallow aquifers.

A. Aquifer data available

Numerous dug and drilled wells tap the alluvial deposits of the Jordan Valley. Additional wells are planned by the Jordan Valley Authority to increase the known water supply and irrigation potential of the Valley. The basalt area in the Yarmouk Basin has been tapped by test wells with good results. In the Azraq Basin, many wells have tapped the basalt and the underlying limestone, yielding fair to good quantities of good quality water. Recently drilled wells in the immediate area indicate the presence of thick shale and marl basalt. Numerous dug and drilled wells tap the water in the Wadi Shallala Formation.

B. Aquifer data needed

Additional test wells need to be drilled in the shallow aquifers for the purposes of defining aquifer boundaries, recharge, movement, relationships to surface water, and changes in ground water quality. Because many of these wells are planned to be drilled through the pursuit of other studies, close cooperation will be needed in obtaining the aquifer data needed to meet objectives of this study.

16 wells should be drilled as part of the "group" or cluster of wells related to the Kornub-Zarqa tests (Figure 2). 16 supplemental wells should be drilled for aquifer test purposes, including 5 test wells in the eastern part of Yarmouk Basin and 16 wells in the Great Azraq Basin. The test wells in the Azraq area should be spaced widely throughout the area northwest of Azraq springs. Primary need is to define sources and directions of ground water movement to the springs.

Two groups of test wells tapping shallow and deeper aquifers near the springs must be developed in a manner to determine vertical as well as horizontal movement toward the springs. These will especially serve to better define hydrologic boundaries and relationships to surface water, to develop the hydrologic characteristics needed for analyzing the aquifer system and to provide the simulation modeling necessary for efficient management of water.

IV. Networks of Observation Wells

Each area-wide group of test wells, plus selected existing wells tapping a single aquifer, will form a network of wells for observing changes in water levels and in the quality of water. The following well data will be collected: sample logs, cores where needed, electric and gamma ray logs, caliper and other logs, depth of well, and altitude of well curb. Water quality samples and pumping (yield) tests should be made at intervals of drilling - especially at major lithologic changes. Packers should be used to isolate the zone being tested.

WORK PLAN FOR THE SYSTEMATICALLY INVESTIGATION OF GROUND WATER RESOURCES

A flow diagrams of project work is given on Figure 3 with the steps of study described as follows (Report produce are emphasized as goals):

A. Steps for Developing a Water Resources Information Retrieval System.

1. Develop computer data forms.
2. Create computer programs for insertion, replacement, addition, and deletion of records. Also error check.

Master records, daily records, well records, quality records, hydrologic characteristics records, and water use records.

3. Data key punched and verified by project personnel.
 4. Install computer and software.
 5. Use and thoroughly test, all computer programs (see 3. above) to file and retrieve data.
 6. Assist hydrologists in examining data for validity and accuracy.
 7. Print tables of data usable in publication.
 8. Prepare computerized directories to link records and files.
 9. Maintain up-to-date final data on file in the data bank.
 10. Prepare report on computer techniques found applicable for country-wide use.
- B. Steps for Identifying the Water Bearing Rock Units.
- a. Co-appraise all available ground water data - locating all existing wells in study areas on maps. Review data for accuracy.
 - b. Transfer historical well data to new forms. Add new data to data forms, as collected in field and lab.
 - c. Field locate test well sites as recommended. Survey, determine location and altitude.
 - d. Drill clusters of test wells into Kornub-Zarqa aquifer, Amman-Wadi Sir aquifer, and shallow aquifers. Slim-hole test wells to be drilled for later use.
 - e. Conduct down-hole geophysical and other tests.
 - f. Develop test wells and test-pump wells.

- g. Sample water quality in each aquifer and in each aquitard.
- h. Prepare tables of well data, water quality, and yields.
- j. Publish report on the water-bearing rocks.
- C. Steps for Defining Aquifers, Analyzing their Hydrologic Characteristics, and Giving Management Alternatives.
 - 1. Appraise, integrate, and interpret all available ground water and quality of water data.
 - 2. Transfer historical ground water data to computer forms. Add new data to forms as collected in field.
 - 3. Perform field aquifer tests of clusters of wells.
 - 4. Develop initial network of gauges in new test wells and existing wells to monitor water-level changes.
 - 5. Develop initial network of gauges in new test wells and existing wells to monitor water quality changes.
 - 6. Develop computer programs for simulation modeling of all or parts of ground water system.
 - 7. Evaluate adequacy of data for simulation modeling of aquifer systems.
 - 8. Monitor changes in aquifer systems.
 - 9. Map hydrogeology and chemical quality for each aquifer-both areally and vertically.
 - 10. Prepare data on capacities of aquifers to transmit and to store water.
 - 11. Determine recharge and boundary conditions.
 - 12. Prepare tables, maps, and graphs showing changes in water quality - areally and vertically.
 - 13. Prepare water table and potentiometric maps for each aquifer, showing changes with time.

14. Test and verify simulation models.
 15. Use simulation models to define effects of changes in recharge, discharge, storage, and water quality. Also ground water movement, saline migration, and relationships of ground water to surface water .
 16. Publish report on aquifers and their hydrologic characteristics.
 17. Use simulation models for meeting management needs and objectives.
 18. Define data network needs - a sensitivity analysis.
 19. Establish water monitoring requirements from above analysis.
 20. Prepare summary report on entire comprehensive study, emphasizing planning and management alternatives.
- D. Steps for Defining Streamflow Systems & Their Relations to Ground Water.
1. Appraise all streamflow, rainfall, and spring data in study area. Review data for accuracy.
 2. Transfer historical data to new forms. Add new data to data forms as collected in field and analyzed in lab.
 3. Develop initial network of streamflow gauges to monitor volume, rate, and duration variability necessary to determine quantity and quality of runoff.
 4. Install automatic recording gauges where necessary to complete network.
 5. Install additional rainfall gauges where necessary to complete existing network.
 6. Install automatic recording or manual spring flow gauges (flumes) at selected spring sites.
 7. Monitor changes in the quantity and quality of streamflow, rainfall, and spring flow.

8. Prepare maps, tables, and graphs showing changes with time.
9. Conduct series of streamflow measurements along selected reaches of streams to determine the gain or loss of ground water - in cooperation with ground water team.
10. Determine hydrologic characteristics of streams in each basin and their relationships to ground water.
11. Prepare reports on above information.

E. Steps for Assessing Water Use.

1. Appraise all available water use data in study area. Locate sites on maps. Review data for accuracy.
2. Transfer historical water use data to new forms. Add new data to data forms as collected and/or estimated in field.
3. Develop procedures for inventorying the daily, monthly and annual quantities of water being withdrawn from wells, springs and streams for public supply, industrial, irrigation, domestic, and stock uses.
4. Measure or estimate discharge of water from each aquifer and basin in study area.
5. Seek and test improved methods for improving estimates of water.
6. Prepare tables, maps, and graphs of water use in area.
7. Publish annual reports on water use.

EQUIPMENT NEEDS AND RECOMMENDATIONS

Relatively detailed estimates have been made of the needs for equipment to conduct the proposed study, of the type and condition of equipment (September, 1980) available to NRA for the study, and recommendations for additional equipment needed for the study. The estimates on the cost of equipment are based on the experience of the NRA staff and some available information on new products. Equipment specifics are given in Table 4.

PERSONNEL NEEDED FOR STUDY

Estimates of the numbers and types of professional, technician, and other personnel deemed necessary to conduct a comprehensive water study in Jordan are given in Table 4. The estimates of salary cost for an average three years of work were supplied by division heads of the NRA.

TRAINING NEEDS AND RECOMMENDATIONS

The training of personnel and institutions in technical skills and management experience necessary for the optimum development of all of Jordan's ground water, is a major objective of the proposed project. Techniques and experience acquired in the comprehensive and systematic study of the ground water resources of the northern basins, as well as the development of a National Water Resources Data System, may be used to assess systematically the potential for ground water development in the remaining basins of Jordan.

Among the types of training believed to be appropriate are organizational training, on-the-project training, overseas short-term training, and academic training. The proposed training needs of the NRA to conduct the study are given in Table 7.

Organizational Training

Senior hydrologists having experience in planning, managing, and coordinating comprehensive and systematic studies of ground water and in the development of a water resources information retrieval system can assist the NRA in developing management capability necessary to assure full application of technical input.

A program planning specialist would assist the NRA in developing a practical plan to systematically conduct the comprehensive study. He would assist in coordinating the efforts of the study teams to produce timely and useful information. This advisor should be assigned to the NRA for periods of two months during each year of the project.

A senior computer specialist would assist the NRA in developing the organizational structure that would direct and support a computer center. He would assist in guiding the development of an internal training program to assure operational efficiency and effectiveness in data processing services. This advisor should be assigned to the NRA for one year.

The above advisors may provide advice to the NRA the NPC, the JVA and others on an all-Jordan basis during their assignment to this study.

On-the-Project Training

The proposed project will provide excellent training opportunities for varied types of professional and technical specialists to gain experience and competence. Not only will they expand their own areas of skill and methodology, but they will also experience a team approach to the study because close communication and the frequent exchange of data and assistance between departments is necessary in conducting a comprehensive study.

Advisors in the development of computer systems, in deep well drilling equipment, in the study of ground water, surface-water and quality of water resources, and in the development of simulation models will provide trainin to project participants directly applicable to this project (see Table 2).

The most important and enduring training will be that given by each participant to his associates, based on courses taken overseas and on other in-country training in special skills and methods. The rapid transfer of new skills and methods will be of benefit to the trainee and many others.

Overseas Training

Project participants requiring specialized training not available through the above proposed training programs may obtain 4-6 months of training overseas, depending upon the experience required and upon the availability of training during the duration of the project. Each overseas trainee will be expected to rapidly rejoin his study team so that he can apply the benefits of his training to as much of the project as possible. All training assignments should be related closely by an agency supervisor to specific work applications to this project.

It is recommended that the United States Geological Survey (U.S.G.S.) provide the short-term training of hydrologists, primarily at its National Training Center in Denver. Training in automatic data processing techniques and analysis should be arranged at a hydrologic agency having such services. The USGS in Reston, Virginia may be able to provide some training. Other training experiences should be scheduled with commercial firms, such as drilling, well screen, cementing, acidizing, pump, and water-quality testing companies.

Academic Training

Participants requesting academic training in hydrology, of two years duration, cannot be accommodated by this project because they would not have the time to participate in the study. I suggest that especially deserving project participants be given the opportunity for specialized academic training after the completion of their role in this study.

