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UNCLASSIFIED

PROJECT PAPER

OMAN: WADI AL-KHAWD AQUIFER RECHARGE

PROJECT NUMBER: 272-0102

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT  <b>PROJECT PAPER FACESHEET</b>	1. TRANSACTION CODE <div style="border: 1px solid black; display: inline-block; padding: 2px;">A</div> A ADD C CHANGE D DELETE	PP <hr/> 2. DOCUMENT CODE 3
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3. COUNTRY ENTITY Sultanate of Oman	4. DOCUMENT REVISION NUMBER <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>
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3. PROJECT NUMBER (7 digits) <div style="border: 1px solid black; padding: 2px;">272-0102</div>	6. BUREAU/OFFICE A. SYMBOL NE	B. CODE <div style="border: 1px solid black; padding: 2px;">03</div>	7. PROJECT TITLE (Maximum 40 characters) <div style="border: 1px solid black; padding: 2px;">Wadi Al Khawd Aquifer Recharge</div>
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B. ESTIMATED FY OF PROJECT COMPLETION FY <div style="border: 1px solid black; padding: 2px;">86</div>	9. ESTIMATED DATE OF OBLIGATION A. INITIAL FY <div style="border: 1px solid black; padding: 2px;">82</div> B. QUARTER <div style="border: 1px solid black; padding: 2px;">3</div> C. FINAL FY <div style="border: 1px solid black; padding: 2px;">82</div> (Enter 1, 2, 3, or 4)
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10. ESTIMATED COSTS (\$000 OR EQUIVALENT \$) -						
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	7500		7500	7500		7500
(GRANT)	( )	( )	( )	( )	( )	( )
(LOAN)	7500		7500	7500		7500
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY		7500	7500		7500	7500
OTHER DONORS						
TOTALS	7500	7500	15000	7500	7500	15000

11. PROPOSED BUDGET APPROPRIATED FUNDS (\$000)									
A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		E. 1ST FY 82		H. 2ND FY		K. 3RD FY	
		C. GRANT	D. LOAN	F. GRANT	G. LOAN	I. GRANT	J. LOAN	L. GRANT	M. LOAN
11. ESF	200		252		7500				
12.									
13.									
14.									
TOTALS					7500				

A. APPROPRIATION	N. 4TH FY		O. 5TH FY		LIFE OF PROJECT		12. IN-DEPTH EVALUATION SCHEDULED
	Q. GRANT	P. LOAN	R. GRANT	S. LOAN	T. GRANT	U. LOAN	
11.						7500	<div style="border: 1px solid black; padding: 5px; display: inline-block;">           MM   YY            01   86         </div>
12.							
13.							
14.							
TOTALS							7500

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.

YES  
 NO

14. ORIGINATING OFFICE CLEARANCE SIGNATURE <i>Walter Bell</i> U.S. AID Representative to Joint Oman-U.S. Commission	15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION DATE SIGNED <div style="border: 1px solid black; padding: 2px; display: inline-block;">           MM   DD   YY            03   12   82         </div>
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AGENCY FOR INTERNATIONAL DEVELOPMENT		1. TRANSACTION CODE <div style="border: 1px solid black; display: inline-block; padding: 2px;">A</div> A = ADD C = CHANGE D = DELETE		PP
Sub-Activity PROJECT PAPER FACESHEET				2. DOCUMENT CODE 3
3. COUNTRY/ENTITY Oman		4. DOCUMENT REVISION NUMBER <input type="checkbox"/>		
3. PROJECT NUMBER (7 digits) <div style="border: 1px solid black; display: inline-block; padding: 2px;">272-0101.2</div>	6. BUREAU/OFFICE A. SYMBOL NE/PD		7. PROJECT TITLE (Maximum 40 characters) <div style="border: 1px solid black; display: inline-block; padding: 2px;">Technical Assistance-Aquifer Recharge</div>	
8. ESTIMATED FY OF PROJECT COMPLETION FY <div style="border: 1px solid black; display: inline-block; padding: 2px;">86</div>		9. ESTIMATED DATE OF OBLIGATION A. INITIAL FY <div style="border: 1px solid black; display: inline-block; padding: 2px;">82</div> B. QUARTER <div style="border: 1px solid black; display: inline-block; padding: 2px;">4</div> C. FINAL FY <div style="border: 1px solid black; display: inline-block; padding: 2px;">86</div> (Enter 1, 2, 3, or 4)		

10. ESTIMATED COSTS (\$000 OR EQUIVALENT \$) - 1,000						
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						1000
(GRANT)	( 500 )	( )	( 500 )	( 1000 )	( )	( )
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
MOST COUNTRY						
OTHER DONOR(S)						
TOTALS	500		500	1000		1000

11. PROPOSED BUDGET APPROPRIATED FUNDS (\$000)									
A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		E. 1ST FY <u>82</u>		H. 2ND FY <u>83</u>		K. 3RD FY	
		C. GRANT	D. LOAN	F. GRANT	G. LOAN	I. GRANT	J. LOAN	L. GRANT	M. LOAN
(1) ESF	200	252		500		500			
(2)									
(3)									
(4)									
TOTALS				500		500			

A. APPROPRIATION	N. 4TH FY		Q. 5TH FY		LIFE OF PROJECT		12. IN-DEPTH EVALUATION SCHEDULED
	O. GRANT	P. LOAN	R. GRANT	S. LOAN	T. GRANT	U. LOAN	
(1) ESF					1000		MM YY <div style="border: 1px solid black; display: inline-block; padding: 2px;">12 85</div>
(2)							
(3)							
(4)							
TOTALS					1000		

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

 1 = NO  
2 = YES

14. ORIGINATING OFFICE CLEARANCE				15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION			
SIGNATURE <i>Robert Beech</i>		DATE SIGNED					
TITLE Director, NE/PD		MM DD YY <div style="border: 1px solid black; display: inline-block; padding: 2px;">03 12 82</div>		MM DD YY <div style="border: 1px solid black; display: inline-block; padding: 2px;">03 18 82</div>			

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\*E.1 Subactivity Authorization

1. Final Feasibility/Design Report: Wadi Al Khawd Aquifer Recharge Project, Stanley Consultants, December 21, 1981. Construction IFB; Bidding Requirements/Conditions: Technical Specifications.
2. Draft Final Feasibility Design Report: Stanley Consultants, August 17, 1981, and Addendum No. 1, September 3, 1981.
3. Environmental and Natural Resources Profile of the Sultanate of Oman: Arid Lands Information Center, Office of Arid Lands Studies, University of Arizona, August, 1981.
4. Corps of Engineers Nov. 1979, Report on Water Resources Study, Phase II, and Technical Proposal for Construction of Water Recharge Projects.
5. Public Authority for Water Resources May, 1980, Preliminary Engineering Design for Wadi Al-Khawd Recharge Scheme.
6. Project Implementation Document (PID), in the form of an Appraisal/Issues Paper.

## PROJECT COMMITTEE

AID Washington

NE/PD/SJILO, D. J. Mackell  
Chairman  
NE/PD/ENGR, J. W. Habron  
F. W. Montanari  
R. M. Henrikson  
NE/TECH, L. Reade  
NE/ENVRN, S. F. Lintner  
NE/ECON, L. G. Rosenberg  
NE/JLS, R. Burns  
NE/DP, S. A. Chernenkoff  
NE/PD, M. A. Kleinjan

Joint Commission

Chester S. Bell, Jr.

Oman Government

Musa Salim Badr al-Mazrowi  
Project Manager  
Chairman—Ministry  
of Agriculture's  
Project Committee

## I. SUMMARY AND RECOMMENDATION

A. BORROWER - The Government of the Sultanate of Oman. The Ministry of Agriculture and Fisheries will be the executing agency.

B. THE LOAN - Not to exceed 7.5 million dollars to assist in financing the U.S. dollar costs for the engineering supervision contract and the construction contract, and for some of the local currency costs of the construction contract, for the water retarding structure for the Wadi Al Khawd aquifer recharge demonstration project.

The A.I.D. loan will finance the U.S. Dollar cost of the engineering supervision contract and the construction contract and the local currency costs of the construction contract not covered by the borrower's 50% contribution to the project.

(\$'s Thousand - Totals Rounded)

	<u>US\$</u>	<u>LC</u>	<u>Total</u>
AID Loan	7,500	0	7,500
Government of Oman	<u>500</u>	<u>6,900</u>	<u>7,500</u>
Total	8,100	6,900	15,000

C. TERMS - Repayable in U.S. Dollars within twenty (20) years from the date of first disbursement of the loan, including a grace period of not to exceed five (5) years. Interest is payable in U.S. Dollars from the date of first disbursement of the loan at the rate of five percent (5%) per annum on the outstanding disbursed balance of the loan and on any due and unpaid interest accrued thereon.

D. DISBURSEMENT - Direct disbursement will be made to the Borrower for the local currency construction costs of the Project. Disbursement of funds for the engineering supervision and construction contract costs, in U.S. Dollars, will be made by direct letter of commitment.

E. DESCRIPTION OF PROJECT - This pilot project will demonstrate the concept of aquifer recharge in the Wadi al Khawd, "capturing" an estimated annual average of 4 million cubic meters of water heretofore passing, unused, in runoff to the sea.

A retarding structure, approximately 4.8 kms, (2.8 miles) long, and 9 meters, (24 feet) high, will be constructed across the main channels of the Wadi Al Khawd and designed to permit a controlled discharge of rainwater flood runoff so that it percolates into the aquifer.

If, as anticipated the demonstration is successful, the Ministry has in mind applying the experience gained to other Wadi sites along the Batinah coast.

**PROJECT GOAL** - To realize effective management of Oman's water resources.  
(Thru storage of storm water run-off generally lost to the sea).

- Purpose : of Loan

To test whether a dam of specific type in the Wadi al-Khawd:

(a) can save rain water by allowing it to percolate into the groundwater aquifer.

(b) will prevent or reduce loss of water to the sea from flood flows.

: of Grant Technical Assistance

To assist the Ministry of Agriculture and Fisheries strengthen its capacity to evaluate the results of the demonstration project, correlate water resources data and identify and develop a training program for Ministry officials.

F. SUMMARY FINDINGS - The water in the recharged aquifer will be available for agriculture, industrial, and urban use and will tend to ameliorate the increasing saline conditions in the Seeb-area wells. By assisting the Government of the Sultanate of Oman in this pilot/demonstration project, AID will be helping to address a major concern--water resources management, including conservation--to which the Government committed itself in its First (1976-1980) and Second (1981-1985) Five-Year Development Plans.

G. STATUTORY CRITERIA - The Project meets all applicable statutory criteria and certifications (see Annex VI. I and J).

H. AID's FUNDING SOURCE - Economic Support Fund

I. MISSION VIEWS - the Ambassador and the AID Representative to the Omani-American Joint Commission for Economic and Technical Cooperation strongly support the Project.

J. ISSUES - None

K. RECOMMENDATION - That a loan of \$7.5 million be authorized on the terms listed in paragraph C above.

## II. PROJECT BACKGROUND

Oman is located on the southeastern edge of the Arabian Peninsula with a detached portion of the country on the Straits of Hormuz. Since 1970 when Sultan Qaboos bin Said came to power, Oman has been undergoing rapid changes, diversifying its economy and creating an infrastructure. Revenues from oil, developed in commercial quantities a few years earlier, have fueled these efforts.

Oman, with a land area of approximately 300,000 sq.kms., (115,800 sq. miles), is about the size of the state of Colorado and has a population, estimated by the IBRD in 1978, to be about 860,000.

### A. Oman Economy

Oman's economy is heavily dependent on the oil sector which contributes two-thirds of the gross domestic product, produces 90 percent of government revenues and accounts for almost all the country's exports. Although not a major world supplier of petroleum, Oman's 103 million barrels of oil produced in 1980, nonetheless, resulted in revenues of \$3.6 billion. Although oil production in Oman declined in the second half of the 1970's increases in the price per barrel of oil to \$32 in 1980 increased the country's oil income to the \$3.6 billion level of a year ago.

The non-oil segment of the economy in Oman has benefited from government and private investments made possible by the oil income. The largest of the Government's development investment have been in infrastructure--schools, roads, health facilities, telecommunications, electric power and potable water systems. Oman has made impressive gains as the following selected GOVOMAN statistics indicated.

	<u>1970</u>	<u>1980</u>
Schools	3	363
Asphalted roads (km)	10	2,142
Graded roads (km)	1,817	14,703
Hospital beds	12	1,783
Telephone lines installed	557	15,044
Electricity produced in capital area (m kWh)	8	642
Water produced in capital capital area (m gal.)	14 (7 months)	2,459

In the two traditional fields of Omani productive enterprise, agriculture and the fisheries, gains have been modest despite Oman Government efforts and investments. Although most Omani's derive their employment from agriculture and fisheries, the share of GDP of the two activities remain two percent combined, a share unchanged from 1975 and projected not to change even in 1985, the end of the current five year plan. Omani agriculture concentrates on the production of dates, mangoes, limes, bananas, alfalfa and livestock. Opportunities exist for production of other foodstuffs, notably vegetables, but water shortages and relatively high labor costs complicate the economics of agriculture. Fisheries support upwards of 7,000 traditional small scale fishermen.

Industrial development has so far been limited. The Government is proceeding with the establishment of an industrial park for light manufactures not far from the capital area. The largest of Omani industrial undertakings are the production of flour, cement and copper.

## B. Water Resources in Oman

### 1. Background

The Sultanate of Oman, an arid land of hot climate, receives an average rainfall of approximately 100 mm. (4 inches) per year, varying from somewhat over 200 mm. in the mountains of the north and the Dhofar region in the south, to a total absence of water in the interior desert area. Rainfall, further, varies from year to year, to a wide degree, making water supply prediction especially difficult. In addition to the scarcity of rain, high rates of evapotranspiration work against the accumulation of surface water. Groundwater supplies in the whole of the country of Oman are as yet unmeasured. There are no lakes or rivers. The Oman Government's objective of more intensive and geographically expanded development of agriculture has been impeded by limited water supplies. So also has been the Government's program to provide increased quantities of potable water for urban areas. A more recent competing use for water, that for industry, will further complicate the water resource problem of the country.

Agriculture in Oman is dependent upon irrigation. One system of collecting and distributing irrigation water is known as the falaj system. Use of falaj water is controlled by the farmers or cooperative groups owning them.

The falaj system is an ancient one and in many places major repair or difficult maintenance are required of the owners or the Government to keep them in operation. As a general statement, it can be said that the falaj system is merely being maintained, rather than extended. This is partly because new water sources must be found if irrigated land is to be increased or more water to be supplied and partly because the Directorate of Water Resources and Irrigation in the Ministry of Agriculture lacks sufficient resources to carry out an ever expanding program of nationwide falaj repair and maintenance.

Since 1970, the Government has been active in providing pumps to farmers to help them draw more water from their wells. The fact that water tables have dropped in some areas is attributed however, to over-pumpiny.