Other Training Opportunities

Technicians training - A formal training program for hydrology technicians, such as proposed by UNESCO (Farvolden, 1978) could provide the essential skills needed for advancing the work on this project and for ensuring the proper collection and handling of hydrological data. Because the two-year course at the Polytechnical Institute has not yet begun, graduating technicians will contribute to subsequent studies of hydrologic basins of Jordan.

Drilling techniques training - the NRA is to be commended for its "short course" on the basic techniques of drilling, casing, and testing of water wells.

ADVISORY SERVICES

Senior hydrologists generally having special skills in subjects directly pertaining to this project are recommended for 2 to 24 month consultant assignments to the NRA for advisory services. These consulting hydrologists would give supplemental training and provide on-the-project experience to project participants, directly pertaining to the geologic and hydrologic characteristics of the study area. The advisors proposed for this project are shown in Table 7.

The NRA has requested, at several levels, that the USGS provide the advisory personnel needed for this project. They have been notified that the USGS cannot provide much support in this area because it is under severe personnel restraints, while having increasing amounts of work to do within the U.S.A.

During the last several years, an unusually large number of highly experienced hydrologists have retired from the USGS. Some of these people have indicated an interest in continuing to work in their fields of speciality. I recommend that the USGS notify these men of the proposed project's advisory jobs and permit their return to the USGS as rehired annuitants. An alternative might be to seek a personal service contract with the NRA.

REPORT PRODUCTS

All data and interpretive products resulting from this program should be published in an interpretive format, using tables, maps, cross sections, charts, and diagrams. A typical report product of this project would include text, maps and diagrams showing:

1. Aquifer boundaries and thickness, and cross sections depicting hydrologic and physical characteristics of the aquifer materials;
2. Recharge and discharge areas of the regional aquifers and approximations of the average annual flow quantities;
3. The distribution of chemical quality characteristics of the ground water, both laterally and vertically, the distribution of fresh and saline water resources, and the sources and extent of pollution;
4. Contours of the water table or potentiometric surface and historic changes in water levels;
5. The magnitude and distribution of water use and its relation to water-level trends;
6. Areas favorable for ground water development in terms of drilling depths, pumping lifts, chemical quality, and aquifer productivity.
7. Effects of various aquifer management alternatives on the areal distribution of the available water resources and discussion of the effects of each;
8. Results of hydrologic system simulation by mathematical modeling techniques, including simulation of water-level trends and the movement and storage of ground water movement of dissolved chemicals in the ground water, including saltwater encroachment, and land-surface subsidence.
9. Data retrieved from the computerized system, computed and analyzed, should be published in a timely manner and in a format suitable to users.

SELECTED REFERENCES

1. Agrar and Hydrotechnik GmbH, and Bundesansalt for Geowissenschaften and Rohstagg, 1977, National Water Master Plan for Jordan; Natural Resources Authority, Amman.
2. Arsalan, F.A., 1976, Geologie and Hydrologie fur Azraq-depression (Ost-Jordanien). Thesis, T.U. Aachen, 185p.
3. Barber, W., 1975, An outline for water planning in East Jordan; Natural Resources Authority, Amman.
4. Bradley, Edward, 1960, Ground water work in Jordan: Engineering Division, USOM/Jordan.
5. Eicher, R.N., 1980, A computer development capability for the Natural Resources Authority, Hashemite Kingdom of Jordan: U.S. Geological Survey project report (IR) JD-10, 2lp, 1 Tbl, 3 pps.
6. Farvolden, R.N., 1978, Organization of Technician training Courses in water resoures: UNESCO technical report RP/1977-78/2.171.3, 13 p., 1 Annex
7. Frantz, H.R., 1978, The water master plan of Jordan: National Water Symposium, Amman.
8. Hirzallah, B. 1973, Ground water resources of the Jordan Valley: Natural Resources Authority, Amman.
9. Humphreys, Howard and Sons, 1977, North Jordzn, Water use Strategy, Azraq: Report to the Hashemite Kingdom of Jordan, 67 p. 9 figs 12 Tbl., 2 2pp.
10. Humphreys, Howard and Sons, 1978, Water Use Strategy, North Jordan: Report to the Hashemite Kingdom of Jordan, v. 2, 260 p., 55 figs, 76 Tbl., 7 app.
11. Joudeh, Omar M., and Mohammad Abu Taha 1978, Present and needed information on water resources in Jordan: Jordan's National Water Symposium, Amman.
12. Nimry, Yousef F., 1978, Present water legislation and institutional framework in Jordan: Jordan's National Water Symposium, Amman.

13. Kilani, Ahmad, 1980, Water Resources Management in Jordan, for Symposium on Water in the XXIst Century Madrid: Natural Resources Authority, Amman.
14. Mudallal, Usama H. and Touqan, 1972, Available water in Amman area, Natural Resources Authority, Amman.
15. Showen, C.R., 1978, Computerization of water resources, Hashemite Kingdom of Jordan: UNESCO Technical report rp/1977-78/2.171.3, 20 p., 1 annex.
16. VBB and Fawzi and Associates, 1977, Water Resources Study for Amman water supply: Amman Water and Sewerage Authority, v. 1+2.

A SYSTEMATIC PROGRAM FOR INVESTIGATING THE GROUND WATER RESOURCES OF NORTHERN JORDAN

Table 1. Data collection and evaluation - Phase one of the project

DATA COLLECTION AND EVALUATION PHASE I SUMMARY

OBJECTIVES	METHODS	HYDROLOGIC INFORMATION NEEDED FOR STUDY			REQUIREMENTS TO BE COLLECTED
		TYPE OF DATA	DESIGN AND PLACING	AVAILABLE TO USA	
Develop water resource information retrieval system	Computerized data bank computer program to create and update files, to compute discharge, retrieve and analyze data, to print data, etc. Final data on file.	Surface water data-stream and spring flow - Rainfall data Hydrogeologic data Groundwater data-well records Water quality data Hydrologic characteristics records Water use data	All project data, both historical and that collected for study. Master records, groundwater, surface water, quality of water, and water use records will be punched, verified and programs tested	Master records 4,500 Well records 1,000 Evaporation 260 Groundwater (station years) 15,000 Rainfall (station years) 18,000 Water Quality records	The records of all data collected from this project will enter into data storage as follows: Master records, well records, streamflow (station years), rainfall (station years), groundwater levels (station years), hydrologic characteristics records, water use records, and water quality records
Identify water bearing rock units Areal extent Thickness Porosity Structure	Structure contour maps Lithology maps Qualitative maps showing variations Maps and sections-lithology and structure Tables of well depths and yields.	Sample logs Cores Electric and Gamma ray logs Caliper and other down hole logs Well records	A network of sampling and observation wells with spacing relative to complexity of geology. Density of wells in area: Shallow aquifer (Madf Chalil) 15/1000 km ² Aman-Badi Sir aquifer 10/1000 km ² Karab-Carga aquifer 1/1000 km ²	Shallow aquifers 35 wells Aman-Badi Sir aquifer 150 wells Karab-Carga aquifer 17 wells	Shallow aquifers - test wells, with at least 10 of these wells in NE basalt. Aman-Badi Sir aquifer - at least 30 test wells, with 10 wells drilled near the 10 wells testing the Karab-Carga aquifer. Additional test wells to be spaced about 1 mile in the Karab-Carga basin, 2 wells in the Carga basin, and 9 wells in the Aman-Badi basin. Min-hole test wells may have to be drilled near each well for data on A.C. well falls penetrate each aquifer and are sealed top and bottom.
Measure well yield	Location Map and above tables	Discharge and direction with time	Wells to fully penetrate aquifers and to be sealed at top and bottom		Karab-Carga aquifer - at least 10 test wells with reported general locations on map 2
Define aquifers and their hydrologic characteristics Status of storage and degree of confinement Areal extent Storage capacity Transmissivity	Water table and potentiometric maps Map of net change in water levels over selected period of time Hydrographs of changes in water levels with time Graphs of water levels versus pumping rates Data on capacity of aquifers to transmit and to store water	Water level measurements in network of observation wells made as close to same time as possible. Complete pumping tests of selected wells tapping known aquifers Analysis of water level change maps Analysis of continuous records showing fluctuations due to changes in system. Pumping tests of wells-measured rates of pumping. Water samples collected from single aquifer wells at same time and analyzed in field and in lab.	See above At least one test near every major pumping area. Other tests made relative to complexity of geology. Each aquifer tested at adequate no. of sites to do simulation modeling of all or parts of the groundwater systems. Network of water quality sampling wells including all test wells drilled for this project and existing wells selected as described in text.	Shallow aquifers - numerous wells tap these aquifers. Specific yield, water quality, specific capacity, and lithologic data available for most drilled wells. Aman-Badi Sir aquifer-most numerous in middle and upper Carga basin/with at least 500 wells in other areas. Specific capacity and yield, water quality, and lithology data are available. Karab-Carga aquifer-15 of the 17 wells are in middle Carga basin. Most are open to upper aquifers, specific capacity, yield, lithology, & some water quality data. A network of water quality sampling wells is being monitored by USA	All existing wells are to be scheduled, sampled for quality, and tested for yield. Geophysical logs obtained where possible. Aquifer tests are to be made of all new test wells, groups of test wells, and of selected existing wells. Observation wells (1/2 mile wells) will be drilled where necessary. Water quality to be analyzed both in field and in lab. of all wells drilled and tested. A network of water quality sample wells in each of the three major aquifers to be monitored for quality changes at least once each year.
Range of Quality of water for each Aquifer	Tables, maps, graphs, and sections showing serial and vertical quality of water				
Define surface water system especially pertaining to aquifers, Rainfall-Distribution in basin and time. Chemical quality of rainfall Stream flow-runoff characteristics, spring discharge, gaining and losing reaches of streams. Sediment transport	Lithological maps of measured, mean, 5-year average, and tables of data. Map and table of quality of precipitation Tables of volume, rate, duration variability and probability. Maps showing gaining and losing reaches of streams and spring discharge. Tables, maps, and graphs of changes in quality with time.	Daily, monthly, and annual quantities collected on standard basis in manual and automatic collectors. Samples collected for lab. analysis Continuous discharge measurements of significant streams, base flow, and spring-flow. Flows to be measured along selected reaches of streams for seepage	Network of rainfall stations adequate for basin coverage Density of stations: 1/200 km ² Density of quality sites: 1/1000km ² Network of stream flow gauges located at or near mouths of all significant units. Portable velocity meters and flumes.	Daily rainfall data from 50 stations 24 streamflow and quality stations includes discharge, stage, hydraulic relations, and sediment sample analysis 3 of above stations are considered complete (but not digitized). Remainder are partial record sites.	10 rainfall stations Design application of rainfall data Evaporation from free water, soil surface and transpiration, variability of run off, flood and low flow characteristics of streams in each basin and watershed. Precipitation related to stream flow. Infiltration studies. Stream discharge changes along reach of streams.
Describe water use	Tables, Maps, and graphs of water uses in	Measure or estimate discharge of groundwater related to use	All surface discharge of groundwater	Estimates of discharge in parts of area for brief periods of time	Measurements and estimates of discharge in entire area - annual
Report on the results of Phase I - For publication.	Finalized tables of water data. Report on the groundwater resources of Jordan and the USA. Report on water use.				

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OBJECTIVES	PRODUCTS	ANALYSIS NEEDS
Test computer program used to file and retrieve data in Phase I	A National Water Resources data bank Tables and analyses of water data	Assist in the examination of water data for validity and accuracy
Develop computer programs for simulation modeling of all or part of groundwater systems. Define areas of recharge and discharge, direction of groundwater movement and relationships to surface water Define effects of recharge on groundwater storage Define effects of stresses on recharge, discharge, and storage conditions Define water quality problems-include effects of pollution and saline water migration, when occur now. Define data network needs	Evaluate adequacy of data for simulation modeling of all or part of system. Maps and sections showing directions of flow and relation of GW to SW. Analyses of aquifer systems. Tests of first trial values of aquifer characteristics and regional synthesis of water quality fabrics. Identify of areas favorable for groundwater development in terms of drilling depths, pumping lifts, chemical quality, and aquifer yield productivity Specific monitoring requirements for water quality and quantity.	Computer simulation to analyse system of aquifers. Sensitivity analysis of above data to define data network needs. Baseline network-analysis of observation wells in areas not significantly effected by pumping. Sensitivity analysis of above data to define data network needs
Report on results of Phase II for publication	Published report on the groundwater systems of the study, area.	Use report on Phase I

OBJECTIVES	PRODUCTS	TYPES OF MODELS
Estimate potential yield of aquifers and when serious reductions on yield may occur in parts of the system. Estimate impact of future withdrawals on water quality, including vertical and lateral saline water migration-also subsidence of land surface Evaluate alternative method for benefitting the aquifers, including redistribution of withdrawals, conjunctive use of surface water for aquifer recharge, salvage of natural discharge, and reduction of ET losses. Evaluate problems and present alternate solutions.	Individualized programs for monitoring system response to changing patterns and trends of resources development Results of hydrologic simulation modelling including the simulation of water-level trends, and the movement and storage of groundwater & the movement of dissolved chemicals in groundwater, including saline migration.	Physical models of aquifer systems Aquifer, Water budget Hydrodynamic Water Quality, Models of Aquifer System Energy & Chemical Mass Character Energy & Chemical Mass Balance Energy & Chemical Mass Transport
Final Report for publication	A summary report - including management	

Table 4. Equipment needed to obtain and analyze data.

EQUIPMENT NEEDED TO OBTAIN & ANALYZE DATA

TOTAL NEEDS	AVAILABLE TO NEA	NEEDED BY NRA	COST
1 Digital computer and equipment such as: Printer/Plotter, Arabic-English display terminal x-y digitizer, digital plotter, and 1 MKB memory.	None	Mini-digital computer and related equipment Peripheral computer equipment	\$ 151,000 50,000
See Appendix for details.		See Appendix for details.	\$ 163,000
3 Rotary Drilling Rigs 2,500'	2 Rotary Drilling Rigs 2000'	1 Rotary Drilling Rig 2500'	\$ 500,000-
5 Percussion Rigs - 2,000'	3 Percussion Rigs 1500'	2 Percussion Rigs 2000'	400,000-
2 Deep Well Test Pumps 1,500'	1 Deep Well Test Pump 1500'	1 Deep Well Pump 1500'	170,000-
3 Vertical Pumps 1,000'	1 Vertical Pump 1000'	2 Vertical Pumps 1000'	125,000-
8 Flat bed Trucks	2 Flat bed Trucks	5 Flat Bed Trucks	200,000-
12 Pickup Trucks (1½ ton)	3 Pickup Trucks (1½ ton)	9 Pickups, (1½ ton)	75,000-
1 Well Acidizing Unit	None	1 Well acidizing unit	250,000-
36,000 Well Casing-Ass't. Sizes	12,000 Well Casing	24,000 well casing (Feet)	500,000-
1,000 Screen, Stainless Steel	None	1000' well screen, stainless steel	120,000-
1 Ultrasonic Pipe Tester	None	1 ultrasonic pipe tester	40,000-
600 Tons Drilling Mud	200 Tons Drilling Mud	400 Tons drilling mud	100,000-
300 Bits, Drilling-Ass't Types	100 Bits, Drilling	200 Bits	350,000
1 Cementing Unit	None	1 Cementing unit	195,000
2 Packers, expandable (Airline)	None	2 Packers expandable	10,000
Geophysical Logging equipment-includes Trucks, resistivity, self potential, gamma gamma, caliper, depth, and down-hole TV equipment	All, but down-hole TV	TV camera + equipment for down-the-hole examination of porosity and lithology.	\$ 60,000
			\$3,495,000
35 Continuous water-level recorders	20 Cont. water-level recorders	15 Continuous water level recorders	\$ 10,000
6 Elec. water-level reels	none	6 Elec. water level reels	500
10 Airline pressure gauges	10 Airline pressure gauges	0	-
20 Steel Tapes - 50-200 m	12 50-100 m	8 Steel Tapes 100-200 m	400
4 Vehicles - 4 wheel drive	none	4 Vehicles - 4 wheel drive	56,000
1 House Trailer	none	1 House Trailer	6,000
2 Surveying equip.-also Bruntons	none	2 Surveying Equipment	20,000
2 Water Quality Field Kits	none	2 Water quality Field Kits	600
5 EC bridges	1	4 EC bridges	2,000
4 Water Well samplers, reel & Tripod	none	4 Water samplers, reel & Tripod	1,500
1 Laboratory equip. -sample bottles chemicals & operations-2500 samples	none	1 Laboratory equip.-bottles, chemicals and operations for 2500 samples.	20,000
1 Automat monitoring system	none	1 Automatic monitoring system	20,000
1 Gas chromatography	none	1 Gas chromatograph	40,000
1 Spectrophotometer, Infra red	none	1 Spectrophotometer, infra red	24,000
			\$ 181,000
80 Rainfall Stations	50 Rainfall stations	5 Recording weather stations	\$ 85,000
10 Digital recorder of stage, stream-flow, and precipitation	5 Evapotranspiration stations (manned)	10 Digital water-level recorders stage and flow equip. for stream gauge stations	40,000
10 Station equipment for each recorder streamflow station	24 Streamflow stations non-digital 3 complet 11 partial record	10 Recording precipitation gages for 10 Digital stations	50,000
7 Vehicles, 4 wheel drive-type Power Wagon, double cab.	2 Vehicles	5 Vehicles, 4 wheel drive Power Wagon Type	70,000
2 House Trailers	Not Available	2 House Trailers	12,000
			\$ 277,000
5 Orifice plates-several sizes	Not Available	4 Sets (9 sizes) Orifice caps	1,000
5 Portable Weirs		5 Portable weirs, galv.nized	1,000
			5,000

Table 5. Personnel needed for study.

PERSONNEL NEEDED FOR STUDY

NO. DESCRIPTION	AVAILABLE TO NRA		NEEDED BY NRA	
	no.	Cost/3 years		Cost/3 years
1 Head, Dept. of Data	None		1	50,000
1 Head, tech.support			1	35,000
1 Head, operations support			1	35,000
1 Systems programmer			1	30,000
1 Systems analyst programmer			1	28,000
1 Computer Operator			1	20,000
3 Data preparation technicians			3	44,000
<u>9</u>			<u>9</u>	<u>\$ 242,000</u>
6 Engineers	3	108,000	3	108,000
2 Drilling support	2	50,000	0	-
22 Drillers	11	237,000	11	238,000
24 Assistant Drillers	14	202,000	10	144,000
60 Fig Workers	20	360,000	40	360,000
10 Watchmen	10	54,000	0	-
15 Pump Crew	5	90,000	10	180,000
22 Drivers	5	72,000	17	245,000
10 Welders	4	57,000	6	86,000
5 Mechanics	2	50,000	3	75,000
<u>176</u>	<u>76</u>	<u>\$ 1,280,000</u>	<u>100</u>	<u>\$ 1,436,000</u>
3 Engineers	2 Engineers	50,000	1	25,000
3 Geologists	2 Geologists	50,000	1	25,000
4 Technicians	4 Technicians	44,000	0	-
1 Programmer - GW	None		1	33,000
Hydrologist, Senior				
1 Programmer - QW	None		1	33,000
Hydrologist, Senior				
1 Geochemist	None		1	28,000
4 Drivers	None	-	4	36,000
<u>17</u>	<u>8</u>	<u>\$ 144,000</u>	<u>9</u>	<u>\$ 180,000</u>
5 Senior Hydrologists (Eng.)				
College graduates experience	3	70,000	2	45,000
4 Technical Assts.-Mid level	1	11,000	3	32,000
20 Observers-High school graduates	11	79,000	9	65,000
5 Drivers	1	90,000	4	36,000
<u>34</u>	<u>16</u>	<u>\$ 169,000</u>	<u>18</u>	<u>\$ 178,000</u>
1 Hydrologist,			1	\$ 25,000
3 Tech. Asst's or High School	None		3	\$ 23,000
240 Persons	104 Persons	\$1,593,000	136	\$ 2,004,000