At the same time, water supply and demand for urban use has increased many-fold, particularly in the Muscat capital area. To meet the growing need in the Muscat metropolitan area desalination plants have been installed as water demand out-ran the development of new sources. Plans have been drawn up for more desalination plants, both for the Muscat area and for other coastal locations where water suppliers are inadequate.

## 2. Governmental Agencies Involved in Water Resources

The Water Resources Council (WRC), a national water policy coordinating committee, was established in 1974 and is chaired by the Sultan. The Deputy Chairman is the Minister of Agriculture and Fisheries. Members include the Ministries of Electricity and Water, Interior, Land Affairs and Municipalities, Communications and Petroleum and Minerals. All major national water questions come before the Council for decision, and national rules and regulations such as those for licensing of wells are issued by the Council. The latest Sultani decree 62/79, concerning reformation of the Water Resources Council is shown in Annex B.

Supporting the Council, in a technical capacity, is the Public Authority for Water Resources, (PAWR) which was formed in 1979. The Chairman of PAWR is the Minister of Electricity and Water. Attached to the PAWR and acting, in some respects, as the Secretariat, are water technical experts from the U.S. firm of Tetrattech International. Studies and research efforts are carried out by PAWR to investigate and measure water resources.

A list of other Government agencies involved in water resources, along with their particular interests in water programs, is contained in Annex C.

The Ministry of Agriculture and Fisheries which has the responsibility for irrigation programs, is the sponsor of the Wadi al Khawd project.

#### C. Project Area

The project will be constructed in the Wadi al Khawd, below the village of Al Khawd, 50 kilometers north west of Oman's capital, Muscat. A map of the area, showing the location of the prospective dam and surroundings, appears in Annex A.

Wadi al Khawd is one of the wide valleys or dry streambeds which drain into the Gulf of Oman along Oman's northwest Batinah Coast. Along with seven other Batinah coast wadis, Wadi al Khawd was studied by the U.S. Army Corps of Engineers in 1978 and 1979 to determine whether building aquifer recharge structures in Wadi's would be an effective means of augmenting water supplies. The conclusion of this investigation was that a substantial share of the flood waters which course through the wadis following storms could be saved by the construction of low dams and dikes. It was also concluded that Wadi al Khawd be selected for the initial pilot demonstration project.

#### D. Rationale for U.S. Assistance and Project Selection

The United States Government in 1980, entered into an agreement with the Government of the Sultanate of Oman (GOVOMAN) which established an Omani-American Joint Commission for Economic and Technical Cooperation (JC). The JC serves as the institutional arrangement for programming and administering U.S. economic assistance.

The U.S. provided \$5.0 million in ESF Grant funds to the JC in an agreement signed September 29, 1980. The \$5.0 million is for technical assistance, project development, implementation, and for certain operational costs of the JC. The U.S. also agreed in principle to provide, in FY 1982 and FY 1983, some loan funds, should suitable projects be identified for funding. The GOVOMAN agreed to match the level of these U.S. loan funds.

Prior to this agreement joining with the GOVOMAN in its development efforts through the establishment and shared funding of the JC, a team of AID/W officials visited Oman in June, 1980. The team and their GOVOMAN counterparts explored possible areas of JC involvement.

The GOVOMAN has as one of its concerns the conservation of water, the paucity of which is a major constraint in Omani development. The GOVOMAN attaches high priority to water resources development, identifying the water sector as a principal area for investment in both of their Five Year Development Plans (1976-1980 and 1981-1985). As a consequence of this long standing concern and

the priority attached to it, numerous studies were commissioned, reports made and suggestions proffered which led to pre-feasibility studies for aquifer recharge pilot projects which would conserve water by capturing storm water otherwise lost as run-off to the sea. Among other studies, those by Tetratex International (advisors to the GOVOMAN) and the U.S. Army Corps of Engineers (COE)—by invitation of the GOVOMAN—produced pre-feasibility data and recommendations for such projects.

In the early discussions between the GOVOMAN and the U.S. as to what activities the new Joint Commission might undertake, the Wadi Al Khawr Aquifer Recharge Project Proposal was recommended by the GOVOMAN.

The GOVOMAN and U.S. planners agreed that the recharge project, having technological characteristics which were new to the Sultanate and having been preliminarily studied by the COE and Tetratex personnel, was an appropriate subject for Omani-American cooperation and the JC's involvement was appropriate. Accordingly, following the JC's establishment, plans were approved for JC financing of a final feasibility/design study. This study was contracted for by AID/W with an IOC/Requirements contractor (Stanley Consultants) for the JC account on May 6, 1981. The final report was submitted in December 1981.

#### E. OTHER DONORS

In the area of aquifer recharge, aside from this combined effort of the Ministry of Agriculture and Fisheries, the Joint Commission, and A.I.D., only the Government of Japan, is currently active. The GOJ through the Japan International Cooperation Agency has funded the Sanyo Consulting Company to carry out a study of the Wadi Jizzi—some 200 kms up the Batinah Coast. The study, started in 1981 and expected to result in a final feasibility and design study in August/September of this year, is focusing on a diversion dam in the wadi to feed water to a small agriculture complex downstream. Sanyo has a 12-man team studying the economic viability of various agricultural alternatives including the feasibility of exports.

The total costs of the project have been estimated to be in the neighborhood of \$40 million. It is anticipated that the final costs and general feasibility will be presented in the August/September 1982 report.

#### International Bank for Reconstruction and Development (IBRD)

Since the early 1970's the GOVOMAN received approximately \$45 million in loans from the IBRD in the following fields:

- Education
- Highway Maintenance
- Communications
- Studies and Technical Assistance

The IBRD has recently announced a 15-year, \$15 million, second-phase highway maintenance loan at 11.6% interest with a 3-year grace period.

### United Nation Agencies

Various UN agencies, e.g., UNDP, FAO, Civil Aviation, and WHO, have funded activities in Oman. These activities which are relatively modest in scale consist essentially, in providing the services of experts/advisors who are integrated into various ministries. These experts serve in such fields as Agriculture, Health, Industrial Planning and Fisheries.

### Arab Funds

Since the early 1970's, bi-lateral and multi-lateral economic aid funds from various Arab countries have been made available to the GOVOMAN on both a grant and loan basis. These arrangements are usually for specific types of projects, e.g., roads, copper mining, schools, hospitals and community centers.

## III PROJECT ANALYSIS

### A. Technical Analysis

#### INTRODUCTION

In arid lands water resources management emphasizing conservation (non-waste), is basic. The physical conditions, topography and rainfall, make it pertinent both to capture all the natural water possible and use it wisely. A series of wadis (dry storm channels) along the northwest coast of Oman carry the infrequent and generally high intensity rain runoff to the sea. While some of the water percolates into the underground aquifer and is available for use, a portion is lost to the sea. This project, in the Wadi al Khwad located some 50 kilometers northwest of the Muscat capital area, is designed to prevent most of the loss of rainwater and recharge the aquifer.

The final project evolved through a series of design phases. The concept began with improving the natural process of aquifer recharge in the wadis by devising a means of increasing the amount of water introduced into the underground aquifer and thus reducing loss both through the high evaporation in the arid environment and as run-off to the sea.

The U.S. Army Corps of Engineers (COE) initiated a two-phase study of the future development of water resources in Oman in August 1978. The Phase I report of the COE recommended, among other things, development of conceptual designs, sitings for recharge projects and the design of a pilot aquifer recharge structure.

The COE Report on Phase II, in November 1979, in addition to identifying eight wadis as potential sites for recharge structures, recommended the Wadi Al Khwad as the site for a pilot water conservation project, which envisioned aquifer recharge and highlighted—in accordance with the Corps' understanding—flood control as a significant objective.

Subsequent to the completion of the COE's report in 1979, the Oman Government Water Authority's American consulting firm Tetratich, having collected data beyond that then available to the COE, developed and proposed an alternative design for the Wadi al Khawd pilot project which emphasized aquifer recharge.

At the request of the GOVOMAN, the COE was asked to reconcile the two conceptual approaches. In the COE's letter report of December 1980, it accepted the Water Authority's scheme which emphasized the use of retarding structures to maximize the recharge of the underground aquifer.

### 1. Design Background

At the request of the GOVOMAN and Joint Commission, Stanley Consultants Incorporated (SCI), was contracted to design an appropriate facility to provide maximum recharge of the rain runoff in Wadi al Khawd. In the course of the design the consultant analyzed various alternatives. Among them were a two dam solution and a one dam solution, and pervious versus impervious structures. A single impervious retarding structure proved to be not only less costly but also offered other efficiencies.

Although there is ample reason to believe the project will achieve its objectives, certain gaps in hydrological data make it prudent to consider the project as demonstrational in nature and a pilot effort. There are similar sites for aquifer recharge projects along the Batinah coast, however, basic data and experience are needed if an extensive program of recharge projects is to be embarked upon. An important facet of this project is the measuring of the results of the Wadi Al Khawd Dam. Therefore a monitoring program is described in a following section.

### 2. Design Criteria

Good design in water resources development must be based solidly on reliable data; and application of the data requires understanding, extensive experience and judgment. This is particularly important in arid areas. Under circumstances such as those in Oman where records of actual experience are less than optimal high reliance must be placed on experience with other locations and professional judgment.

Hydrological and meteorological records for Oman are of quite short duration and pertinent data for the project area are even more sparse, the continuous records covering the period 1974-1979. An unusual flood, having a return period variously estimated in the range of 25 years, occurred in May, 1981. This provided a judgmental validation of the synthetic data and statistical analyses used by the consultant in developing the design basis for the retarding structure.

The GOVOMAN's PAWR, in its report "Ground Water Recharge Alternatives for Wadi al Khawd, 1980", outlined five objectives which were used to guide the design efforts:

- a. Maximization of existing subsurface storage potential.
- b. Preservation of historical water resources for current users.
- c. Minimization of requirement for new (groundwater) recovery and transport facilities.
- d. Exploitation of aquifer hydraulic properties to maximize retention of water in storage.
- e. Minimization of wetted areas and subsequent evaporation loss during periods of recharge.

Based on the available records and generalized information for flood flows on the Arabian Peninsula developed by the COE, the critical flood value for safety, that is the Probable Maximum Flood, was estimated. This was utilized to design the spillway features.

An embankment type retarding structure utilizing wadi materials close to the structure, was selected as the most appropriate from the view points of economy of construction, ease of maintenance, simplicity of operation, and safety.

Recharge is achieved by controlling the flood flows to the amount which can reasonably infiltrate to the subsurface aquifer. This can be accomplished by storing the flows which exceed the infiltration capacity and releasing them at the rate they can be absorbed, or pooling them in spreading basins to allow the percolation to take place over a larger area. The available information indicates that controlling discharge to the natural percolation mechanism can be expected to be more efficient. Discharge culverts are used to provide the controlled discharge. Therefore, operators in the normal sense of full-time surveillance, are not required.

Regular maintenance is relatively simple. It only requires the following minimum activities under the direction of a qualified dam safety engineer.

- 1) Annual inspection to determine damage or evidence of deterioration. If found, defects should be promptly repaired, restoring structure to full integrity.
- 2) Inspection immediately following a flood event to determine damage or evidence of deterioration. If found, defects should be promptly repaired, restoring structure to full integrity.
- 3) Removal of debris so that culverts can operate as designed
- 4) Removal of collected sediment when judged necessary. This operation estimated to be required not more frequently than every 10 years on the average.

Generally accepted engineering criteria and guidelines for embankment retarding structures are conservatively applied. Safety, economy of construction, and simplicity of operation and maintenance were carefully considered. These are described in detail in the "SCI" report, "Feasibility Report - The Wadi al Khawd Aquifer Recharge Project - December 1981" and accompanying "Computations and Technical Specifications".

### 3. Design Features

The retarding structure has been designed as an earth-fill embankment using wadi material. The extended discharge of the stored water to be accomplished by the pervious nature of the structure in the original proposal will be achieved by means of culverts running through the structure. The culvert feature provides a positive control of the discharge quantity and the ability to vary the quantity, a feature not present in the pervious structures, and needed in a demonstration effort.

Data upon which to develop estimates of both the flows of run-off water to be managed and the amount which may be recharged to the underground are extremely limited. Never the less based on the sparse records, the results of the drilling program, and pragmatic evaluations of the wadi underground structure, the most probable method of good infiltration appears to be through the existing channels as compared with stilling basins. In any event, stilling basins can be tested if desired and if operation indicates a need to do this.

Available records, although of short duration, indicate an average annual flood flow volume of 16.8 million cubic meters (mcm) per year at a gaging station upstream of the project area. The average flood flow measured below the project (at the Coast Road) is 4.58 mcm per year. This estimate, based on flood flows, is felt to be conservative with considerably greater recharge occurring under total annual flows.

The underground aquifer conditions and its use are quite complex. In the upper wadi, water is being extracted by two organizations for domestic use, PDO Petroleum Development (Oman), for its installation and Ministry of Electricity and Water's Seeb wellfield to supply water to the Muscat capital area. In the lower wadi, close to the sea, water is extracted from shallow wells for agriculture, as well as domestic use. In general, the domestic wells are low yield installations producing up to 320 g/p/m. The groundwater supplies are combined with desalted water from the GOVOMAN's Gubrah desalination plant to provide the needed quantity for the capital area.

In the Seeb area, concern has been registered about increasing salinity. One suggested cause is salt water intrusion. A more probable explanation is that the salinity increase is a result of irrigation practices, which because of recirculation, causes leaching of the soil and an eventual salinity condition which can make the soil unusable for cultivation.

## Key Features

The structure will be approximately 4,300 meters (2.8 miles) long and 3 meters (24 feet) high at the lowest point in the wadi. The core zone will be of the finest wadi material available close-by in the reservoir area. The downstream area will be maintained in its natural condition. Since sudden draw-down conditions will prevail and both faces will be saturated under overflow conditions, side slopes are limited to 1 on 3. The upstream face will be covered by riprap and gabion mattress protection will be provided for the spillway sections. Riprap protection will be provided to both upstream and downstream faces of the non-overflow abutment sections.

Key-trenches under the embankment, and concrete collars on the culverts are designed to protect against piping failure, generally the most frequent hazard in embankment structures. Toe drains have been provided to pass the calculated flow of water through the structure safely. Small stilling basins lined with gabion mattresses have been designed for the downstream toe of the overflow sections to minimize erosion.

The report in draft form was discussed in detail with officials of the Directorate of Water Resources and Irrigation of the Ministry of Agriculture and Fisheries. The Directorates staff and two UN (FAO) advisors to the Directorate enthusiastically supported the project. Particular interest was expressed in the pilot, demonstrational nature of the project and the monitoring (long term) facet.

The Minister of Agriculture and Fisheries, who is also the Deputy Chairman of the GOVOMAN's Water Resource Council, convened the Council to review the SCI Report. The Council agreed to proceed with the project as outlined herein.

## 4. Recharge Monitoring/Evaluation

Increasing groundwater recharge and the amount of water available for use can provide benefits both in the quantity and quality of the resource. A monitoring/evaluation, effort is essential to measure the effects of the installation of the retarding structure.