Table 6. Training needs for study and advisors needed

TRAINING NEEDS FOR STUDY & ADVISORS NEEDED

TRAINING NEEDED				ADVISORS NEEDED				
CATEGORY	ON-THE-PROJECT	month	OVERSEAS	month	COST	TYPE	DURATION	COST
National	1 Dept. Head	6	1 Dept. Head		\$ 16,000	Auto-Data Processing to Senior computer specialist	12 mo.	\$ 110,000
Water Data	1 Tech. Support	6	1 Tech. Support		16,000			
Information system	1 Operation Support	6	1 Operation Support		16,000			
	1 Systems Programm	6	1 Systems Programm		16,000			
	1 System Analyst	6	1 System Analyst		16,000			
	1 Computer Operation	6	1 Computer Operation		5,000			
	3 Technicians	9	- Technicians		\$ 88,000			
		<u>45</u>	<u>6</u>					
Test Drilling and Pumping	3 Engineers	18	2 Eng.-Well Design	12	48,000	1 Drilling Company Specialist to train NRA crew.	6 mo.	\$ 55,000
	2 Drilling Support	12	1 Eng.-Well Development	6	24,000			
			1 Eng.-Pump Testing & use of Packers	4	16,000			
	5	<u>30</u>	1 Eng.-Acid and Cement Work	4	16,000			
			<u>5</u>	<u>26</u>	\$ 104,000			
Ground-Water System Quality	3 Engineers @	12	2 Engineers	8	32,000	1 Senior Hydrologist Program Manager	5 mo.	\$ 50,000
	3 Geologists @	12	2 Geologists	8	32,000			
	1 Hydrologist GW Program	6	1 Hydrologist GW Program	6	24,000	1 Hydrologist with GW Modelling Experience	24 mo.	\$220,000
	1 Hydrologist QW Program	6	1 Hydrologist QW Program	6	24,000			
	1 Geochemist	6	1 Geochemist	4	24,000			
	9	<u>42</u>	7	<u>32</u>	\$ 136,000	1 Hydrologist with Recharge Experience	2 mo.	20,000
								<u>\$320,000</u>
Surface Water Systems Quality	2 Engineers	12	2 Engineers	8	32,000	1 Hydrologist with SW Modelling Experience	10 mo.	\$ 90,000
	1 Engineer SW Programmer	6	1 Engineer SW Program	6	24,000			
	4 Tech. Assts.	12	-	-	-			
	20 Observers	40	-	-	-			
	27	<u>70</u>	3	<u>14</u>	\$ 56,000			
Water Use	1	6	1 Hydrologist	4	\$ 16,000			
	3	12						
Overseas Travel (NRA Cost)					\$ 30,000			
54 Persons		205	23	98	\$ 430,000	7 Specialist Advisors	64 mo.	\$595,000

Figure 1. Index Map of the Proposed Project Area in the Hashemite Kingdom of Jordan

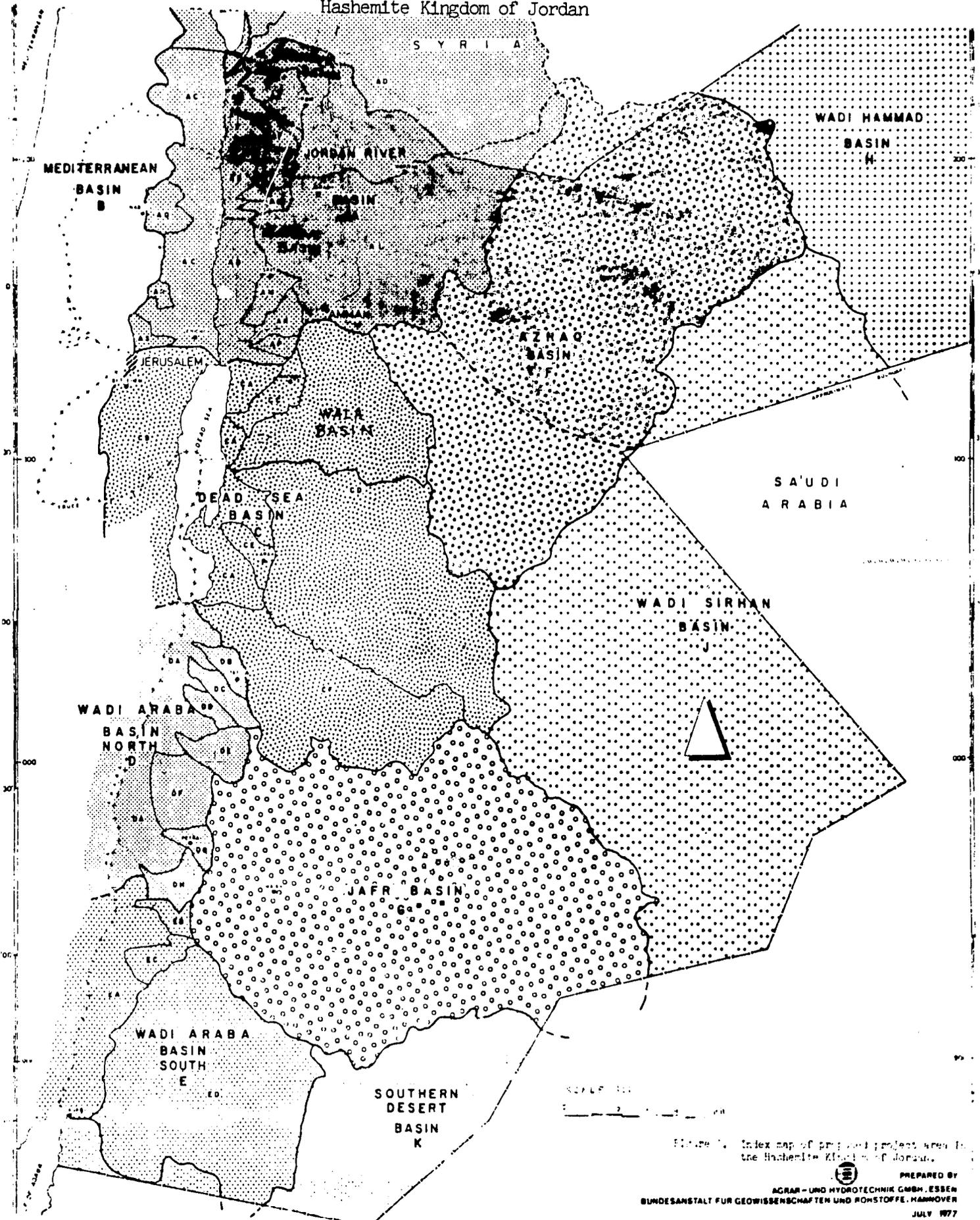


Figure 1. Index map of proposed project area in the Hashemite Kingdom of Jordan.

FIGURE 2
PROPOSED SITES FOR GROUPS OF TEST WELLS IN THE
KORNUB-ZARQA, AMMAN-WADI SIR AND SHALLOW AQUIFERS
UNDERLYING THE NORTHERN DRAINAGE BASINS OF JORDAN

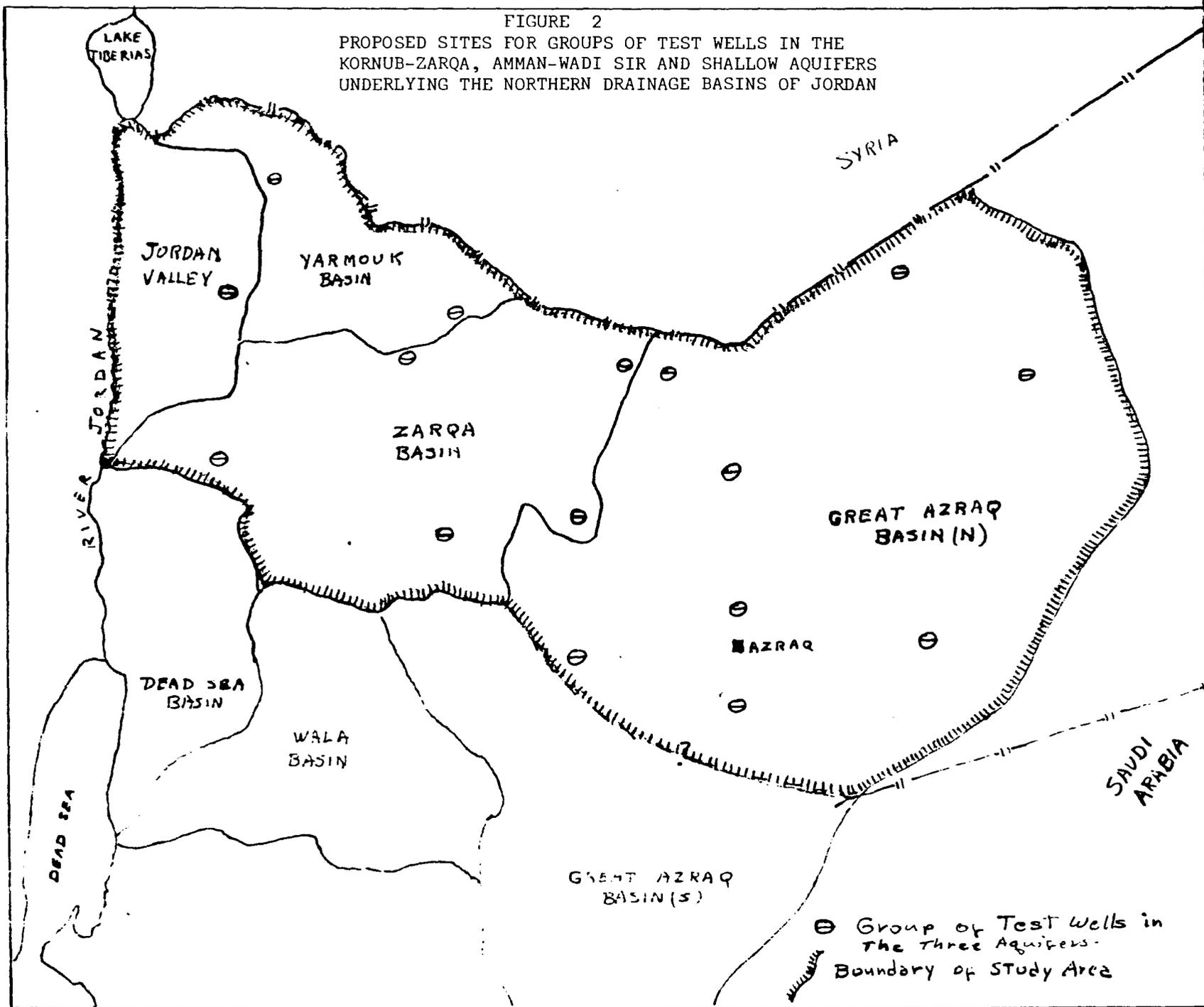
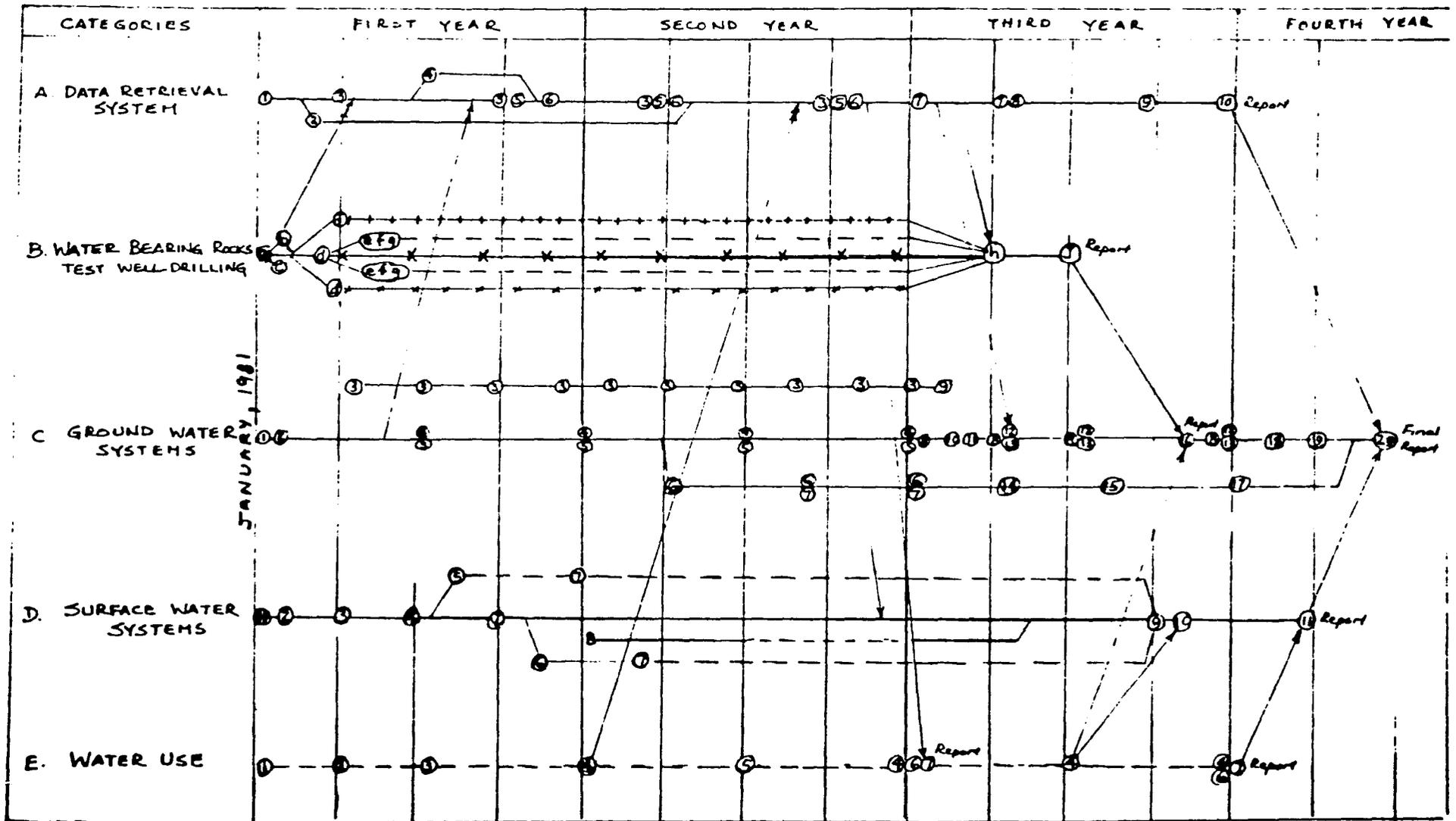