Since a principal objective of the project is to develop a data base and state-of-the-art information on the performance of the recharge facility, the monitoring and evaluation facets are especially important. This requires the determination of existing conditions of the groundwater in the wadi (baseline) and measuring the changes in both quantity and quality which occur over time as the result of the retarding structure. To determine the amount of water saved from discharge to the sea requires measurement of surface flows in the wadi, upstream from the structure, and at the Coast Road. It is generally accepted that water reaching the Coast Road is "lost".

A preliminary conceptual design of a monitoring system contemplates a grid of observation wells, with simple measuring devices to be distributed in the wadi below the retarding structure to measure water levels and provide samples to determine water quality. The wells, properly located and developed, would be installed early in the construction activity under the supervision of the consultant, SCI. Detailed location and final equipment specifications for the wells will be provided by the consultant for approval by the GOVOMAN.

Gaging facilities to measure the surface flows in the wadi will also be provided by the consultant. Two level recording stations including simple drum recorders and the necessary stilling wells will be required; one at the Al Khawd gaging station (destroyed in the 1981 flood) and one in the pool behind the structure. The flows at the coast road would be measured with a current meter or staff gage whenever they occur.

A preliminary budget for the installation and equipping of the monitoring facilities follows:

	<u>U.S.\$'s</u>
Up to 12, - 100 mm monitoring wells, 50.00 mts deep complete with casing and screens .12 at \$14,000.	158,000
Up to 5, - 200 mm monitoring wells, 100,00 mts deep, complete with casing and screens - 5 at \$30,000	150,000
Equipment 2 drum recorders complete with stilling well and shelter. Current meter. Misc., Equipment. Up to 30 samplers.	30,000
Contingencies 10%	36,000
Engineering Supervision	20,000
TOTAL	<u>\$404,000</u>

The monitoring and evaluation activities consist of data gathering, as noted above, and the development of a methodology to track the performance of the recharge facility over time. This latter dimension must by its nature be accepted as extending at least 5 to 10 years before any reliable trends can be expected.

During the course of the development of the project, representatives of A.I.D., the Joint Commission and the Ministry of Agriculture, and Fisheries explored the needs of the GOVOMAN to further their efforts in water resources management related to the special responsibilities of the Ministry. The requirements for technical support, technology transfer and manpower development crystallized into a basic Technical Assistance Program which will also encompass the institutionalization of an expanded monitoring phase, provision of technical consultants, and short-term technical professional training in the U.S. and the Sultanate of Oman, and which will be developed with funds from the Project Grant Agreement signed September 29, 1980, between the Sultanate of Oman and A.I.D. (the "Grant"), subject to approval of the subactivity in accordance with the Grant and signing of a Sub-Grant Agreement between the Grantee and the Ministry of Agriculture.

#### 5. Technical Assistance Program (TAP)

Plans for a program of technical assistance related to Aquifer Recharge and other water resources development possibilities evolved in talks among the Ministry of Agriculture and Fisheries, the Joint Commission, A.I.D. and SCI. Initially, attention was focussed on testing the results of the aquifer recharge through the measuring/recording and analyzing the data collected. This level of testing is an integral part of the demonstrational nature of the aquifer recharge concept.

It became apparent that the effort necessary to properly test the results of the recharged aquifer presented an opportunity for the Ministry of Agriculture to develop/strengthen the capabilities of its staff. An expanded program of monitoring, to include review and correlation of water resources data as it relates to other aquifers along the Batinah coast, would help the ministry in proceeding further with its water resources development plans.

Consideration of expanding the monitoring led to suggestions that a team (1 or 2 consultants) of hydrogeologists be provided to guide the expanded monitoring effort and offer training in the discipline of researching, organizing, and analyzing water resources data as these relate to conditions along the Batinah coast in particular and potential aquifer recharge and water resources management in Oman in general.

It seemed clear that in pursuing such a course, training opportunities for Ministry of Agriculture-assigned personnel would also be identified; thus, a training component was introduced into the T.A.P.

These discussions have resulted in a Technical Assistance Program (T.A.P.) which would comprise three parts as follows: (ANNEX F.1, contains the expanded presentation)

1. Monitoring/evaluation of the results of the Wadi Al-Khawi Aquifer Recharge Demonstration Project;
2. Collecting, researching, organizing, analyzing, and correlating water resources data as it relates to the potential of wadi aquifers along the Batinah coast; and
3. Identifying short-term training opportunities for Ministry of Agriculture personnel.

It is proposed that the T.A.P. Assistance be provided pursuant to a contract between the Ministry of Agriculture and Fisheries and qualified contractor. It is anticipated that arrangements would be made for a technically qualified consultant to go to Oman after the signing of the construction contract to develop the details of the scope of work of the T.A.P. in conjunction with the Ministry, the Joint Commission and A.I.D.

It is proposed that the T.A.P. cover a period of three years and be implemented in phases.

The outline of the program shown in Annex F.1 serves as the scope of work and project presentation for this activity.

As the approval of AID/W is required for funding sub-grant activities, approval of the NEAC is requested for this T.A.P. sub-grant funded activity. This approval will permit the JC to proceed with the negotiation and signing of the sub-grant agreement with the Ministry of Agriculture and Fisheries as the implementing agency. The GOVOMAN has requested this T.A.P. and that it be funded from the grant. Muscat cable 1265 of 3/17/82 confirms that the Ministry of Agriculture's letter to this effect was received by the Joint Commission. A draft letter from the JC Co-chairman approving the T.A.P. is shown in Annex F.3.

As noted in the T.A.P. (Annex F.1), this subgrant agreement would be developed in detail and signed only after the signing of the Loan Agreement, the engineering supervision contract and the construction contract.

Funding for the trip to Oman for the technically qualified senior consultant to develop the detailed scope of work would also be from the grant and arranged by the JC.

B. Financial Analysis

1. Financial Plan

Total estimated project engineering supervision costs and construction costs and costs for the drilling of test wells for monitoring the quantitative and qualitative characteristics and various water recording devices, and sources of financing are as follows:

(\$ thousands)

	A.I.D.		FC	GOVOMAN	TOTAL
	FX	LC		LC	
Engineering	650			250	900
Construction	5,700		500	5,300	13,500
Monitoring Wells	150			350	500
Total Project Costs	7,500		500	6,900	15,000

The \$7,500,000 A.I.D. Loan will finance 50% of the cost of the project and a contribution by the borrower will finance the other 50% with the borrower financing any costs above the estimated costs. The A.I.D. loan will first be used to finance the U.S. dollar costs of the engineering contract, then the U.S. dollar costs of the construction contract and finally any local currency costs of the construction costs up to 50% of the project costs. The proportion of U.S. dollar and local currency costs will vary depending on whether the construction contractor is of U.S. or Omani nationality. The GOVOMAN, in addition will finance the recurring maintenance costs and provide counterpart personnel and support facilities for the monitoring program to be carried out by the Ministry of Agriculture and Fisheries. The monitoring activity is included in the T.A.P., details of which are shown in Section III.A.4, and 5, and will be funded under the existing Grant.

2. Disbursement Schedule

Project disbursements are expected to begin in the fourth quarter of FY'82 and terminate in FY'84.

An estimated disbursement schedule is shown below:

Estimated A.I.D. Loan Disbursement Schedule  
(\$ Millions)

	<u>FY 82</u>	<u>FY 83</u>				<u>FY 84</u>		<u>TOTAL</u>
		1	2	3	4	1	2	
Engineering Supervision	.040	.120	.120	.120	.120	.100	.030	.650
Construction	.300	1.2	1.2	1.20	1.20	1.20	.550	6.950
TOTAL	.340	1.320	1.320	1.320	1.320	1.320	.580	7.500

Reasonableness of Cost Estimates

Within the requirements of FAA Section 611(a)(1), A.I.D. has reviewed the engineering and financial plans for this project and found them to be satisfactory and the cost estimates reasonably firm.

3. Debt Services Capability

The total cost of the project is \$15 million. The GOVOMAN will fund 50% of this cost—\$7.5 million from their own resources. A.I.D. will lend \$7.5 million to the GOVOMAN as its 50% share of the cost of the project. The terms of the A.I.D. loan are 20 years at 5 percent interest per year with a 5 year grace period for principal repayment.

The current and projected financial position of the GOVOMAN is such that there is every reason to believe that the GOVOMAN will be able to repay fully the A.I.D. loan in accord with the terms outlined above.

The table below provides actual 1978, 1979 and estimated 1980 debt services ratios (total public debt service divided by total exports consisting of 95% of crude oil exports): (Million of U.S. dollars)

	<u>1978</u>	<u>1979</u>	<u>1980</u>
Total Public Debt Service	135	209	161
Exports	1599	2282	3814
Debt service Ratio (%)	8.5	9.2	4.2

The substantial decrease of the debt service ratio from 1979 (9.2%) to 1980 (4.2%) resulted from the advance repayment of most of the commercial loans. Projections of exports for 1981-1985 by the IBRD estimated that the dollar value will increase by over 50 percent with an average current account surplus exceeding the 1980 estimated level (about 1.3-1.4 billion in comparison with \$1.2 billion in 1980). Such favorable results would indicate the GOVOMAN will have, as previously mentioned, no problem in repaying the long-term debt incurred by the project.

### C. Economic Analysis

The Wadi Al Khawd aquifer recharge project is essentially a demonstration project. The technical-hydrological information and analysis provides a possible range for firm yield from 1.5 to 5.0 MCM per annum. Given this hydrological information an average yield of 4.0 MCM per annum was adopted in the economic analysis.

The economic analysis is a least cost analysis, comparing the availability of water from the Wadi Al Khawd with alternative sources of potable water for the capital city area of Muscat from 1983-1997. The basis for this selection of potable water use adopted the criteria of maximizing water value. It was initially estimated that the economic rate of return in agriculture uses would be approximately 6.0%. This was substantially less than the 10% opportunity cost of capital currently used by the Development Council of Oman in approving publicly-financed projects and assumed to be the appropriate rate of return or discount rate in this economic analysis.

The economic comparison of the Wadi Al Khawd with alternative water supplies, as noted above, was a least-cost discounted cash flow analysis. The Sultanate of Oman currently has available a least-cost long-term plan to meet the projected urban water supply requirements of the capital city area. These water supply requirements are presented in Table 1, Annex A. The output of the Wadi Al Khawd is a new source, not included in the plan. Wadi Al Khawd was included in the least cost plan when the estimated annual costs of the aquifer recharge project were less than the avoidable costs of alternative water supplies. Avoidable cost was defined as variable (or avoidable) costs related to the output of the alternative sources. In this analysis, the alternative water supply sources were primarily water desalination plants and the avoidable costs were mainly fuel and energy expenditures. At this stage of knowledge of the projects benefits no firm yield for the Wadi Al Khawd project can be established and the deferral of alternative water supply projects included in the long-term plan was not contemplated.

The result of the least cost analysis was substantially favorable to the Wadi Al Khawd aquifer recharge project. Discounted avoidable costs over the 1982-1997 time period were about 3.7 R.O. million in 1982 values (see Table 2, Annex H). This could be compared to R.O. 6.2 million

investment costs used in the economic analysis. If the avoidable costs are defined as project benefits, the economic rate of return is approximately 18.2 percent.

In view of the quite favorable economic results mentioned above, the project's attractiveness is not affected adversely to a significant degree unless critical variables are radically revised. The following changes in two critical variables that appear improbable would decrease the rate of return to the marginal 10 percent minimum assumed as appropriate for the project's economic justification:

Increase capital costs by 50% (from 6.2 million to 9.9 million R.O.). Decrease firm yield to 2.3 MCM per annum (from 4.0 MCM per annum).

On the basis of the results of the economic analysis related to the Wadi Al Khawd aquifer recharge project, this project appears economically worthwhile.

#### D. ENVIRONMENTAL ANALYSIS

An Environmental Analysis\* of the proposed project based on field and office studies was conducted by Stanley consultants in conformance with the requirements of 22 CFR 216, "A.I.D. Environmental Procedures"

Principal impacts associated with the proposed project include:

- . A reduction of peak discharges during flood periods in Wadi Al Khawd and hence reduce damage and loss of life in downstream areas;
- . Provision of additional water supplies from project implementation is anticipated to allow for aquifer recharge in the Seeb area which is currently experiencing increased salinity in well water;
- . The loss of natural vegetation and wildlife habitat in those areas disturbed during construction;
- . The potential alteration of traditional water rights;
- . The potential destruction of disturbance of unknown archaeological or histroical sites;
- . An incremental increase in environmental disturbance due to urban expansion as a result of additional water supplies being available;

\*See: Stanley Consultants, Inc. 1981.  
Feasibility Report - The Wadi Al Khawd Auquifer  
Recharge Project  
"Part 7 - Physical Environment".

- . Potential expansion of agricultural lands would increase the habitat and carrying capacity for coastal wildlife species, especially birds.

Mitigation activities will include: (a) notification and consultation with the Advisor for the conservation of Environment and the Director General of Antiquities prior to project implementation and (b) the monitoring and evaluation of environmental impacts, especially as they relate to changes in traditional water rights (see Section III E.4).

#### E. Social Soundness Analysis

The social soundness analysis of this project was prepared by Stanley Consultants and submitted as part of their feasibility design report.\* Their major findings are outlined below.

##### 1. Project beneficiaries

Summary - The beneficiaries affected by the project could include urban water users in Muscat, coastal farmers and residents of Seeb and other residents within the drainage basin of Wadi Al Khawd who have historical rights to water.

##### - Urban Water Supply

Total incremental capture from the recharge project is estimated at 4.0 MCM/year. 11,000 daily cubic meters of incremental water could supply approximately 26 percent of 1983 total urban demands and 14 percent of 1990 demand. Residential, commercial, industrial, and government users will benefit. Residential users currently account for about 65 percent of total water demand. It is estimated that there are presently over 10,000 residential connections to the system. There may be a small decrease in cost per consumer for potable water relative to total expenditure per consumer.

##### - Water Supply to Seeb

The 0.68 MCM increment not pumped into the capital area water system would remain in the aquifer to augment the existing natural groundwater supply available to the individual wells in the Seeb area. Currently Seeb, the garden area, is experiencing increasing levels of salinity.

\*See: Stanley Consultants, Inc. 1981. Feasibility Report - The Wadi Al Khawd Aquifer Recharge Project, "part 6 - Sociocultural, Socioeconomic Feasibility.

If the aquifer recharge project is successful in reducing salinity, residence of the Seeb who presently draw supplies from individual wells may benefit from improvements in water quality. In addition, distribution system extensions to Seeb are presently under design and will soon be implemented independent of the recharge project.

- Historical Water Rights

The project site includes no settlements and is owned by the GOVOMAN. Water rights to this property are also held by the government and groundwater is presently extracted for use by PDO, the National Petroleum Development Organization, and by the capital area municipal system. No other liens on the water resources of the project site and Wadi Al Khawd have been identified during the presentation of project documents. Historical water rights should be factored into decisions on the extension of the water distribution grid and on the allocation of incremental water supplies.

- Other Impacts

In addition to increases in recoverable water supplies, the Wadi Al Khawd project will retard the rate of surface water runoff, thereby providing a measure of protection against potential downstream flood damage.

While average damage reductions cannot be estimated from available data, it is expected that floods as large as the May, 1981, event would be reduced in impact. The flood claimed six lives and damaged 600 homes and 30 businesses in Seeb.

- The urbanization of Oman's population is an established trend occurring independent of this or similar projects which supply services to the growing urban population. This project will not be a significant factor accelerating urbanization.

2. Feasibility - The project does not raise serious questions regarding its construction, the O&M of the earthen works, the recruitment of staff, or the establishment of new operating units. There are ample construction capabilities in Oman, the dams are designed for minimum maintenance; and the water that may be available would be under the management of an existing and expanding organization. The project does not add a significant increment of staff to this organization.

3. Replicability - From an engineering point of view, duplication of this project is speculative. Until further detailed studies of individual wadis and their runoff/recharge characteristics are completed, the Wadi Al Khawd project is regarded as demonstrational.

To the extent this concept would be utilized in other wadis, site-specific socio-economic characteristics would be assessed along with other technical issues. Suggested assessment elements to be considered in a socio-economic environmental evaluation are shown in Section IV G.

#### IV. IMPLEMENTATION

##### A. ADMINISTRATIVE ARRANGEMENTS FOR CONSTRUCTION

###### 1. Implementing Agency

The Ministry of Agriculture and Fisheries will have the overall responsibility for the implementation of the Wadi al Khawd Aquifer recharge project. This includes engineering supervision through the engineering contract, the construction through the construction contract and the monitoring and evaluation of the program for testing the success of the aquifer recharge through the project committee responsible for the T.A.P. The Ministry of Agriculture has approximately 1,000 employees in four General Directorates. The General Directorate of Water Resources and Irrigation is the group within the Ministry of Agriculture with responsibility for this project and is headed by Abdulla Hamdan al-Wahaibi. The specific responsibility is lodged with a Project Committee which has been established within the Ministry. The Directorate and the Project Committee are staffed with professional level Omanis. The FAO has had a long-term advisory relationship with this Directorate and currently two senior hydrologists are residents in Oman rendering assistance. To date the Ministry of Agriculture's project manager is Eng. Musa Salim Badr Al-Mazrowi, who was appointed early in 1981, and has continued a close working relationship with the Joint Commission, A.I.D. and Stanley in that capacity. It is anticipated that the Ministry's Project Committee will continue as the point of contact throughout the time of this project.

The Directorate General of Water and Irrigation has had experience in the design and implementation of small water projects throughout Oman and is responsible for development/conservation of water resources in the wadis along the Batinah coast among other locations. The Ministry of Agriculture has under consideration plans to develop these wadis in much the same manner as the Wadi al Khawd Project is being developed, dependent on the success of the concept.

a. Supervision of Construction

Although the Ministry of Agriculture will have an engineering supervision contractor directly responsible for overseeing the construction it is anticipated that reviews of work progress will be conducted by the Project Committee together with other engineering resources necessary on a weekly basis. The object of the reviews would be so that the committee remain as current on the work as possible, and through fore knowledge of likely problem areas, (procurement documentation, materials delivery, etc.) be in a position to take or suggest remedial action.

b. Maintenance and Operation

As no full time operating personnel are required for the retarding structure to function as designed, "operation" can best be understood in terms of the maintenance procedures required. These procedures for which the consultant will prepare a detailed operating manual are presented below.

- General

Hydraulic structures are not maintained free and regular maintenance will be absolutely essential to successful contained operation.

Four areas require constant attention. These are:

1. Removal of accumulated sediment deposits, particularly from within the reservoir area.
2. Removal of trash accumulations at culvert inlets.
3. Transfer of coarser material around the dam to compensate for expected downstream channel erosion.
4. Monitoring and repairing erosion damage. This may be experienced in the riprap, in the gabion spillway lining, in the stilling basin below culvert outlets, and inside the culverts.

Successful operation will require budgeting for regular attention and an adequate staff.

- Engineering Inspection

Maintenance items other than those mentioned above should not require much attention. It is, however, necessary that the dam be thoroughly inspected on an annual basis by an engineer experienced in dam construction who would report on all items requiring attention and initiate maintenance work. This effort would entail only a few days work each year.

- Maintenance Equipment

The embankment day has been designed similar to most highway embankments reinforced by the special feature associated with impoundment and spillway overflow. Normal highway construction equipment will suffice for maintenance purposes. The estimated cost for this yearly maintenance is \$99,000.

As explained in Section III.A.4 "Technical Assistance Program," the responsibility for maintenance and operation in accordance with the maintenance and operating manual is that of the Ministry of Agriculture, specifically that of the Ministry's Project Committee using appropriate counterpart personnel from the Departments of Water Resources and Irrigation.

2. GOVOMAN Responsibilities

The GOVOMAN through the executing agency, the Ministry of Agriculture and Fisheries, is responsible for:

- (a) Contracting for Engineering supervision of construction;
- (b) Contracting for the construction;
- (c) Disbursement to contractors;
- (d) Certification of successfully-completed construction;
- (e) Operation and maintenance of the complete structure;
- (f) Providing counterparts and facilities support for the Technical Assistance program. See Section III.A.4;
- (g) Monitoring GOVOMAN policies regarding potential effluents investing the aquifer, and taking appropriate action;
- (h) Monitoring settlement in the wadi discharge areas in view of potential damage during time of floods.

3. A.I.D. Responsibilities

- (a) Periodic monitoring and inspection of project construction to assure that construction is according to agreed upon design and plans.
- (b) Payment, upon certification of Engineer and GOVOMAN for cost items to be financed from U.S. Dollar portion of project.

Project implementation and monitoring of the A.I.D. input will be the responsibility of the A.I.D. Representative through the Joint Commission with assistance of AID/Washington technical inputs as needed and agreed to by the AID Representative, the Joint Commission and AID/Washington. It is possible that the project will necessitate extensive AID/W technical support given the small presence of AID in the J.C.

#### B. Contracting Procedures

The feasibility/design study was done by SCI under an AID/W IQC/Requirements contract at the request and for the account of the JC out of the FY 1980 A.I.D. grant of \$5 million. SCI's draft final report was completed in August, 1981, and accepted by the GOVOMAN in October 1981. The final report was submitted in December, 1981. The GOVOMAN, at the time of review of the draft final report, indicated its desire to contract with Stanley for the engineering supervision of the construction. Since it is in keeping with customary practice to have the firm responsible for the feasibility/design do the construction supervision, a waiver has been prepared to permit A.I.D. to fund from the loan the GOVOMAN-Stanley host country contract.

Prequalification of construction contractors is underway, with SCI handling the procedures under its feasibility/design contract. Recommendations as to prequalification will be made for the review and approval of the GOVOMAN and A.I.D.

The draft IFB for the construction contract which is to be sent to the approved short list of prequalified firms, was prepared by SCI, reviewed and approved by the JC, the GOVOMAN and A.I.D.

The responses to the IFB will be reviewed and again be evaluated by the engineering construction supervision contractor, and a recommendation for award will be made to the GOVOMAN.

AID will review, for acceptance, the GOVOMAN's recommendation for award. The construction contract will be a host country lump-sum, fixed price or unit price payment, or combination thereof.

#### C. Commodity Procurement

Source and origin for goods and services will be the U.S. and Oman. A waiver is being requested to permit procurement, from 941 countries, of approximately \$1.5 million of cement and steel needed for construction of the dam, neither of which are as yet manufactured in Oman. Procurement will be in accordance with I/L #6 January 5, 1982 for the GOVOMAN-U.S. Grant 276-0101. This I/L #6 is incorporated by reference in the Loan Agreement for this project.

#### D. Cost Estimates

Construction cost estimates have been prepared by Stanley Consultants as part of their feasibility/design contract and included in their report. Summary cost figures are in Annex G.

A.I.D. had reviewed these costs estimates and found them reasonable.

In addition to the construction costs there is included in the project an amount for engineering supervision services and installation of test wells for monitoring and the purchase of accompanying recording devices. The total cost of the Project is estimated to be \$15,000,000 to be shared fifty percent (50%) by the GOVOMAN and fifty percent (50%) by A.I.D.

E. IMPLEMENTATION SCHEDULE

Schedule of Major Events

<u>Events</u>	<u>Date</u>
1. Project Paper submitted to AID/W	3 - 82
2. Project Paper approved by AID/W	4 - 82
3. Project Authorization issued	4 - 82
4. Loan Agreement signed	4 - 82
5. PIL Number One issued	4/5 - 82
6. Initial conditions precedent met	5 - 82
7. Engineering Supervision Contract signed. (Phase I starts)	5 - 82
8. IFB for Construction issued	5 - 82
9. Construction Contract signed	8 - 82
9A. Phase II Engineering Contract signed	8 - 82
10. Construction started	9 - 82
11. Grant-funded T.A.P. initiated - Sub-Grant Agreement signed	1 - 83
12. First Disbursement for Project submitted to AID	8 - 82
13. Baseline Evaluation Data gathered	1983
14. Construction completed	1 - 84
15. Engineering Contract completed	4 - 84
16. Project completed	3 - 84
17. Terminal date for disbursement	12 - 84
18. First Project Evaluation begins	9 - 83
19. Technical Assistance Program completed	12 - 85
20. Evaluation of T.A.P. on completion of 19	
21. Final Evaluation	1 - 86

F. REPORTING REQUIREMENTS

A.I.D. and the JC will look to the Ministry of Agriculture and Fisheries to establish a satisfactory reporting system for monitoring and construction, engineering supervision and maintenance of the Project. The reports will cover engineering supervision procurement, financial and construction phases of the Project and will be prepared or certified by the consulting firm as may be appropriate. Suggested types and frequency of reports are as follows:

A. Monthly Reports

1. Three copies of the consulting firm's monthly narrative report during the pre-construction phase of the Project. Monthly reports normally include exhibits as appropriate and should summarize (to the extent that each is applicable to the current report period):
  - a. Personnel arrivals, departures and end-of-month strength.
  - b. Major conferences, submittals, decisions and events.
  - c. Major problem areas current or foreseen, together with recommendations for their resolution.
  - d. Progress on bidding and contracting.
  - e. Expenditures, both from Loan proceeds and other sources, to date and during the reporting period.
2. During the construction phase of the Project the monthly report should be amplified and include such items as:
  - a. a suitable bar chart which shall show the estimated and actual construction progress.
  - b. typical construction photographs and/or diagrams showing job progress.
  - c. a detailed listing of work performed during the past month.
  - d. a detailed listing of the work performed during the past month.
  - e. a general listing of the work to be performed during the coming three (3) months.

Monthly reports should be due as of the working day of each calendar month following the calendar month reported. Reports will be submitted to A.I.D. and the JC.

B. Quarterly Progress Reports

Such reports normally include:

1. Statistical data such as bar charts to show actual versus scheduled progress; procurement schedules; financial plan and cash flow charts; and tabulation of accrued charges and payments received by the consulting firm and the construction contractor; and a Project personnel chart in tabular form.
2. A narrative summary (similar to that prepared by the consulting firm and submitted monthly to the Ministry of Agriculture and Fisheries).
3. A visual presentation such as maps and photographs as applicable to the reporting period.
4. Quarterly Progress Reports are due not later than four weeks after the end of the quarter reported. The first quarterly report shall be prepared for the calendar quarter in which the first disbursement is made under the Loan.

C. Shipping Reports - Details to be supplied in an implementation letter.

D. Project Completion Report

A Project Completion Report (a statistical, historical, financial, and technical summary) shall be due within thirty (30) days after the completion of all work.

G. EVALUATION PLAN

The GOVOMAN with the collaboration of the JC agree to establish an evaluation program as part of the Project which will cover both the construction and Technical Assistance Program (T.A.P.). The program will include, during the implementation of the Project and at one or more points thereafter (a) evaluation of progress towards attainment of the objectives of the Project; (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.

The Evaluation Program will include the design and construction, the quantitative and qualitative aspects of the water (The T.A.P.), including the status existing prior to completion of the dam and the results achieved after completion and the socio-economic and environmental effects of the project.

The major socio-economic and environmental elements to be considered in an evaluation if this concept would be utilized in other wadis are:

1. Impact on historical water rights and water use patterns
  - a. De facto and de jure transfer of water rights and resources
    - individual or community to central government
    - rural to urban
  - b. Water use patterns
    - Human settlements
      - Availability of domestic water
      - Per capita consumption of potable water
      - Community organization based on water use
      - Role of women in water collection
      - Distribution of water within communities
    - Economic uses of water
      - Irrigation Infrastructure
        - Impact on traditional and modern infrastructure (pumps, irrigation ditches, etc.).
      - Agricultural techniques
        - Impact on falaj irrigation systems
        - Impact on cropping patterns as reliability of water is altered
  - c. Utilization of water for aquifer recharge to combat increases in salinity.
  - d. Pastoralism
    - Impact on seasonal/intermittent use.
2. Assessment of comparability of sites
  - a. Identify flow frequency and aquifer recharge characteristics which allow for project replication.
  - b. Identify distribution of human settlement characteristics and agricultural and pastoral water use patterns.
  - c. Develop schema for assessing and mitigating impacts on other potential sites based on socio-economic features and experience in Wadi al Khawd.
  - d. Develop schema for assessing and mitigating impacts on other potential sites based on environmental features and experience in Wadi al Khawd.

V. CONDITIONS AND COVENANTS

A. CONDITIONS PRECEDENT TO DISBURSEMENT

1. Initial Conditions Precedent

- a. Legal Opinion
- b. Statement of Borrower's Authorized Representative
- c. Approval of Co-Chairman of Joint Commission

2. Additional Conditions for Specific Disbursements.

a. Prior to any disbursement under the Loan or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, for engineering services, the Borrower shall except as A.I.D. may otherwise agree in writing furnish to A.I.D. in form and substance satisfactory to A.I.D., a signed contract for such services.

b. Prior to any disbursement under the Loan, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, for construction services, the Borrower shall furnish to A.I.D., in form and substance satisfactory to A.I.D., except as A.I.D. may otherwise agree in writing, a signed contract for such services.

B. Special Covenants

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 towards attainment of the objectives of the Project; (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.

2. Project Implementation procedures. The Parties agree that the Project shall be governed by the procedures for implementation of activities (including without limitation the procurement of goods and services) formally established by the Joint Commission, as in effect from time to time.

3. Supervisory Engineering Services. The Borrower covenants that it will acquire and maintain the services of a supervisory engineering firm acceptable to A.I.D. through completion of Project construction, start-up and testing, pursuant to a contract acceptable to A.I.D.

4. Testing. The Borrower covenants that it will submit a testing program to A.I.D. for A.I.D.'s approval, and that it will initiate implementation of the program in the project area prior to project completion, or shortly thereafter, including without limitation by providing the necessary budget, staff, and staff training.