FIGURE 3 - WORK PLAN FOR THE SYSTEMATIC INVESTIGATION OF THE GROUND WATER RESOURCES OF NORTHERN JORDAN



- ① Steps of work - see listings of work categories and steps
- X Karoub-Zarga aquifer
- + Amman-Wadi Sir aquifer
- Shallow aquifer
- ↗ Data flow to data center - ex. mple only
- ↘ Information flow to report center - ex. mple only

5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable generally to projects with FAA funds and project criteria applicable to individual fund sources: Development Assistance (with a subcategory for criteria applicable only to loans); and Economic Support Fund.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? IDENTIFY. HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT? Country checklist is up to date.

Standard item checklist has been reviewed for this project.

A. GENERAL CRITERIA FOR PROJECT1. FY 79 App. Act Unnumbered; FAA Sec. 653(b); Sec. 634A.

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

(a) It is contained in an Advice of Program change to the Congressional Presentation of FY 1980.

(b) Yes

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

(a) Yes

(b) Yes

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

No further legislative action is required.

4. FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?

Yes

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project? N/A
6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. Project is not susceptible. Assistance will not directly encourage regional development programs.
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions. N/A
8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise). U.S. private enterprise will supply the equipment needs of the project, and U.S. citizens will provide technical assistance.
9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services. The Project Agreement will so provide.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release? Jordan is not on excess currency country.
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? Yes.
12. FY 79 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity? N/A

B. FUNDING CRITERIA FOR PROJECT

1. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531(a). Will this assistance support promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102?

The assistance will support economic stability by promoting a coordinated approach to groundwater resources investigation. The Project will reflect policy directions of Section 102 indirectly.

b. FAA Sec. 533. Will assistance under this chapter be used for military, or paramilitary activities?

No

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

THE HASHEMITE KINGDOM
OF JORDAN
NATIONAL PLANNING COUNCIL
AMMAN

Tel. 44466 - 44470
Tlx : 21319 - P.O. Box 555
Teleg. NPC - Amman



ANNEX C

المجلس القومي للتخطيط

عمان

الهاتف : ٤٤٤٦٦ - ٤٤٤٧٠
تلكس : ٢١٣١٩ - ص.ب. ٥٥٥

No. 109/37 / 4762

Date 24/9/1980

Ref. _____

الرقم _____

التاريخ _____

المرافق _____

ACTION COPY

Dr. Edgar Harrell.
Director USAID/Jordan
U.S. Embassy
Amman - Jordan

Dear Dr. Harrell,

Subject : Ground Water Resources Investigation

Reference is made to our discussions concerning the grant from USAID for Ground Water Resources Investigation.

Would you kindly make the necessary arrangements to allocate the sum of 5 million US Dollars to finance this project.

Yours sincerely,

President

cc : H.E. Vice President - NRA

A.I.D. PROJECT NO. 278-0243

PROJECT

GRANT AGREEMENT

BETWEEN

THE HASHEMITE KINGDOM OF JORDAN

AND THE

UNITED STATES OF AMERICA

FOR

GROUNDWATER RESOURCES INVESTIGATION

Date: September , 1980

Project Grant Agreement

Date: September , 1980

Between

The Hashemite Kingdom of Jordan ("Grantee")
acting through the National Planning Council ("NPC")
as its representative and the Natural Resources
Authority (NRA) as the implementing agency.

And

The United States of America, acting through the
Agency for International Development ("A.I.D.")

Article 1: The Agreement

The purpose of this Agreement is to set out the understandings of the parties named above ("Parties") with respect to the undertaking by the Grantee of the Project described below, and with respect to the financing of the Project by the Parties.

Article 2: The Project

SECTION 2.1. Definition of Project. The Project, which is further described in Annex 1, will consist of developing and carrying out a systematic investigation of the availability of ground water in Northern Jordan. Annex 1, attached, amplifies the above definition of the Project. Within the limits of the above definition of the Project, elements of the amplified description stated in Annex 1 may be changed by written agreement of the authorized representatives of the Parties named in Section 8.3, without formal amendment of this Agreement.

SECTION 2.2.(a) Incremental Nature of Project. A.I.D.'s contribution to the Project will be provided in increments, the initial contribution of One Million Six Hundred Twenty Thousand United States ("U.S.") dollars (\$1,620,000) being made available in accordance with Section 3.1 of this Agreement. Subsequent increments will be subject to availability of funds to A.I.D. for the purpose, and to the mutual agreement of the parties, at the time of a subsequent increment, to proceed.

The total A.I.D. contribution over the life of the Project will not exceed Five Million United States ("U.S.") dollars (\$5,000,000).

(b) Within the overall Project Completion Date stated in this Agreement, A.I.D., based upon consultation with the Grantee, may specify in Project Implementation Letters appropriate time periods for the utilization of funds granted by A.I.D. under an individual increment of assistance.

Article 3. Financing

SECTION 3.1. The Grant. To assist the Grantee to meet the costs of carrying out the Project, A.I.D., pursuant to the Foreign Assistance Act of 1961, as amended, agrees to grant the Grantee under the terms of this Agreement not to exceed One Million Six Hundred Twenty Thousand United States ("U.S.") Dollars (\$1,620,000) ("Grant").

An incremental grant of Three Million Three Hundred Eighty Thousand U.S. Dollars (\$3,380,00) is expected to be made subject to the availability of funds to A.I.D. for this purpose. Such incremental grant is expected to be made by amendment to this Agreement.

The Grant may be used to finance foreign exchange costs, as defined in Section 6.1, and local currency costs, as defined in Section 6.2, of goods and services for the Project.

SECTION 3.2. Grantee Resources for the Project.

(a) The Grantee agrees to provide or cause to be provided for the Project all funds, in addition to the Grant, and all other resources required to carry out the Project effectively and in a timely manner.

(b) The resources provided by Grantee for the Project will be not less than the equivalent of U.S. \$3,765,000, including costs borne on an "in-kind" basis.

SECTION 3.3. Project Assistance Completion Date.

(a) The "Project Assistance Completion Date" (PACD), which is September 30, 1984, or such other date as the Parties may agree to in writing, is the date by which the Parties estimate that all services financed under the Grant will have been performed and all goods financed under the Grant will have been furnished for the Project as contemplated in this Agreement.

(b) Except as A.I.D. may otherwise agree in writing, A.I.D. will not issue or approve documentation which would authorize disbursement of the Grant for services performed subsequent to the PACD or for goods furnished for the project, as contemplated in this Agreement, subsequent to the PACD.

(c) Requests for disbursement, accompanied by necessary supporting documentation prescribed in Project Implementation Letters are to be received by A.I.D. or any bank described in Section 7.1 no later than nine (9) months following the PACD, or such other period as A.I.D., giving notice in writing to the Grantee, may at any time or times reduce the amount of grant by all or any part thereof for which requests for disbursement, accompanied by necessary supporting documentation prescribed in Implementation Letters, were not received before the expiration of said period.

Article 4: Conditions Precedent to Disbursement

SECTION 4.1: First Disbursement. Prior to the first disbursement under the Grant, or to the issuance by A.I.D of documentation pursuant to which disbursement will be made, the Grantee will, except as the parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

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

(b) A statement of the name of the person holding or acting in the office of the Grantee specified in Section 8.3., and of any additional representatives, together with a specimen signature of each person specified in such statement.

(c) Evidence that a Project Manager has been designated for the Project.

SECTION 4.2. Notification. When A.I.D. has determined that the Conditions Precedent specified in Section 4.1 have been met, it will promptly notify the Grantee.

SECTION 4.3. Terminal Dates for Conditions Precedent.

If all of the Conditions specified in Section 4.1 have not been met within 90 days from the date of this Agreement, or such

later date as A.I.D. may agree to in writing, A.I.D., at its option, may terminate this Agreement by written notice to Grantee.