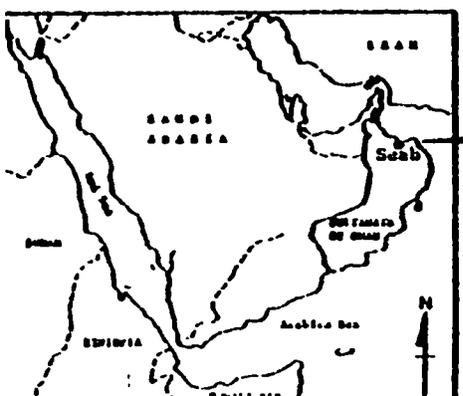
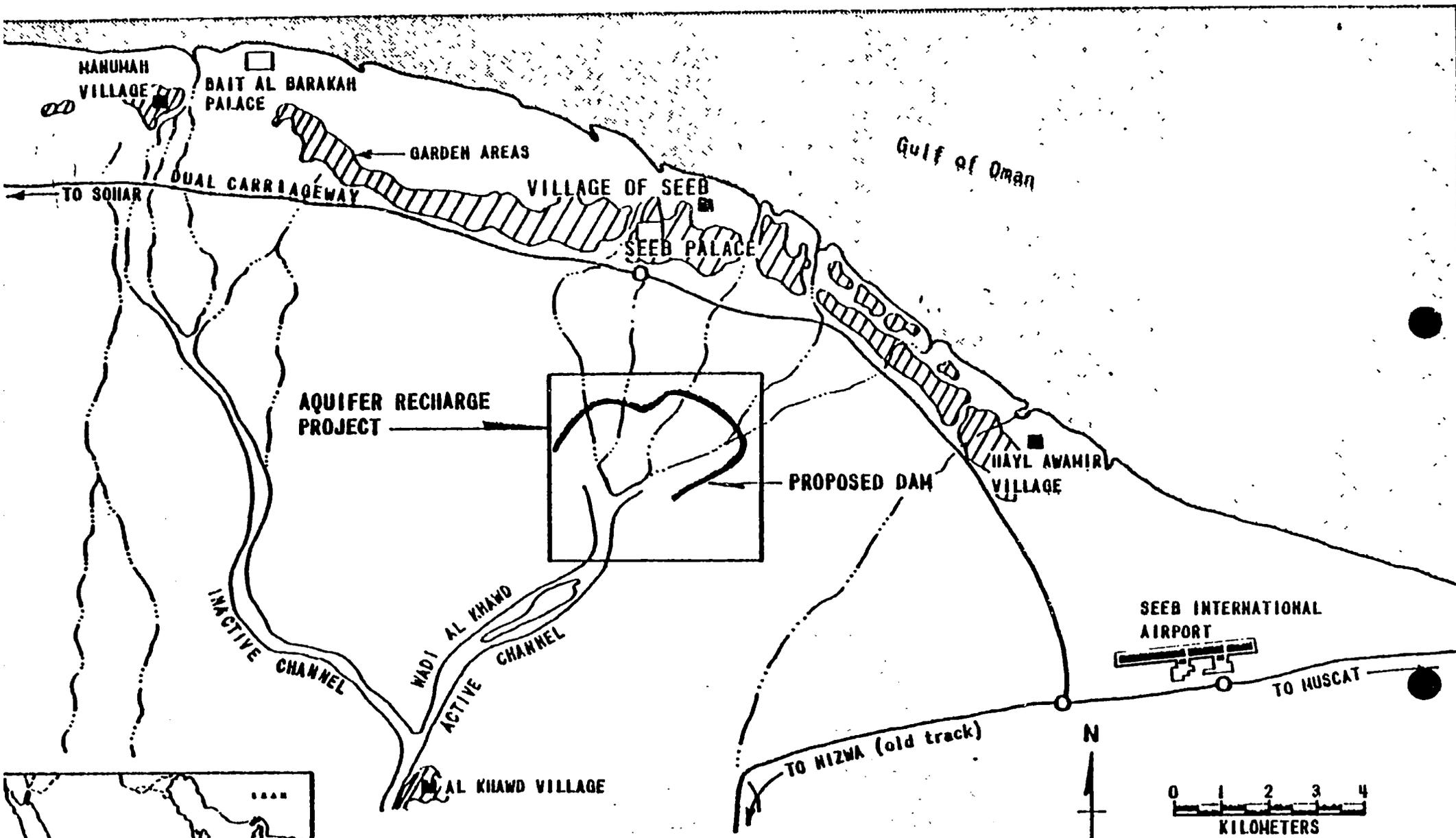
5. Maintenance. The Borrower covenants that it will submit to A.I.D. a plan for operation and maintenance of the Project for A.I.D.'s approval, and that it will implement such plan in a timely manner, including without limitation, by providing the necessary budget, staff and staff training.

6. Protection Measures. The Borrower covenants that adequate measures will be taken:

- a. to prevent contamination of the Wadi Al Khawd aquifer; and
- b. to prevent establishment of facilities in areas downstream from the structure which may be subject to flooding according to most probable flood estimates.

ANNEXES

- A. Map of Project Area
- B. Sultanti Decree - Reformation of Water Resources Council
- C. Governmental Agencies Involved in Water Resources
- D. Organization Charts
- E. Project Authorization and Request for Allotment of Funds
- F. Logical Framework
  - F.1 Technical Assistance Program (T.A.P.)
  - F.2 Draft Sub-grant Agreement for T.A.P. with Scope of Work
  - F.3 Draft Letter of Approval of Sub-grant Activity by J.C.
  - F.4 Letter of Request for Technical Assistance Program
- G. Cost Estimate and Disbursement Plan
- H. Economic Analysis
- I. Statutory Criteria
- J. Section 611(e) Determination  
Section 611(b) Determination
- K. Borrower's Request
- L. Documents Available in NE/PD Files for Reference
- M. NEAC PID Approval Cable



LOCATION MAP  
WADI AL KHAWD  
FIGURE 1.1

SULTANI DECREE NO. 67/79Concerning reformation of the Water Resources Council

His Majesty, His Highness Sultan Qaboos Bin Sa'eed, Sultan of Oman, after reviewing the Sultani Decree No. 26/75 concerning the issuing of the law of organization of the administrative machinery of the State and its Amendments, and the Decree No. 45/75 concerning the formation of the Water Resources Council and its amendments. And the Decree No 76/77 concerning the issuing of the law for the Development of the Water Resources.

And for the public interest:

Has decreed the following:

- Article 1: The Water Resources Council shall be reformed under our Chairmanship as follows:
- Minister of Agriculture & Fisheries  
(Deputy Chairman)
  - Minister of Electricity & Water (Member)
  - Minister of Interior (Member)
  - Minister of Land Affairs & Municipalities  
(Member)
  - Minister of Communications (Member)
  - Minister of Petroleum & Minerals (Member)
- Article 2: The Water Resources Council shall be the top authority for drafting the National Plan for the development of the Water Resources in the Sultanate, preserving it, and approving all plans and projects which are submitted by various quarters in this connection before implementation.
- Article 3: The Water Resources Council shall meet at least once every two months.
- Article 4: All items, from the provisions of the two previous decrees: No. 45/75 and 76/77 which are in contradiction with the provisions and rules of this Decree shall be hereby cancelled.

~~Article 5~~

: All concerned ministries shall adopt necessary measures, each in the limits of its jurisdictions, to implement this decree.

Article 6

: This decree shall be published in the Official Gazette and be enforced from the date of its publication.

Issued On : December, 4 - 1979.

SULTAN OF OMAN.

# Sultanate of Oman

Water Resources Council  
P. O. Box 5225  
MUSCAT



## Governmental agencies involved in water resources

### 1. Water Resources Council and Secretariat

It makes recommendations to the Development Council on Water Policy  
it provides coordination in water resources activities to all other agencies;  
it assesses overall water availability on the basis of plans and proposals submitted by various agencies; it assesses the feasibility of artificial recharge; it evaluates the dangers of saline intrusion;  
it manages the water resources development through operation of a permit and licenses system.

### 2. Office of H.E. Wali of Dhofar

It supplies water to the city of Salalah and to villages in Jebel-Qarah;  
it collects basic hydrologic and meteorologic data in Salalah.

### 3. Ministry of Education

It provides training and scholarships to students in water resources.

### 4. Ministry of Commerce and Industry - Laboratory

It conducts chemical and physical analyses of water samples;  
it develops water standards for the Sultanate.

### 5. Ministry of Commerce and Industry - Directorate of Industry

It designs and constructs (or approves) water supply works for industrial development.

### 6. Ministry of Health

It monitors water quality for human consumption; its laboratory conducts chemical and bacteriological analyses of water samples.

7. Ministry of Land Affairs and Municipalities

It provides and manages waste water disposal facilities in all cities of the Sultanate; it provides drinking water to the smaller municipalities.

8. Ministry of Agriculture - Irrigation and Falaj Maintenance Dept.

It performs, or finances, repairs and aflaj; it reclaims land for agricultural purposes.

9. Ministry of Agriculture - Water Resources Department

It evaluates and assesses availability of water for agricultural purposes; it plans agricultural development projects; it collects basic hydrologic data as part of a national water survey.

10. Ministry of Defense

It supplies water to military camps and installations.

11. Ministry of Electricity and Water

It supplies drinking water to the larger cities and municipalities.

12. Ministry of Social Affairs and Labor

It supplies drinking water to new housing developments outside existing cities.

13. Diwan of H.M. for Protocol

It supplies drinking and irrigation water to the properties of His Majesty.

14. Ministry of Communications

It collects hydrometeorological data through a network of observations stations; it conducts hydrologic studies for road designs.

15. Ministry of Awqaf

It maintains a register of awqaf properties, including water rights.

16. Petroleum Development (Cen)

It supplies water at its own facilities and residential areas.

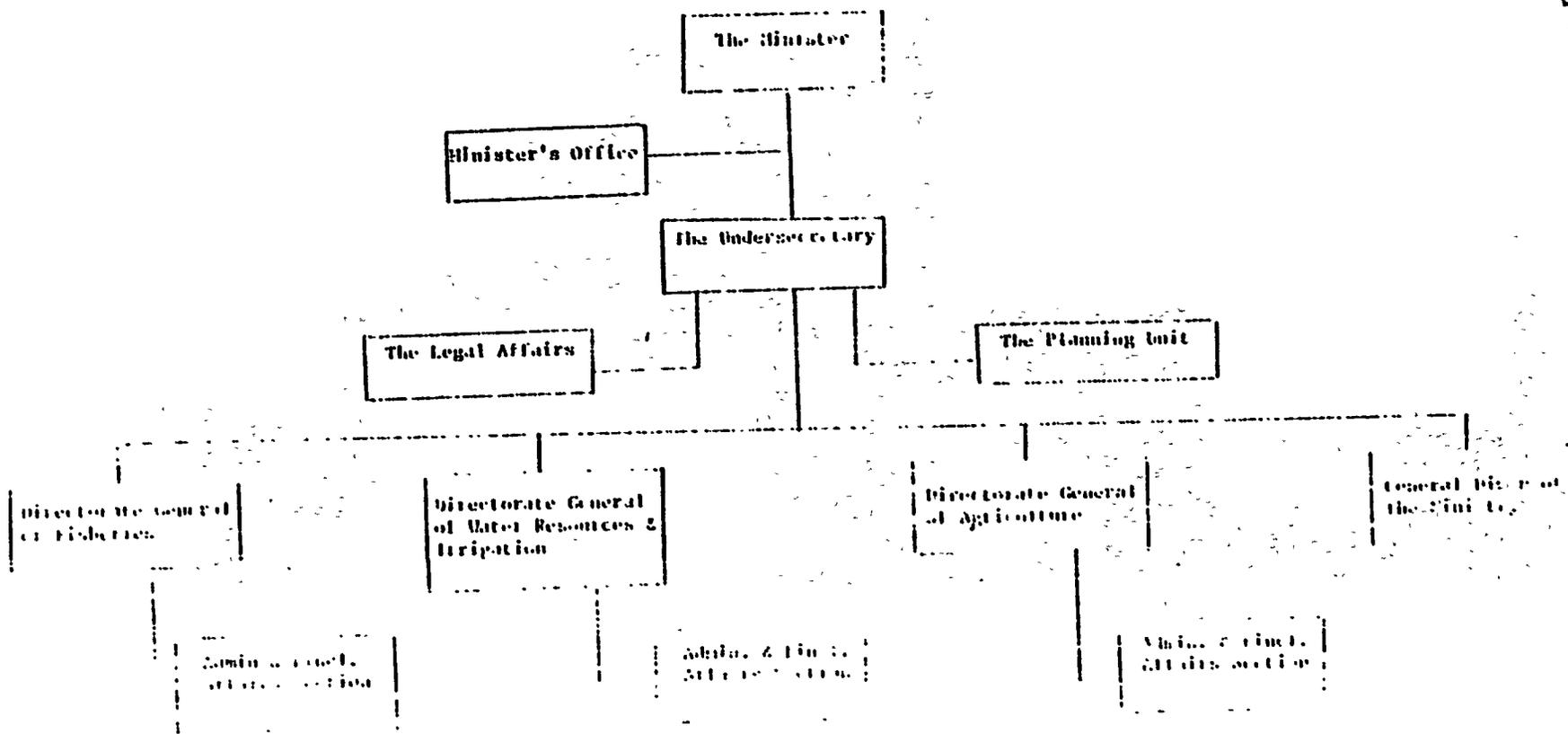
17. Ministry of Interior

Through the offices of the local Wails it acts as the first judge in settling disputes concerning water rights.

15. Ministry of Diwan Affairs

It has an active unit for environmental protection including safeguarding the water resources.