Article 5: Special Covenants:

SECTION 5.1. Project Evaluation. The Parties agree to establish an evaluation program as part of the Project. Except as the Parties otherwise agree in writing, the program will include, during the implementation of the Project, and at one or more points thereafter: (a) evaluation of progress toward attainment of the Project purpose; (b) identification and evaluation of problem areas or constraints which may inhibit such attainment; (c) assessment of how such information may be used to help overcome such problems; and (d) evaluation, to the degree feasible, of the overall development impact of the Project.

SECTION 5.2. Access to Sites. Grantee agrees to allow full and ready access to all well drilling sites and other places required for implementing the project and to assure, to the extent that may be required, that such sites are free of mines and other explosive devices.

SECTION 5.3. Cooperation. Grantee agrees that all the organizations involved in the water sector will cooperate with the NRA in the implementation of the Project and will provide all hydrologic and other data presently available and which may become available, to the NRA for the purpose of achieving the objectives of the Project.

SECTION 5.4. Equipment and Personnel. Grantee agrees that the suitable NRA equipment and personnel, which are available at the time of this Agreement and are required to carry out the Project activities, will be assigned to the Project.

SECTION 5.5. Use of Project Equipment. Grantee agrees that the additional staff required to operate and maintain the equipment procured for the Project will be employed and trained; and that the equipment and qualified, trained staff will be used to carry out this and similar projects.

Article 6: Procurement Source.

SECTION 6.1 Foreign Exchange Costs. Disbursements pursuant to Section 7.1 will be used exclusively to finance the costs of

goods and services required for the Project having their source and origin in the United States (Code 000 of the A.I.D. Geographic Code Book as in effect at the time orders are placed or contracts entered into for such goods or services) ("Foreign Exchange Costs"), except as A.I.D. may otherwise agree in writing, and except as provided in the Project Grant Standard Provisions Annex, Section C.1 (b) with respect to marine insurance.

SECTION 6.2. Local Currency Costs. Disbursements pursuant to Section 7.2 will be used exclusively to finance the costs of goods and services required for the Project having their source and, except as A.I.D. may otherwise agree in writing, their origin in the Hashemite Kingdom of Jordan ("Local Currency Costs"). To the extent provided for under this Agreement, Local Currency Costs may also include the provision of local currency resources required for the Project.

Article 7: Disbursement.

SECTION 7.1 Disbursement for Foreign Exchange Costs.

(a) After satisfaction of the Conditions Precedent, the Grantee may obtain disbursements of funds under the Grant for the Foreign Exchange Costs of goods or services required for the Project in accordance with the terms of this Agreement, by such of the following methods as may be mutually agreed upon.

(1) By submitting to A.I.D., with necessary supporting documentation as prescribed in Project Implementation Letters, (a) requests for reimbursement for such goods or services, or (b) requests for A.I.D. to procure commodities or services on the Grantee's behalf for the Project; or,

(2) By requesting A.I.D. to issue Letters of Commitment for specified amounts (a) to one or more U.S. banks, satisfactory to A.I.D., committing A.I.D. to reimburse such bank or banks for payments made by them to contractors or suppliers, under Letters of Credit or otherwise, for such goods or services, or (b) directly to one or more contractors or suppliers for such goods or services.

(b) Banking charges incurred by the Grantee in connection with Letters of Commitment and Letters of Credit will be financed under the Grant unless the Grantee instructs A.I.D. to the contrary. Such other charges as the Parties may agree to may also be financed under the Grant.

SECTION 7.2. Disbursement for Local Currency Costs.

(a) After satisfaction of conditions precedent, the Grantee may obtain disbursements of funds under the Grant for Local Currency Costs required for the Project in accordance with the terms of this Agreement, by submitting to A.I.D.; with necessary supporting documentation as prescribed in Project Implementation Letters, requests to finance such costs.

(b) The local currency needed for such disbursements may be obtained:

(1) By acquisition by A.I.D. with U.S. Dollars by purchase; or

(2) By A.I.D. (a) requesting the Grantee to make available the local currency for such costs, and (b) thereafter making available to the Grantee, through the opening or amendment by A.I.D. of Special Letters of Credit in favor of the Grantee or its designee, an amount of U.S. Dollars equivalent to the amount of local currency made available by the Grantee, which dollars will be utilized for procurement from the United States under appropriate procedures described in Project Implementation Letters.

The U.S. Dollar equivalent of the Local Currency made available hereunder will be, in the case of subsection (b)(1) above, the amount of U.S. Dollars required by A.I.D. to obtain the local currency, and in the case of subsection (b)(2) above, an amount calculated at the rate of exchange specified in the applicable Special Letter of Credit Implementation Memorandum hereunder as of the date of the opening or amendment of the applicable Special Letter of Credit.

SECTION 7.3. Other Forms of Disbursement. Disbursements of the Grant may also be made through such other means as the Parties may agree to in writing.

SECTION 7.4. Rate of Exchange. Except as may be more specifically provided under Section 7.2, if funds provided under the Grant are introduced into the Hashemite Kingdom of Jordan by A.I.D. or any public or private agency for purposes of carrying out obligations of A.I.D. hereunder, the Grantee will make such arrangements as may be necessary so that such funds may be converted into currency of the Hashemite Kingdom of Jordan at the highest rate of exchange which, at the time the conversion is made, is not unlawful in the Hashemite Kingdom of Jordan.

SECTION 7.5. Date of Disbursement. Disbursements by A.I.D. will be deemed to occur (a) on the date on which A.I.D. makes a disbursement to the Grantee or its designee, or to a bank, contractor or supplier pursuant to a Letter of Commitment, contract, or purchase order; (b) on the date on which A.I.D. disburses to the Grantee or its designee local currency acquired in accordance with Section 7.2(b)(1); or (c) if local currency is obtained in accordance with Section 7.2 (b)(2), on the date on which A.I.D. opens or amends the Special Letter of Credit there referred to.

Article 8: Miscellaneous:

SECTION 8.1. Investment Guaranty Project Approval. Construction work to be financed under this Agreement is agreed to be a project approved by the Hashemite Kingdom of Jordan pursuant to the Agreement between it and the United States of America on the subject of investment guaranties, and no further approval by the Hashemite Kingdom of Jordan will be required to permit the United States to issue investment guaranties under that agreement covering a contractor's investment in that project.

SECTION 8.2. Communications. Any notice, request, document, or other communication submitted by either Party to the other under this Agreement will be in writing or by telegram or cable, and will be deemed duly given or sent when delivered to such party at the following addresses:

To the Grantee:

Mail Address: The National Planning Council
Amman, Jordan.

To A.I.D.:

Mail Address: U.S.A.I.D. Mission
Amman, Jordan

All such communications will be in English, unless the Parties otherwise agree in writing. Other addresses may be substituted for the above upon the giving of notice. The Grantee, in addition, will provide the USAID Mission with a copy of each communication sent to A.I.D.

SECTION 8.3. Representatives. For all purposes relevant to this Agreement, the Grantee will be represented by the individual holding or acting in the office of the President, National Planning Council and A.I.D. will be represented by the individual holding or acting in the office of Mission Director, each of whom, by written notice, may designate additional representatives for all purposes other than exercising the power under Section 2.1 to revise elements of the amplified description in Annex 1. The names of the representatives of the Grantee, with specimen signatures, will be provided to A.I.D., which may accept as duly authorized any instrument signed by such representatives in implementation of this Agreement, until receipt of written notice of revocation of their authority.

SECTION 8.4. Standard Provisions Annex. A "Project Grant Standard Provisions Annex" (Annex 2) is attached to and forms part of this Agreement.

IN WITNESS WHEREOF, the Grantee and the United States of America, each acting through its duly authorized representative, have caused this Agreement to be signed in their names and delivered as of the day and year first above written.

THE HASHEMITE KINGDOM OF JORDAN

BY: Hanna Odeh

TITLE: President, National
Planning Council

THE UNITED STATES OF AMERICA

BY: Edgar C. Harrell

TITLE: Mission Director,
USAID/Jordan

PROJECT DESCRIPTION

1. Project Objective.

The objective of the project is to assist the Government of Jordan, Natural Resources Authority, in developing and carrying out a systematic and comprehensive investigation of the availability of ground water resources in northern Jordan. This assistance will include helping the NRA to develop the capability to conduct similar investigations in other areas of the country.

2. Project Components.

The project has the following elements of technical assistance as components:

(a) Consulting services and equipment to assist the NRA in developing a water resources information storage and retrieval system, to include developing computer programs to record existing and newly-discovered data, the training of NRA personnel to operate the computer system, and preparation of a final report.

(b) Consulting services and equipment for a drilling program of test wells in the four drainage basins of the investigation, including the appraisal of available data, the drilling of new test wells to obtain new data, and the preparation of a final report.

(c) Consulting services and equipment to define aquifers and analyze the hydrologic characteristics of ground water systems in the study area, including the appraisal of available data, the testing and monitoring of water quality and quantity for all wells, the development of computer programs for simulation modeling of the ground water systems and the preparation of a final report.

(d) Consulting services and equipment to define streamflow systems (surface water) and their relationship to ground water, including the appraisal of available data, the testing and monitoring of water quality and quantity in surface water systems (streamflow, spring flow and rainfall), the measurement of interaction with ground water, and the preparation of a final report.

(e) Consulting services to assess water use (withdrawals) in the study area, including the appraisal of all available water data, the development of procedures for inventorying quantities of water being withdrawn from wells, springs, streams, and aquifers, and the publication of an annual report.

NRA obligations will include, but not be limited to:
(a) providing approximately \$3.765 million equivalent in local currency; (b) providing all the necessary financing beyond the financial plan which may be required for completion of the project; (c) selection or aid in selection of consultants and contractors and execution of their contracts; (d) providing all available requisite background information and data required to carry out the project; (e) supervision of activities; (f) allocating drilling, test and laboratory equipment to the project, (g) providing facilities and personnel required for the project.

A.I.D. obligations will include, but not be limited to:
(a) review and approval of the scopes of work and contract documents for consultants and contractors; (b) approval of the selected consultants for supervision of the program and of the selected contractors for the supply of equipment; (c) review and approval of requests for disbursement; (d) follow-up on project progress and reporting; (e) review of draft and final reports.

NRA and AID will hold periodic meetings to jointly review, evaluate and recommend solutions to problems encountered during project implementation.

3. Project Cost Estimate and Financial Plan.

(a) Estimated Project Costs.