MINISTRY OF AGRICULTURE & FISHERIES  
ORGANIZATIONAL CHART

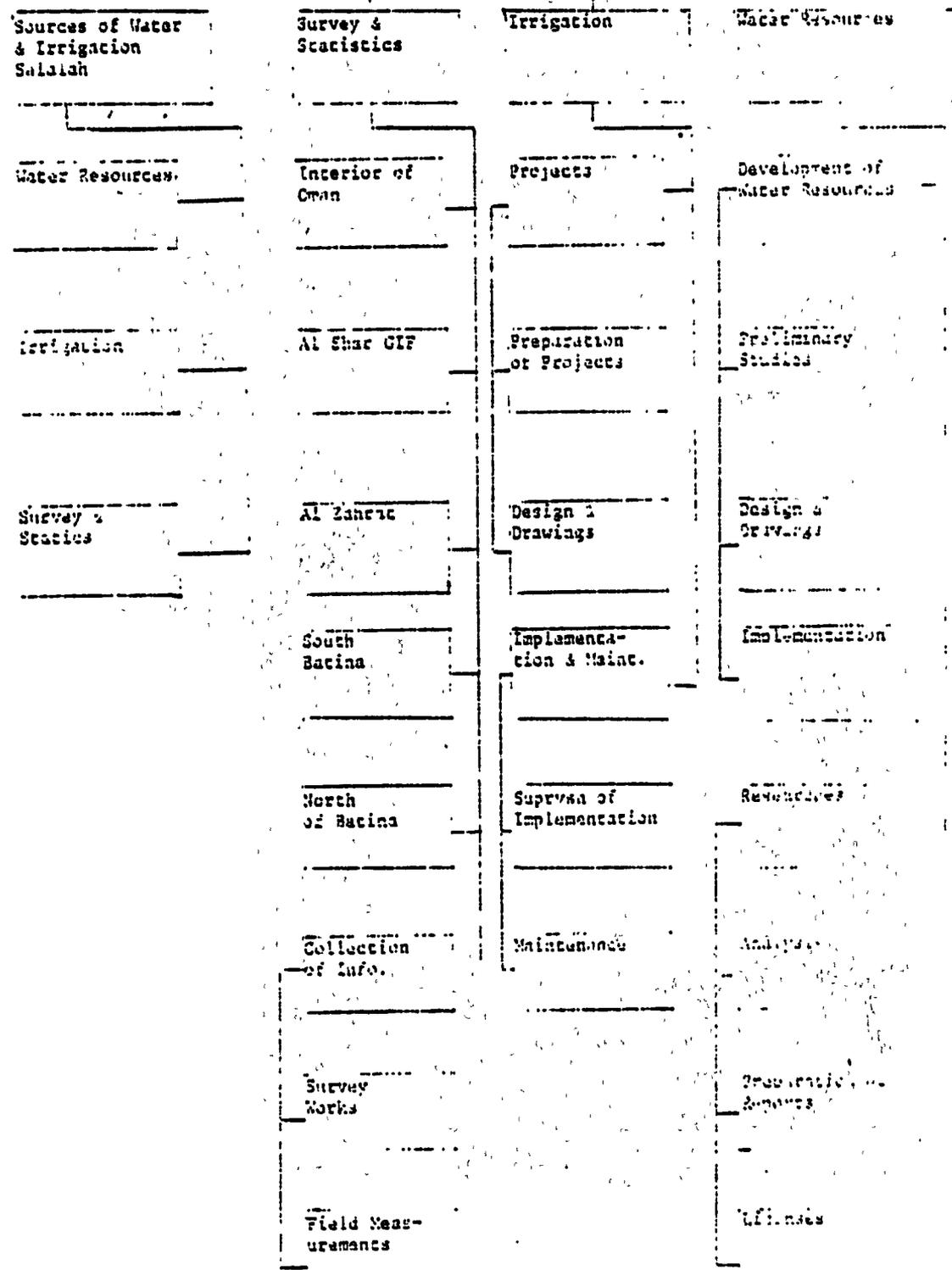


BEST AVAILABLE DOCUMENT

DESIGNATED DOCUMENT

PROTODATE GENERAL OF WATER RESOURCES AND IRRIGATION

Administrative & Financial Affairs Section



DIRECTORATE GENERAL OF AGRICULTURE

Administrative & Financial Section

- North of Bahina Region
- South of Bahina Region
- Eastern Region
- Al Zahrah Region
- Interior of Oman Region
- Intermediate Region
- Southern Region

Agricultural Statistics

Agricultural Research

- Soil & Water
- Protection of Agricl. Products
- Field Products
- Vegetables
- Fruits

Cooperation & Agricl. Mktg.

- Cooperative Societies
- Agricultural Marketing

Agricultural Affairs

- Agricultural Preparations
- Agricultural Guidance
- Post-control

Agricultural Industries

Animal Health

- Veterinary Medicine
- Animal Products
- Animal Prod. Regulations

BEST AVAILABLE DOCUMENT

Rec'd  
5-11-82

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR, BUREAU FOR NEAR EAST

FROM: NE/PD, Selig A. Taubenblatt

*STB*

SUBJECT: Oman: Wadi Al-Khawd Aquifer Recharge Project (Loan No. 272-0102) and Wadi Al-Khawd Technical Assistance Program (Joint Commission Grant Subactivity No. 272-0101.2)

Problem: Your approval is required to authorize (1) a \$7.5 million loan to the Government of the Sultanate of Oman for the Wadi Al-Khawd Aquifer Recharge Project and (2) a \$1 million Wadi Al-Khawd Technical Assistance Program Subactivity under the Joint Commission Grant to the Sultanate of Oman. This activity is one project with two funding sources.

Discussion: In 1980, the United States entered into an agreement with the Sultanate of Oman (GOVOMAN) establishing a Joint Commission on Economic and Technical Cooperation to serve as the institutional framework for U.S. economic assistance. The U.S. separately agreed to provide \$5.0 million annually in ESF grants, the first of which was made in FY 1980. An FY 1982 grant has been authorized (collectively the "Grant"). Also in 1980, the U.S. agreed to provide certain loan funds, should suitable projects be identified. In connection with the establishment of the Joint Commission, A.I.D. and the GOVOMAN identified construction of a pilot aquifer recharge project in the Wadi Al-Khawd as a top priority activity, particularly since the water sector is of major concern in Oman's 5-year development plans and a pre-feasibility study for this project had already been conducted.

It is proposed that a \$7.5 million loan from FY 1982 ESF funds be authorized for the Wadi Al-Khawd Aquifer Recharge Project (the "Project"). The Project consists of financing the foreign exchange and local currency costs, over a three-year period, for engineering supervision and construction services for a water retarding structure in the Wadi Al-Khawd. The structure will capture storm water which would otherwise run off to the sea, so that it can percolate down to replenish the underground aquifer. If the Wadi Al-Khawd project, which is a demonstration project, is successful, the GOVOMAN may replicate it in other wadi locations in Oman. The Project will be carried out in accordance with a feasibility study and final design prepared by Stanley Consultants. The loan will be repayable over 20 years at 5% interest with a 5 year grace period on principal repayment, and the GOVOMAN will match the U.S. contribution to the Project.

It is also proposed that a \$1 million technical assistance program be authorized as a subactivity under the Grant (the "Sub-activity"). The Subactivity, which will be conducted over a three-year period, consists of:

- (1) Providing technical assistance to the Ministry of Agriculture and Fisheries in monitoring and evaluating data from the Project;
- (2) Providing technical assistance for the collection and analysis of water resources data as it relates to the potential of other aquifers along the Batinah coast; and
- (3) Short-term training for Ministry of Agriculture and Fisheries personnel.

The first \$500,000 will be funded from the FY 1982 Grant, while the second \$500,000 will be funded from the FY 1983 Grant, subject to authorization thereof and the availability of funds.

Procurement for both the Project and the Subactivity will be from the United States and Oman, as is authorized under the Grant. Procurement for both the Project and the Subactivity will also be conducted in accordance with the procurement procedures established pursuant to the Grant for Joint Commission-sponsored activities.

The NEAC approved the project paper for the Project and the Subactivity on March 31, 1982, subject to certain minor adjustments which have been made. The Project was contained in A.I.D.'s FY 1982 Congressional presentation.

There are no current human rights issues under Section 502(b) of the Foreign Assistance Act which would preclude provision of this assistance to Oman.

Recommendations:

- (1) That you authorize the Wadi Al-Khawd Aquifer Recharge Project in the amount of \$7.5 million by signing the attached project authorization; and
- (2) That you authorize the Wadi Al-Khawd Technical Assistance Program Subactivity in the amount of \$1 million by signing the attached subactivity authorization.

ASSISTANT  
ADMINISTRATOR

PROJECT AUTHORIZATION

Name of Country: Sultanate of Oman

Name of Project: Wadi Al-Khawd  
Aquifer  
Recharge  
Project

Number of Project: 272-0102

1. Pursuant to Section 531 of the Foreign Assistance Act of 1961, as amended (the "Act"), I hereby authorize the Wadi Al-Khawd Aquifer Recharge Project (the "Project") for the Sultanate of Oman involving planned obligations of not to exceed seven million five hundred thousand United States dollars (\$7,500,000) in loan funds over a three year period from date of authorization, subject to the availability of funds in accordance with the AID/OYB allotment process, to help in financing foreign exchange and local currency costs for the Project.

2. The Project consists of the construction of a water retarding structure in the Wadi Al-Khawd designed to maximize aquifer recharge and provide some flood control.

3. The Project Agreement(s) which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with AID 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 AID may deem appropriate.

4. Terms and Conditions

a. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to A.I.D. in United States Dollars within twenty (20) years from the date of first disbursement of the Loan, including a grace period of not to exceed five (5) years. The Cooperating Country shall pay to AID in United States Dollars interest from the date of first disbursement of the Loan at the rate of five percent (5%) per annum on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Goods

Goods and services, except for ocean shipping, financed by AID under the Project shall have their source and origin in the United States or in the Cooperating Country, except as AID may otherwise agree in writing. Ocean shipping financed by AID under the Project shall, except as AID may otherwise agree in writing, be financed only on flag vessels of the United States or the Cooperating Country.

c. Conditions Precedent to First Disbursement

Prior to the first disbursement under the Loan, or to the issuance by AID of documentation pursuant to which disbursement will be made, in addition to the standard conditions precedent thereto, the Cooperating Country will, except as AID may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID, evidence that the Project has been approved by the two co-chairmen of the Joint Commission on Economic and Technical Cooperation established by an Agreement of August 16, 1980, between the United States of America and the Sultanate of Oman (the "Joint Commission").

d. Additional Conditions Precedent for Specific Disbursements

(1) Prior to any disbursement under the Loan, or to the issuance by AID of documentation pursuant to which disbursement will be made, for engineering services, the Cooperating Country shall furnish to AID in form and substance satisfactory to AID, except as AID may otherwise agree in writing, a signed contract for such services.

(2) Prior to any disbursement under the loan or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, for construction services, the Cooperating Country shall furnish to A.I.D. in form and substance satisfactory to A.I.D., except as A.I.D. may otherwise agree in writing, a signed contract for such services.

e. Covenants

(1) Project Implementation Procedures. The Cooperating Country shall agree that the Project shall be governed by the procedures for implementation of activities (including without limitation procurement of goods and services) formally established by the Joint Commission, as in effect from time to time.

(2) Supervisory Engineering Services. The Borrower shall covenant that it will acquire and maintain the services of a supervisory engineering firm acceptable to AID through completion of Project construction, start-up and testing, pursuant to a contract acceptable to AID.

(3) Testing. The Cooperating Country shall covenant that it will submit to AID a testing program satisfactory to AID and that it will initiate implementation of the program in the Project area prior to Project completion including without limitation by providing the necessary budget and staff.

(4) Maintenance. The Cooperating Country shall covenant that it will submit to AID a plan satisfactory to AID for operation and maintenance of the Project, and that it will implement such plan in a timely manner, including without limitation by providing the necessary budget and staff.

(5) Protection Measures. The Cooperating Country shall covenant that adequate measures will be taken:

- i. to prevent contamination of the Wadi al-Khawd aquifer; and
- ii. to prevent in areas downstream from the structure establishment of facilities which may be subject to damage by flooding according to most probable flood estimates.



---

W. Antoinette Ford  
Assistant Administrator,  
Bureau for Near East

**12 MAY 1982**

---

Date

ASSISTANT  
ADMINISTRATOR

SUBACTIVITY AUTHORIZATION

Name of Country: Oman (United States Oman Joint Commission on Economic and Technical Cooperation)

Name of Subactivity: Technical Assistance Program (In Conjunction with the Wadi Al Khawd Aquifer Recharge Project)

Number of Subactivity: 272-0101.2

1. In accordance with Project Implementation Letter No. 5, Section IC9, for Grant No. 272-0101, dated September 28, 1980 between the United States of America and the Sultanate of Oman (the "Grant"), setting forth procedures for selecting subactivities under the Grant, I hereby authorize financing of the Technical Assistance Program (in conjunction with the Wadi Al Khawd Aquifer Recharge Project) Subactivity (the "Subactivity") under the Grant in an amount not to exceed \$1,000,000 over a 3 year period from the date of this authorization, subject to authorization and availability of funds in the Grant in accordance with the A.I.D. CYB/allotment process.

2. The Subactivity consists of a technical assistance program to complement the Wadi Al Khawd Aquifer Recharge Project by assisting the Ministry of Agriculture and Fisheries, Directorate of Water Resources and Irrigation (the "Ministry") to further develop and strengthen its staff through training and the provision of consultants for evaluating the results of the project and analyzing water resources data.

3. The Subactivity shall be carried out, and any subgrant agreements shall be negotiated and executed subject to the following essential terms and provisions.

B. Terms and Conditions

a. Conditions Precedent to Execution of Subgrant Agreement

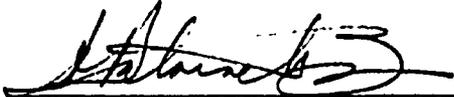
Prior to execution of the Subgrant Agreement, the Sultanate of Oman shall furnish in form and substance satisfactory to A.I.D. evidence that the two Joint Commissioners have approved the Subactivity.

b. Conditions Precedent to Disbursement

Prior to any disbursement, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, for consultants' services, the Ministry shall furnish to the Joint Commission, in form and substance satisfactory to A.I.D., except as A.I.D. may otherwise agree in writing, a signed contract for such services.

c. Covenant

The Ministry shall covenant that the Subactivity will be carried out in accordance with the terms and conditions of the Grant.



W. Antoinette Ford  
Assistant Administrator  
Bureau for Near East

4 2 MAY 1982

Date

PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

Project Title & Number: Wadi Al Khawd Aquifer  
Recharge Demonstration Project -  
272-0102 - 272-0101.2

Life of Project:  
From FY 82 to FY 86

NARRATIVE SUMMARY

Program or Sector Goal: The broader objective to which this project contributes:

To realize effective management of Oman's water resources.  
(Thru storage of run-off generally lost).

Project Purpose:

To test whether a dam of specific type in the Wadi al-Khawd:

(a) can save rain of water by allowing it to percolate into the groundwater aquifer.

(b) will prevent or reduce lost of water to the sea from flood flows.

: of Grant Technical Assistance

To assist the Ministry of Agriculture and Fisheries strengthen its capacity to evaluate the results of the demonstration project, correlate water resources data, and identify and develop a training program for Ministry Officials.

Outputs:

Increased amounts of water are stored in aquifer of wadis and increased amounts of water are made available for extration from aquifer. Improved water quality expected in areas of increasing salinity.

Water analyses completed successfully in a timely manner.

Water resources data correlation for participation to other wadis is significant.  
MinAg personnel trained.

Inputs:

1. A.I.D. Project Loan
2. Govoman 50% Contribution to Project
3. Engineering Services
4. Construction Services
5. \$ 1 Million T.A.P. ( See Annex F.1)

OBJECTIVELY VERIFIABLE INDICATORS

Measurers of Goal Achievement:

1. Significant amounts of rain run-off are conserved, increasing available water for:
  - a. Irrigated agriculture -
  - b. Increased Water supply.

Conditions that will indicate purpose has been achieved: End of project Status.