Total project cost is estimated at U.S. \$ 8.765 million, of which \$5.0 million represents foreign exchange costs. Subject to the availability of funds and to the mutual agreement of the parties, AID funds will be utilized to meet up to \$5.0 million of the costs. The division between foreign exchange and local currency expenditures projected for each element of the Project is set forth in Table 1.

(b) Financial Plan.

The estimated Disbursement Schedule is set forth in Table 2.

TABLE 1
COST ESTIMATE
(U.S. \$ X 1,000)

<u>Item</u>	<u>Local</u> ^{1/}	<u>Foreign</u>	<u>Total</u>
1. Mini-digital computer, related and peripheral equipment.	-	163	163
2. Drilling rigs	-	1,300	1,300
3. Pumps.	-	295	295
4. Vehicles	-	275	275
5. Related drilling equipment	-	1,565	1,565
6. Water testing and related equipment.	-	276	276
7. Surface water recording and related equipment.	-	279	279
8. NRA personnel requirements	3,677	-	3,677
9. NRA training requirements	-	340	340
10. NRA consultant requirements	88	507	595
TOTAL	3,765	5,000 ^{2/}	8,765

Notes: ^{1/} Exchange rate :\$1.00 = J.D. 0.291
^{2/} AID's contribution to the Project will be provided in increments, the initial one being \$1,620 million. Subsequent increments will be subject to availability of funds to AID for the purpose and to the mutual agreement of the parties, at the time of a subsequent increment, to proceed.

TABLE 2
ESTIMATED DISBURSEMENT SCHEDULE
(U. S. \$ X 1,000)

	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>	<u>Total</u>
A.I.D.	0	1,408	3,498	94	0	5,000
G.O.J.	0	242	1,086	1,171	1,266	3,765

4. Project Implementation

Because of the important need to gather and have available as soon as possible reliable information on the Azraq area and Zarqa Basin, implementation of the project will begin in the Azraq area. As soon as equipment and personnel are available, the investigation will begin in the Zarqa Basin as well. It is anticipated that the investigation may be conducted in both regions concurrently on a first priority basis.

Proposed Project Schedule

Negotiation and execution of Project Agreement	September, 1980
Conditions Precedent met	December, 1980
NRA personnel available to carry out project activities	December, 1980
Senior hydrologist (team leader) arrives in Jordan	January, 1981
Computer specialist arrives in Jordan	January, 1981
Drilling program using NRA equipment begins	February, 1981
Procurement of project financed equipment begins	March, 1981
Computer, water-testing, and laboratory equipment arrive in Jordan	September, 1981
Project financed drilling equipment arrives in Jordan	March, 1982
Interim project evaluation	January 1983
Completion of drilling program.	May, 1983
Final reports submitted	September, 1984
Final project evaluation.	January, 1985

AGENCY FOR INTERNATIONAL DEVELOPMENTADVICE OF PROGRAM CHANGE

Date:

Country: Jordan

Project Title: Groundwater Resources Investigation

Project Number: 278-0243

FY'80 CP Reference: None

Appropriations Category: Economic Support Fund

Intended FY 1980 Obligations: \$1,620,000

This is to advise that AID plans to obligate \$1.620 million in FY 1980 for the Groundwater Resources Investigation Project, with an anticipated Life of Project cost of \$5 million to be funded in future years. The Project will assist the Government of Jordan in a systematic and comprehensive approach to the development of its groundwater resources. The Project was not presented in the FY'80 Congressional Notification. Its development has proceeded at a more rapid pace than originally planned.

Attachment: Revised Activity Data Sheet

Off
NE/PD/SJIL:AMohn:gig 9-8-80

learance:

NE/PD:SATaubenblatt	Draft	Date 9/8/80
NE/JLS:BRichardson	Draft	Date 9/8/80
GC/LPID:JRogan	Draft	Date 9/8/80
NE/DP:WMcMoll	<i>W</i>	Date <i>9/3/80</i>
D-AA/NE:BLangmaid	<i>BL</i>	Date <i>9/10/80</i>

PROGRAM: Jordan

ACTIVITY DATA SHEET

CP 88 05/10 78

TITLE Groundwater Resources Investigation		FUNDS Economic Support Fund		PROPOSED OBLIGATION (In thousands of dollars)		
NUMBER 278-0243		NEW <input checked="" type="checkbox"/>		FY 80	1,620	LIFE OF PROJECT
GRANT <input checked="" type="checkbox"/> LOAN <input type="checkbox"/>		CONTINUING <input type="checkbox"/>		ESTIMATED FINAL OBLIGATION		5,000
PRIOR REFERENCE None		INITIAL OBLIGATION FY 80		ESTIMATED FINAL OBLIGATION FY 81		ESTIMATED COMPLETION DATE OF PROJECT FY 83

Purpose: To assist the Government of Jordan (GOJ) develop a systematic and comprehensive approach in the development of Jordan's groundwater resources.

Background: Recognition of the limited availability of water as one of Jordan's primary development constraints has resulted in the decision to initiate a major program to discover and develop all possible sources of water. Although an exploratory well drilling program was started in the 1960's, it was primarily limited to water supplies at depths above 150 meters; consequently, very little is known about the potentially large amounts of water lying below that level. This program will include a thorough study of the availability of exploitable groundwater resources in a selected geographical region which includes the most heavily populated areas in the country.

Effective development of Jordan's groundwater resources will require 1) more data than is currently available on the location, size, origin and content of potentially exploitable sources; 2) a trained staff adequately versed in data collection and interpretation, as well as in planning and resource management; and 3) a data storage and retrieval system that will contain the now widely scattered data collected from previous efforts, as well as newly discovered information.

A predetermined network of exploratory wells will be drilled at selected depths in order to collect data on shallow, middle-level, and deep aquifers. Yield tests will be made for each well in each aquifer drilled to determine the interrelationship of the different aquifers, as well as the quantity of water available. Field tests at each site will determine the types of rocks being penetrated and the chemical properties of the water at various depths. The interrelationships between groundwater and surface water will be studied, particularly the effects of development of aquifers on surface water supplies. In addition, the recharge potential for storing surface water discharge in groundwater reservoir will be addressed. The methods used for data collection and the experience gained during project implementation will be readily

transferable to other geographical regions of Jordan. The establishment of a water resources information storage and retrieval system, with the potential for containing water data for the entire country, will be essential in developing the technical procedures required for planning and managing the optimum exploitation of the country's water resources.

Host Country and Other Donors: Jordan will contribute staff, equipment and operating equipment costs, and logistics, expected to equal or exceed 25 percent of the total cost of the project. No other donors are expected to be directly involved in the project.

Beneficiaries: National Resources Authority personnel will benefit from the technical assistance and training. A successfully established water resources program will potentially benefit almost the entire population of the country.

Major Outputs:All Years

- | | |
|-----------------------------------|---|
| 1. A water resources data bank | 1 |
| 2. Data management system | 1 |
| 3. Trained and equipped personnel | |

AID-Financed Inputs:

	(\$ Thousands)
	FY '80
Equipment	620
Consultants	600
Training	400
TOTAL	1,620

U.S. FINANCING (In thousands of dollars)				PRINCIPAL CONTRACTORS OR AGENCIES
	Obligation	Expenditures	Unliquidated	
Through September 30, 1978				To be selected
Estimated Fiscal Year 1979				
Estimated through September 30, 1979				
Proposed Fiscal Year 1980	1,620	Future Year Obligations 3,120	Estimated Total Cost 5,000	

UNITED STATES GOVERNMENT

memorandum

DATE: September 23, 1980
REPLY TO: *Stanley A. Stalla*
ATTN OF: Stanley A. Stalla, CD/E, A.I.D.

SUBJECT: Project Authorization

TO: Edgar C. Harrell, Director, USAID/Jordan

Your approval is required for a grant of \$ 1,620,000 from the Economic Support Fund appropriation to Jordan for the Ground Water Resources Investigation Project, 278-0243.

Discussion: The project consists of developing and gathering reliable data by means of drilling wells to various depths, conducting aquifer, geophysical and related tests for determining water quantity and quality from individual aquifers and developing a data storage and retrieval system.

Waivers: No waivers are contemplated at this time.

Justification to the Congress: The Congressional Notification, Advice of Program Change for this project was submitted to the Congress on September 12, 1980, and the waiting period expires on September 26, 1980.

Recommendation: That you sign the attached Project Authorization.

Clearance:

<u>NAME</u>		<u>INITIAL</u>	<u>DATE</u>
TPearson	CD	_____	_____
DLeaty	PROG	_____	_____
EGiza	CONT	_____	_____
GDavidson	RLA	_____	_____
LRichards	DD	_____	_____



Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

DRAFT PROJECT AUTHORIZATION

ANNEX G

(T: 3:19)
Ann 8A Ch 8 HB 3

AGENCY FOR INTERNATIONAL DEVELOPMENT PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS PART I				1. TRANSACTION CODE <input type="checkbox"/> A ADD <input type="checkbox"/> C CHANGE <input type="checkbox"/> D DELETE <input checked="" type="checkbox"/> A		PAF 2. DOCUMENT CODE 5				
3. COUNTRY/ENTITY Jordan				6. DOCUMENT REVISION NUMBER <input type="checkbox"/>						
5. PROJECT NUMBER (7 digits) [278-0243]		6. BUREAU/OFFICE A. SYMBOL: NE B. CODE: [03]		7. PROJECT TITLE (Maximum 40 characters) [Ground Water Resources Investigation]						
8. PROJECT APPROVAL DECISION ACTION TAKEN <input checked="" type="checkbox"/> A APPROVED <input type="checkbox"/> D DISAPPROVED <input type="checkbox"/> DE DEAUTHORIZED				9. EST. PERIOD OF IMPLEMENTATION YRS. [04] QTRS. [0]						
10. APPROVED BUDGET AID APPROPRIATED FUNDS (\$000)										
A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		E. 1ST FY		H. 2ND FY		K. 3RD FY		
		C. GRANT	D. LOAN	F. GRANT	G. LOAN	I. GRANT	J. LOAN	L. GRANT	M. LOAN	
(1) ESF	729	876		1,620		3,380				
(2)										
(3)										
(4)										
TOTALS				1,620		3,380				
A. APPROPRIATION	N. 4TH FY		O. 5TH FY		LIFE OF PROJECT		11. PROJECT FUNDING AUTHORIZED		A. GRANT	B. LOAN
	D. GRANT	P. LOAN	R. GRANT	S. LOAN	T. GRANT	U. LOAN	(ENTER APPROPRIATE CODE(S)) 1. LIFE OF PROJECT 2. INCREMENTAL LIFE OF PROJECT			
(1) ESF					5,000				2	
(2)										
(3)										
(4)										
TOTALS					5,000		C. PROJECT FUNDING AUTHORIZED THRU			[81]
12. INITIAL PROJECT FUNDING ALLOTMENT REQUESTED (\$000)								13. FUNDS RESERVED FOR ALLOTMENT		
A. APPROPRIATION	B. ALLOTMENT REQUEST NO. *							TYPED NAME (Initial, SURNAME/ESD) DANNIE BAKER FM/FCD		
	C. GRANT	D. LOAN						SIGNATURE		
(1) ESF	1,620									
(2)										
(3)										
(4)										
TOTALS		1,620						DATE: 9/21/80		
14. SOURCE/ORIGIN OF GOODS AND SERVICES <input checked="" type="checkbox"/> 000 <input type="checkbox"/> 941 <input checked="" type="checkbox"/> LOCAL <input type="checkbox"/> OTHER										
15. FOR AMENDMENTS, NATURE OF CHANGE PROPOSED										

STATE 251980 Provided allotment of Funds for this Project (\$1,620,000).