1. The amounts of water in the aquifer has been increased significantly. ✓
2. The structure functions are designed, controlling discharge of flood waters.
3. Water quality and quantity analyzed.
4. Water resource data correlated
5. Training program completed

Magnitude of Outputs:

An estimated average of 4.0 million cubic meters of water per year is saved by the dam.

Sufficient water analyses completed to indicate purpose has been achieved. (Several hundred).

Data for 200 km's pf wadis correlated.

10-20 Min Ag personnel trained.

Implementation Target (Type and Quantity)

1. \$7.5 million A.I.D. Fund Commitment - FY 1982
2. \$7.5 million GovOman Commitment FY 1982

(See Section III B.1 and Annex G)

Host Country Technical assistance contract signed and functioning.

(See Section III A.5 and Annex F. 1)

MEANS OF VERIFICATION

1. Visual inspection and gage measurement of flood waters, both upstream and at coast road.
2. Monitoring of groundwater, both quantitatively and qualitatively.

- 
1. Monitoring shows the increase in the water stored underground.
  2. Engineering inspection shows little or no damage, and adequate functioning of structure.
  3. Analysis is completed water data successfully utilized.
  4. Trained personnel usefully integrated in Min. Ag.

Maintenance experience has been satisfactory. Monitoring: instruments will verify water stored and extracted from the aquifer, as well as water quality.

Analyses verify project purpose.

Effective data correlation leads to productive application in other wadis.

Personnel trained.

- 
1. Signed Loan Agreement
  2. Notification from GovOman of Funds Contribution
  3. Engineering Services Contract Signed
  4. Construction Contract Signed
  5. J.C. verifies MinAg Assignment of Counterpart Personnel
  6. Signed Contract water analyses completed, data coorelated and personnel trained.

#### IMPORTANT ASSUMPTIONS

##### Assumptions for achieving goal targets:

1. This project will prove successful enough to demonstrate the major amounts of wadi flood waters can be saved.
2. Other water projects will be undertaken
3. Sound water policies adopted/followed by Gov.

##### Assumptions for achieving purpose:

1. Project is carefully constructed, and functions as planned.
2. Flood flows and aquifer water storage capacity are carefully measured and monitored.
3. T.A.P. successfully designed.
4. MinAg counterparts provided perform successfully.
5. Sufficient number of personnel available for training.

##### Assumption of achieving outputs:

1. Dam is properly designed for catching and slowing floods.
2. The hydrologic data on which dam design is based are typical.
3. Water samples collected and correctly analyzed.
4. Correlation of existing data sufficient.
5. Personnel available for training.

##### Assumptions for providing inputs:

Host country contracting done on timely basis.

Qualified firms are selected to do the project work.

Host country contracting completed in timely manner.

Qualified consultants retained.

TECHNICAL ASSISTANCE PROGRAM

(T.A.P.)

While the T.A.P. is envisioned as a three-year effort encompassing three parts at an estimated cost of \$1.0 million funded from the Grant, it is proposed that the T.A.P. be implemented in phases.

Initially the detailed scope of work will be developed through the services of a senior, technically qualified advisor from either the United States Geological Service or an A.I.D. IQC contractor, together with representatives of the Ministry of Agriculture and Fisheries in Muscat. This step will be funded from the current Grant and take an approximately one month at an estimated cost of between \$15,000 and \$20,000. The advisor would develop the scope of work to include, but not limited to, the tasks outlined under the three main phases which follow further below.

The scope of work will form the basis for the Sub-Grant Agreement estimated to cost up to \$1.0 million over the three-year period and which can be implemented in phases.

A. The first phase to be implemented will be the monitoring/evaluation. While the monitoring wells will be drilled during the construction phase and the costs included in the project the costs for the recording devices will be included under the Engineering Contract and procured under the direction of the Engineering Contract but the use will be the responsibility of this first step of the T.A.P. The scope of the monitoring/evaluation activity will include:

1. Determining and overseeing purchase of exact type of equipment to--
  - record/measure recharge basin inflows and outflows; and
  - collect water samples for quality analysis.
2. Installation and training in use of equipment
3. Developing of program/schedule for collection of data and training Omani Personnel to carry out such programming and collection.
4. Programming/scheduling the analysis of the data.
5. Analysis of the data and training in the quantitative and qualitative aspects. This would involve establishing working relationships with the water analysis laboratory section of the Ministry of Agriculture's Agriculture Research Laboratory in Rumais, the laboratory of the Ministry of Commerce and Industry, and the Public Authority for Water Resources' laboratory.

6. Presentation of the results of the analyses carried out for the Wadi Al-Khawd demonstration project. This would include training in the methods and procedures involved in the presentation.
7. Assisting the Ministry of Agriculture in carrying out the plan for the maintenance and operation of the retarding structure (prepared by the Consultant) including --
  - scheduling/programming
  - marshalling the resources (manpower, finances, equipment)
  - overseeing the inspection tours for maintenance
  - training in all the above

B. The second phase of the T.A.P. will address "water resources data," the scope of which will include:

1. The development of a plan for the systematic collection and organization of water resources data as in relation to wadi aquifers along the Batinah Coast. Where this has been done or is being done by or for a Government agency, the activities shall not be duplicated, but rather coordinated/complemented.
2. The development of a "profile or list" of significant criteria which would be indicators of a wadi with potential for successful aquifer recharge and training in this process.
3. The correlation of data collected so as to permit comparison with the profile developed.
4. Developing research programs which would provide data on circumstances associated with various water uses, e.g. agricultural, urban, or industrial as they relate to the wadi areas along the Batinah Coast.

C. The third phase of the T.A.P. will address "training," the scope of which will include:

1. Developing and presenting a training program for the Ministry of Agriculture to prepare Omani personnel of the Ministry of Agriculture to carry on the activities of the Technical Assistance Program at the end of the three-year program.
2. The development, implementation, and overseeing of a short-term training program both in Oman and the United States with the aim of further strengthening the capabilities of the Ministry of Agriculture personnel assigned to the various aspects of this aquifer recharge effort as part of a national water resources effort.

3. Developing training seminars in Oman for the benefit of the Ministry of Agriculture's efforts in aquifer recharge as a water resources activity in association with agriculture development along the Batinah Coast. This responsibility would include course content, participants, consultants, timing, and evaluation of the courses' effects.

It is planned that the T.A.P. will involve the technical advisor/consultant(s), the Ministry of Agriculture's Project Committee, and counterparts from the Departments of Irrigation and Water Resources. It is anticipated that the Project Committee will have the responsibility on behalf of the Ministry of Agriculture to ensure that the finally-agreed-up tasks are carried out.

The estimated costs of the three phases are:

1. Monitoring/Evaluation

1 Sr. Hydrogeologist Project Manager, 3 yrs. \$450,000

6 short-term technical consultants (estimated  
12 man months) 130,000

2. Water Resource Data

1 technical consultant on Water Data 1 yr. 120,000

Up to 6 short-term technical consultants  
(estimated 12 man months) 130,000

3. Training

Short-term training in U.S., estimated 10-20  
persons (2 months each @ \$5,000/person) 150,000

Training seminars in Oman, 6 over 2 yrs. 20,000

Estimated Total \$1,000,000

SUBGRANT AGREEMENT dated \_\_\_\_\_, 1982, among the Sultanate of Oman, the Ministry of Agriculture and Fisheries (the "Ministry"), and the United States-Oman Joint Commission on Economic and Technical Cooperation (the "Joint Commission").

Whereas the Sultanate of Oman and the United States of America acting through the Agency for International Development ("A.I.D.") entered into a loan agreement dated \_\_\_\_\_, 1982 (the "Loan Agreement"), whereby A.I.D. agreed to loan the Sultanate of Oman up to seven million five hundred thousand United States dollars (\$7,500,000) for the Wadi Al-Khawd Aquifer Recharge Project as described therein; and

WHEREAS the Ministry has been vested with the responsibility of carrying out the Wadi Al-Khawd Aquifer Recharge Project; and

WHEREAS the United States of America, acting through A.I.D., has granted the Sultanate of Oman Ten million United States dollars (\$10,000,000) (the "Grant") for support of operations of the "Joint Commission", pursuant to a Project Grant Agreement dated September 28, 1980; and

WHEREAS the Loan Agreement counterparts a technical assistance program in connection with the Wadi Al-Khawd Aquifer Recharge Project (the "Subactivity") will be provided under the Grant Agreement; and

WHEREAS the Joint Commission and A.I.D. have approved the Subactivity in accordance with the procedures established under the Grant Agreement;

NOW THEREFORE, the parties hereby agree as follows:

1. The Sultanate of Oman shall make available proceeds of the Grant totalling \_\_\_\_\_ million United States dollars (\$ \_\_\_\_\_) to the Ministry and the Ministry agrees to such proceeds of the Grant for the Subactivity as stated in paragraph 2 below.
2. The Subactivity comprises a Technical Assistance Program, Annex 1, attached, provides details of the Subactivity. Within the definition of the subactivity, 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 of the Grant Agreement, without formal amendment of this Agreement.
3. Prior to the first disbursement for the subactivity, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Ministry shall furnish to A.I.D. in form and substance satisfactory to A.I.D., except as A.I.D. may otherwise agree in writing a signed contract for such a technical assistance program.
4. The Ministry shall abide by the provisions of the Grant Agreement, which forms a part hereof as if the Ministry were an original party to the Grant Agreement, except the articles that apply to the Sultanate of Oman alone.

5. The Ministry shall consult with the Sultanate of Oman in carrying out the necessary arrangements in light of action to be taken by A.I.D. and the Joint Commission in accordance with the provisions of the Grant Agreement.

5. The persons listed below, or such other persons as each may have time to appoint in writing, is designated as the authorized representative of the applicable party for the purpose of taking any action required or permitted to be taken under this Subgrant Agreement.

The Sultanate of Oman:

The Ministry:

The Joint Commission:

IN WITNESS WHEREAS, the Sultanate of Oman, the Ministry of Agriculture and Fisheries, and the United States-Oman Joint Commission on Economic and Technical Cooperation, each acting through its duly authorized representative, have caused this Subgrant Agreement to be signed and delivered as of the date first written above.

SULTANATE OF OMAN

UNITED STATES OF AMERICA

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

UNITED STATES OMAN JOINT COMMISSION  
ON ECONOMIC AND TECHNICAL COOPERATION

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: Co-Chairman

Title: Co-Chairman

TO: The Co-chairmen  
Omani-American Joint Commission  
for Economic and Technical Cooperation

SUBJECT: Request for your Approval of a Project Subactivity

Section 4.3 of the Project Grant Agreement requires that you consider the project paper for subactivities before submission to A.I.D.

We need you approval therefore of the Technical Assistance Program Project Paper which is part of the Wadi Al Khawd Water Recharge Project Paper. The development of which was approved by the Joint Commission.

Approval of the Technical Assistance Program

---

Yusuf al-Alawi Abdulla  
Undersecretary  
Ministry of Foreign Affairs  
Omani Co-chairman

Sultanate of Oman  
Ministry of Agriculture & Fisheries  
Office of the Minister

17/3/82

No: SWZA/1/7/7/77/82  
Date: 13/3/1982

Mr. Hamoud Hilal Al Habsi,  
The Managing Director,  
Omani American Joint Commission for Economic & Technical Cooperation.

Dear Sir,

Sub: The Technical Help Program Internal Recharge Dam Project, at Wadi Al Khoud

We refer to your letter No. 77 dated 8th March 1982 regarding your proposals that the internal recharge dam project, at Wadi Al Khoud, includes the technical help to provide the three following factors:

- 1 - Supervising the measure of internal recharge and the project evaluation side.
- 2 - Set a plan for the collection and organization of water resources data so as to evaluate the possibility of internal recharge for the water internal dams in the other wadis at Al Batina Coast.
- 3 - To set and implement a short term and long term training program for the Omanis employed in the field of water resources development, at the Ministry of Agriculture & Fisheries.

Kindly arrange to take the necessary action in coordination with the Co-chairman of the Joint Commission to the necessary fund mentioned in your said letter amounting to one million dollars on basis of a grant from the Commission.

We remain.

Yours faithfully

Abdul Hafiz Salim Rajab

Minister of Agriculture & Fisheries

- CC. H.E. The Undersecretary
- Planning Unit
- Director General of Water Resources & Irrigation.
- The file

## COST ESTIMATES AND DISBURSEMENT PLAN\*

9.1 Construction Cost Estimate

The construction cost estimate (see Table 1) represents the contract costs of completing all construction work including mobilization, overhead, and profit.

It is assumed that the majority of the work will be performed by a prime general contractor. It has been assumed that 60 percent of this construction firm will be foreign ownership and 40 percent Omani ownership.

Omani's will be employed when available, but the majority of craft labor will be Pakistani and Indian. Labor rates for these crafts vary from \$1.05 per hour for laborers to \$5.50 per hour for heavy equipment operators. These unit rates include all fringe benefits and home leave where applicable. Normal working day is ten hours.

This estimate assumes that sufficient construction equipment is available within Oman. Therefore, no allowance has been made for mobilization of this equipment.

Mobilization and demobilization includes the cost to recruit and transport to Oman 12 English speaking people and one hundred Third World Nationals. Also included in mobilization and demobilization is the cost of the site office, workshops, toilets, and miscellaneous structures. Items included as overhead are the cost for nonproductive personnel such as accounting, clerk-typists, surveyors, quality control inspectors, watchmen, guards, etc. Also included in overhead are the housing required for foreign supervisors. Overhead also includes the cost of insurance, money costs, and home office expenses.

\*Source - Stanley Consultants Inc., Feasibility/Design Report Dec. 1981

Exchange rate used:

U.S. \$1 = OR 0.34

OR 1 = US \$2.92

TABLE 1

CONSTRUCTION COST ESTIMATES

Description	Quantity	U/M	Foreign				Local				Total Project		
			Material		Labor		Equipment		Material			Labor	
			Unit	Total	Unit	Total	Unit	Total	Unit	Total		Unit	Total
3 Diversion and Care of Water		LS		20,000		2,000		2,500				2,500	27,000 ✓
4 Clearing and Grubbing		LS				500						500	1,000 ✓
5 Foundation Preparation	147,505	M3			0.050	7,375	0.210	30,976			0.030	4,425	42,776 ✓
6 Embankment Fill:													
Core Zone	691,345	M3			0.260	179,750	0.600	414,807			0.040	27,654	622,211 ✓
Toe Drain and Gabion Bedding	64,715	M3			0.290	18,767	0.770	49,831			0.040	2,589	71,187
Riprap Bedding	27,635	M3			0.290	8,014	0.770	21,279			0.040	1,105	30,398
Riprap	59,875	M3			1.460	87,418	2.420	144,898	2.50	149,688	0.340	20,358	402,362
Erosion Protection	7,800	M3			0.290	2,262	0.770	6,006			0.040	312	8,580
Reinforced Concrete Culvert Pipe:													
48" Diameter R.C.P.	482	LH	114.900	55,382	5.470	2,637	9.130	4,401			1.370	660	63,080
Reinforced Concrete	309	M3	40.000	12,360	8.550	2,642	20.450	6,319	2.740	847	1.710	528	22,696
Gabions 12"	136,965	M2	3.250	445,136	0.750	102,724	1.400	191,751	2.310	316,389	0.280	38,350	1,094,350
Adjust Existing Wells	45	LH	10.000	450	2.000	90	2.500	113					653
Waterline Relocation		LS		10,000		2,150		5,000				400	17,550
7 Mobilization and Demobilization				68,750		33,446							102,196 ✓
Supervision						272,232							272,232
Overhead				147,510		67,060				79,680		37,558	331,808
Subtotal				759,588		789,067		877,811		546,604		136,939	3,110,079
Profit	10%												311,008
Escalation (To June 1982 Bid Date)	7%												239,476
Contingency	10%												366,437
Total Base Bid in R.O. (Rials Oman)									Dollars	\$11,776,000			4,027,000R.O.
Additive Bid Items													
Slide Gate Assembly	2 Ea		925	1,850	300	600	400	800	325	650	100	200	4,100R.O.
Debris Deflectors	11 Ea				30	330	60	660	500	5,500	110	1,210	7,700R.O.