FOR PPC/PIAS USE ONLY	16. AUTHORIZING OFFICE SYMBOL	17. ACTION DATE	18. ACTION REFERENCE (Optional)	ACTION REFERENCE DATE
		MM DD YY		MM DD YY

PROJECT AUTHORIZATION

Name of Country : Hashemite Kingdom of Jordan
Name of Project : Groundwater Resources Investigation
Number of Project: 278-0243

1. Pursuant to Section 532 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Groundwater Resources Investigation Project for Jordan involving planned obligations of not to exceed \$5,000,000 in grant funds over a two year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project.

2. The Project consists of developing and carrying out a systematic investigation of the availability of groundwater in Northern Jordan.

3. The Project Agreement which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Goods and Services

Goods and services, except for ocean shipping, financed by A.I.D. under the Project shall have their source and origin in the United States and the cooperating country, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States.

b. Conditions Precedent to Disbursement

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement, the Cooperating Country shall furnish, in addition to the standard legal opinion and specimen signature(s), in form and substance satisfactory to A.I.D., evidence that a Project Manager has been designated for the Project.

c. The Cooperating Country Shall Covenant:

(i) to allow full and ready access to all well drilling sites and other places required for implementing the Project and to assure, to the extent that may be required, that such sites are free of mines and other explosive devices;

(ii) that all the organizations involved in the water sector will cooperate with the NRA in the implementation of the Project and will provide all hydrologic and other data presently available and which may become available, to the NRA for the purpose of achieving the objectives of the Project;

(iii) suitable NRA equipment and personnel, which are available at the time of this Agreement and are required to carry out the Project activities, will be assigned to the Project;

(iv) that the additional staff required to operate and maintain the equipment procured for the Project will be employed and trained; and that the equipment and qualified, trained staff will be used to carry out this similar Project.

Typed Name

Office Symbol

Date

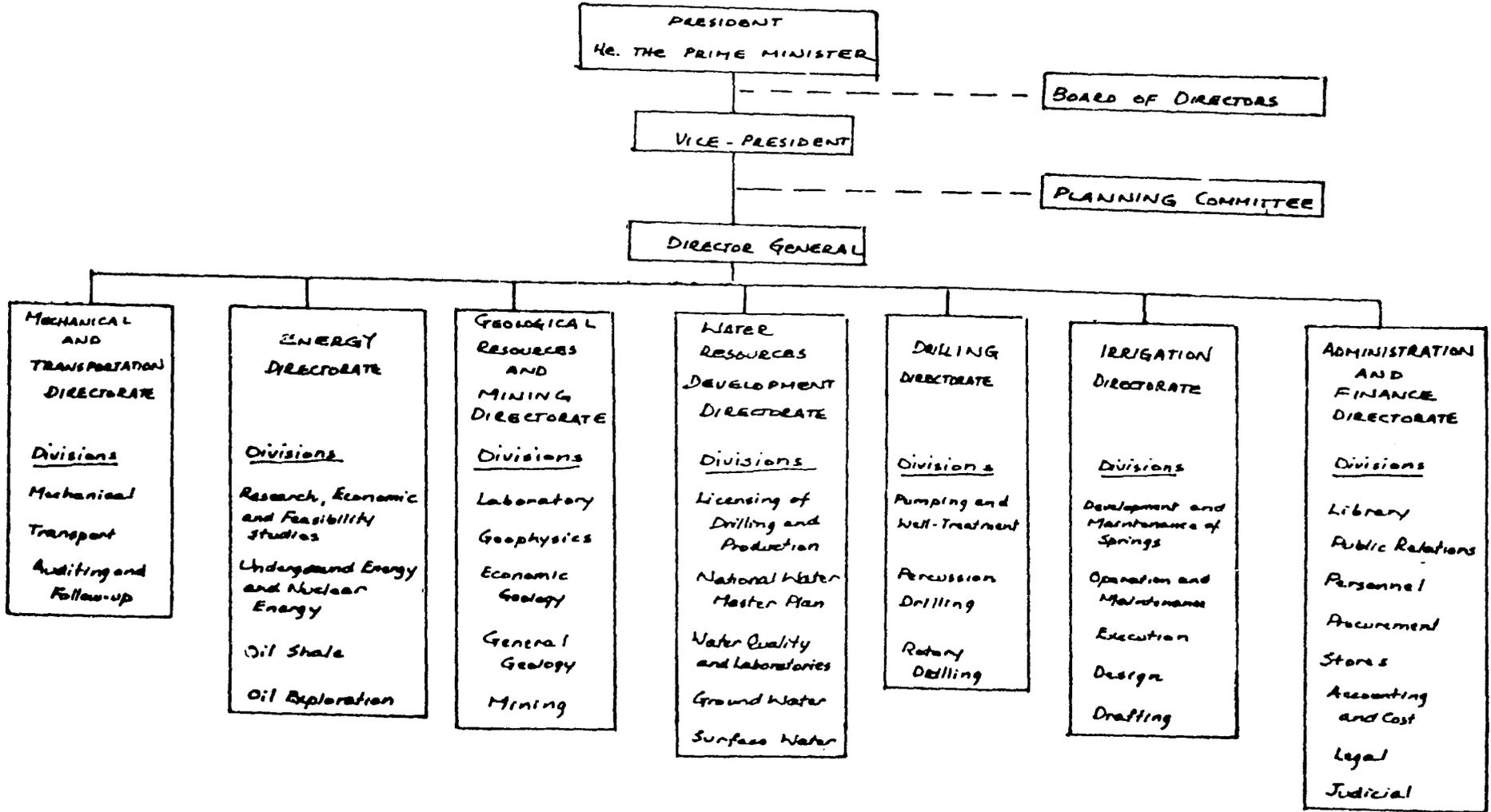
Initials

Signature _____

Typed Name of Authorization
Officer

NATURAL RESOURCES
AUTHORITY

ANNEX I



ANNEX I

LOGICAL FRAMEWORK - GROUND WATER RESOURCES INVESTIGATION

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Program or Sector Goal: To increase the supply of water to Jordan's growing population and economy to satisfy demands in domestic, agricultural and industrial sectors.</p>	<p>Measures of Goal Achievement:</p> <ol style="list-style-type: none"> Increase in average daily per capita water consumption toward the accepted minimum requirement for good health. Increase of water available to contribute to maximization of agricultural sector potential. Increase of water available to satisfy expanding and new industrial demands. 	<ol style="list-style-type: none"> Review records of water sales from the Water Supply Corporation, the Amman Water and Sewerage Authority, The Jordan Valley Authority and municipal water departments. Review reports written by or for the Ministry of Agriculture and the Ministry of Trade and Industry. Conduct a survey of individual users. 	<ol style="list-style-type: none"> NRA will use data system for planning development of and management of water resources.
<p>Project Purpose: To assist the GOJ in developing and carrying out a detailed and comprehensive study of the availability of ground water in northern Jordan.</p> <p>Sub-Purpose: To assist the NRA in developing the capability to conduct similar investigations in other areas of the country.</p>	<p>End of Project Status:</p> <ol style="list-style-type: none"> A computerized information bank with a complete set of data on the water resources of northern Jordan. An NRA staff trained in the technique of data collection and transfer of data to the computer and capable of conducting similar investigations in other parts of the country. 	<p>Examine and evaluate computer programs for completeness and availability of data in files, including maps, tables, graphs and diagrams.</p> <ol style="list-style-type: none"> (a) NRA conduct an employee performance evaluation. (b) Review of performance of trainees in school. (c) Review NRA plans for conducting similar investigations elsewhere. 	<ol style="list-style-type: none"> Training of NRA personnel will be successful. Other GOJ agencies in water sector will cooperate with NRA in providing available data. GOJ continuity of personnel for other projects.
<p>Outputs:</p> <ol style="list-style-type: none"> Network of grouped exploratory/observation test wells drilled in all aquifers of study area. Water resources information storage and retrieval system established and functioning. NRA personnel trained in well drilling, water resources data collection, and computer programming. 	<p>Magnitude of Outputs:</p> <ol style="list-style-type: none"> Ca. 33 test wells spaced strategically in Kurnub-Zarga, Amman-Said Sir, or Shallow aquifers. (a) One (1) installed and operating PDP 11/44 computer system or equivalent, plus required accessories and programs. (b) Existing and newly collected water resources data converted into computer programs for storage and retrieval. NRA personnel participating in investigation. 	<ol style="list-style-type: none"> Review of drilling records and maps, with possible spots checking of actual sites. Inspection of computer and facility, including files and programs. Review of employee rosters, with spot checking at selected sites. 	<ol style="list-style-type: none"> NRA takes available project equipment already owned. On-time delivery of purchased equipment. Technical assistance and training will be available when needed.
<p>Inputs:</p> <ol style="list-style-type: none"> Capital for drilling, water testing, laboratory and computer equipment. Existing NRA drilling, water testing and laboratory equipment. NRA personnel for work and training under the project. In-country and overseas training for NRA personnel. Technical assistance in hydrology and computer programming. 	<ol style="list-style-type: none"> \$4.153 million for required equipment purchases. Existing drilling rigs, pumps, vehicles, recorders, gauges, rainfall stations, evapotranspiration stations, streamflow stations, etc.. Current and new NRA employees. Availability of on-the-job training and training programs in USGS National Training Center in Denver. Senior computer specialist, 1 drilling company specialist, 1 Senior hydrologist program manager, 4 hydrologists ca. 64 person-month. 	<ol style="list-style-type: none"> Review Disbursement documentation. Check NRA equipment inventory sheets. Review employee rosters. Spot check on the job training programs and review catalogs and transcripts for overseas training. Review reports. 	<ol style="list-style-type: none"> GOJ will meet Project Agreement Conditions Precedent in a timely fashion.