Source: Stanley Consultants

Profit is included as 10 percent of all direct costs, mobilization, supervision, and overhead. Profit is split between foreign and local in the relationship of the ownership (60 percent foreign - 40 percent local).

The unit prices used in this estimate include escalation for the period of time from the start of construction to the finish; escalation from the date of preparation to the start of construction (June, 1982) is listed as a separate item on the cost estimate.

This estimate is divided by local and foreign costs. Foreign costs include depreciation of equipment, material shipped into Oman, foreign personnel, and overhead and profit on the foreign portion of the general construction contractor. The majority of craft labor which will be Pakistani or Indian are considered foreign personnel. Local costs include locally purchased materials, Omani labor, and taxes. The unit costs for reinforced concrete have been split between foreign and local components. This is to take into consideration and fact that cement, reinforcing steel, and fuel are imported, and sand, aggregate, and water are local components.

Various cost sources have been used in preparing cost estimates:

1. Past experience in work in Oman.
2. Mid-East Division of the Corps of Engineers' Unit Price Book for Oman.
3. Costs gathered by Stanley Consultants' estimating personnel while in Oman.

## 9.2 Engineering and Supervision Costs

The engineering design fee is a predetermined and negotiated item and is not considered a part of the total project cost.

Construction management services (engineering firm independent of contractor) to assure compliance with plans and specifications is considered as a part of the total project cost. These costs are summarized below:

Staff: Three expatriate personnel will be required on the project for sixteen months. These are a construction manager,

assistant construction manager, and a field inspector.

Assume an average of three people per family.

All costs have been escalated to February, 1983.

Travel: (Assume one round trip per person to the U.S. and one local leave trip)

18 round trips x \$2,500 = \$45,000

Housing and Utilities:

3 facilities @ \$3,500/month x 16 months = \$168,000

Direct Cost: Salary based on hourly fees (including benefits) for overseas personnel.

Construction Manager 16 mo. x \$13,600/mo. = \$217,600

Field Inspectors (2) 32 mo. x \$8,600/mo. = \$275,200

Local Hire:

(Secretary, driver, etc.) 16 mo. x \$5,000/mo. = \$80,000

Miscellaneous Expense: Includes education, post allowance, relocation, insurance, passports, visas, and field office expenses.

Lump Sum \$138,000

Total Estimated Cost of Engineering Services for Construction

Management \$923,800 Dollars

316,400 R.O.

### 9.3 Total Project Cost

Total project cost is the comprehensive cost of the project.

This cost includes the construction cost and the cost for construction management services.

Construction Cost 4,027,000 R.O.

Construction Management Services

316,400 R.O.

Total Project Cost

4,343,400 Rials Omani

Total Project Cost

12,682,000 Dollars

69

#### 9.4 Operating and Maintenance Costs

Itemized below is an estimate of costs for the maintenance procedures as outlined in Part 4 of this report. Operating and maintenance cost is an additional cost and is not included in the total project cost.

Assuming 70,000 cubic meters of sediment to be excavated per year, maintenance cost would include:

- 1 - Front end loader
- 1 - Equipment Operator
- 1 - Oiler
- 2 - Dump truck 16.5 C.Y. capacity
- 2 - Driver

Based on this crew, an annual cost for excavating is:

	<u>Material and Labor</u>	
Mobilization and Demobilization	Lump Sum	\$ 5,000
Excavation	70,000 m <sup>3</sup> x \$0.40	\$28,000
Hauling	70,000 m <sup>3</sup> x \$0.76	<u>\$53,200</u>
		\$36,200
		use \$90,000/year
		or 30,825 R.O./year

Estimated Disbursement Plan

Project disbursements are expected to begin in the fourth quarter of FY 82 and terminate in FY 84.

An estimated disbursement schedule is shown below:

Estimated A.I.D. Loan Disbursement Schedule  
(\$millions)

	<u>FY 82</u>	<u>FY 83</u>				<u>FY 84</u>		<u>TOTAL</u>
	4	1	2	3	4	1	2	
Engineering Supervision	.040	.120	.120	.120	.120	.100	.030	.650
Construction	<u>.300</u>	<u>1.20</u>	<u>1.20</u>	<u>1.20</u>	<u>1.20</u>	<u>.120</u>	<u>.550</u>	<u>6.850</u>
	.340	1.320	1.320	1.320	1.320	1.300	.580	7.500

ANNEX II - STANLEY CONSULTANTS, INC.  
ANALYSIS OF ESTIMATED COSTS - PHASES I AND II  
WADI AL KHAWD AQUIFER RECHARGE PROJECT

Items	Details On Schedule	Work- Months	Local Currency Costs R.O.	Dollar Costs	Total Costs (U.S.\$) (\$1.00=R.O. 0.345)
1. Base salaries - Field staff	1	<u>34.0</u>	_____	133,288	<u>133,288</u>
2. Field staff differential, if any	1		_____	28,824	<u>28,824</u>
3. Overhead - field staff Percentage rate (127.4%)			_____	183,937	<u>183,937</u>
4. Home office salaries	2	<u>9.0</u>	_____	27,781	<u>27,781</u>
5. Overhead - home office Percentage rate (138.0%)			_____	38,338	<u>38,338</u>
6. Fixed-fee			_____	61,825	<u>61,825</u>
7. SUBTOTAL (Cost per m/m \$11,023)		<u>43.0</u>	_____	473,993	<u>473,993</u>
8. Subcontract costs, if any			_____	_____	_____
9. Cost of consultants, if any			_____	_____	_____
10. Travel and per diem- personnel: (a) Inter- national travel and per diem	3a		_____	46,562	<u>46,562</u>
(b) Travel and per diem in the contractor's country	3b		_____	1,880	<u>1,880</u>
(c) Local travel and per diem - borrower country	3c		12,525	_____	<u>36,304</u>
11. Transportation - personal baggage	4		_____	8,344	<u>8,344</u>
12. Transportation - household effects	4		_____	26,400	<u>26,400</u>
13. Transportation - equipment			_____	_____	_____
14. Equipment	5		_____	1,300	<u>1,300</u>
15. Other direct costs:			_____	_____	_____
(a) Insurance	6a		_____	7,091	<u>7,091</u>
(b) Miscellaneous	6a & b		54,726	123,355	<u>281,981</u>
16. SUBTOTAL (8 through 15)			67,251	214,932	<u>409,862</u>
17. TOTAL COSTS (7 plus 16)			<u>67,251</u>	688,925	<u>883,855</u>

ECONOMIC ANALYSISA. Basic Assumptions and Methodology

The economic analysis of the Wadi Al Khawd aquifer recharge project consists of a discounted least cost analysis of supply alternatives to meet the projected urban requirements of the metropolitan area of the capital city of Muscat. The major basic assumptions underlying this methodology is as follows:

1. The aquifer recharge project is primarily a demonstration project as detailed in Section III A. One of the major benefits, of the project will, therefore, be the experience gained and the lessons learned from the construction, operation maintenance and monitoring of the facilities.
2. The end-use of the projects output, the incremental water obtained from the aquifer recharge, remains to be decided by the Omani Government. The economic rationale for the selection adopted in this paper is the value in alternative uses, subject to demand constraints. Based on this methodology, it was estimated that the highest value use in terms of deferred costs (least cost analysis) was to replace (or defer) higher variable (or avoidable) costs of water currently programmed to meet the potable water requirements of the metropolitan area of Muscat. The estimated rate of return, if the water was utilized in agriculture was substantially lower than the discount rate equalizing the comparative costs of the Wadi Al Khawd and the alternatives selected for comparison.<sup>1/</sup>
3. For purposes of project analysis, a 4.0 MCM per annum incremental quantity of water was assumed. In the sensitivity analysis, this quantity was varied to estimate a break-even point in economic terms (the 10% discount rate was used as the minimal economic rate of return).

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<sup>1/</sup> For details of agricultural analysis (which resulted in a 5.9% economic rate of return), as well as an expanded discussion of the contents of this Annex, the reader is referred to the Consultants report (Part 5. Economic Investigation) in the Project Files of AID/W, NE/PD.

4. The Oman economy is essentially a free market economy with international prices prevailing for traded goods. Capital and recurrent costs, therefore, did not require any shadow pricing.

### B. Water Demand Estimates

Table 1 provides the population and water demand projections for 1977-1995 adopted by Stanley Consultants. The 18.0 percent per annum increase from 1980-1985 appears reasonable given the 1979 restricted demand schedule. From 1979 to 1995, litres per capita per day is projected to increase from 30-40 to 150 for the low income group, from 100-150 to 300 for the medium income group and from 200 to 400 for the high income group. The overall average daily domestic consumption is estimated at 263 litres by 1995, and remains a fairly stable percentage of total water consumption (varying from about 65-70% for the 1977-1995 time frame).

The water demand growth from 1980 to 1995 exceeds the population growth because of the elimination of suppressed or restricted demand and income growth. The consumption levels of the high income group reflect in part the impact of the expatriate group employed in Oman.

It should be noted that the Wadi Al Khawd aquifer recharge project is estimated to provide 11,000 MCM per day. This quantity represents approximately two years incremental supply requirements if the 1980-1985 time period is used as the base comparison or four years if 1985-1990 is used.

### C. Supply Alternatives

The Power and Urban Water Supply Study, Phase II prepared by Preece, Cardew and Rider with Sir M. MacDonald, 1979, included a least cost analysis of water supply alternatives for the capital area. The analysis included a demand forecast, possible resources were identified and placed in an operational time dimension, alternative schemes to meet demand were constructed, costs for each scheme were estimated and discounted (at 10%) cash flows were used to select the least costly alternative. The proposed Wadi Al Khawd aquifer recharge project would

be a new addition to that analysis.

The least cost analysis mentioned above included storage dams at Wadi Mayh (5,500 MCM/day base yield - 5 kms from grid), Batinah (25,500 MCM/day base yield - 150 kms from grid), Wadi Dayqah (36,000 MCM/day base yield - 90 kms from grid) and three water desalination plants sized at 14,000, 18,750 and 24,000 MCM base yield located at Ghubrah. The annualized delivered costs of each of these alternatives, the water demand schedule and the availability factor were fitted into a long-term least cost plan. Tables 5.5, 5.6 and 5.7 (pp.5-10-12) of the Stanley Report provide this basic information.

#### D. Cost Avoidance Methodology<sup>1/</sup>

The essence of this least cost analysis is to calculate the costs of the alternative water supplies listed above that can be avoided by implementation and operation of this proposed project.<sup>2/</sup>

The least cost plan (M5) calculated in the Power and Urban Water Supply Study, Phase II, was used as the base comparison with the Wadi Al Khawd water supply. Since Wadi Al Khawd must prove its potential yield over an extended period of time by monitoring wells and gauging, it was not assumed in this analysis as providing a firm base yield. The avoidable costs are, therefore, defined to consist of variable operating costs related to the 4.0 MCM per year that Wadi Al Khawd will provide the urban grid. In other words, given the demonstration nature of this proposed project, other water supply projects scheduled for construction and operation in the 1983-1997 time period are unlikely to be deferred.

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<sup>1/</sup> Two other project benefits are mentioned in the Stanley Consultants report. They are flood damage protection and the net increment of well water that will beneficially impact on coastal wells that have experienced an increase insalinity. Neither benefit could be quantified.

<sup>2/</sup> For the three water desalination units mentioned above, total annual 1979 costs vary from \$3.07-\$3.44/000 U.S. gal. delivered into the transmission grid. This is compared with the \$0.38-\$0.76/000 U.S. gals. for the dam sites also specified above.

They will go forward as scheduled and the Wadi Al Khawd will replace more expensive water sources in meeting the water requirements of the capital area. Given these assumptions, variable operating costs (costs that can be avoided when output approaches zero) of alternative water sources are used to determine which sources are superseded by the Al Khawd water supply and to measure avoidable costs.

#### E. Wadi Al Khawd Project Costs

The total project capital cost for the dam, well field and transmission costs (June 1982 prices) for the Wadi Al Khawd project is about 6.2 Million R.O. (313.1 Million).<sup>3/</sup> This includes about 1.8 Million R.O. for new well field capital costs including transmission, diesel generating station, and surface storage reservoir (2000 M<sup>3</sup> capacity). The annual operating and maintenance costs are 147,262 R.O. or 37 baiza/m<sup>3</sup> (\$0.13/m<sup>3</sup> = \$0.49/000 gal.).

The cost outlay schedule for the proposed Wadi Al Khawd project that will be compared to the avoidable costs of alternative supply sources is as follows (R.O. 000): 1982 - 3,734; 1983 - 2,526; and 1984-1997 - 147. A salvage value of 2.9 Million R.O. is included in 1998.

#### F. Least Cost Comparison

The 4.0 MCM per annum output of Wadi Al Khawd will essentially replace part of the output of two desalination plants during 1983-1997. These two marginal units are the existing desalination plant that is being upgraded to 23,000 MCM per annum and a new desalination unit of 18,750 MCM per annum that will come on stream in 1984. Relatively small amounts of avoidable costs in 1984, 1989 and 1990 will be generated from the planned Wadi Dayqah storage dam.

Table 2 presents the calculation of the least cost analysis utilizing a 10 percent discount rate. The 10 percent discount rate is used by the Development

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<sup>3/</sup> 1 rial Omani = \$2.92  
1000 Baiza = 1 rial Omani

76.  
Council of the Sultanate of Oman in approval of projects. It appears to represent a reasonable opportunity cost of capital for Oman.

The net present worth advantage of the Wadi Al Khawd proposed project over alternative supply sources, as evidenced by Table 2, is substantial. The approximate 3.7 million R.O. difference in June 1982 costs between the Wadi Al Khawd proposed project and avoidable costs is almost  $\frac{60}{100}$  percent of the proposed projects estimated capital costs of about 6.2 million R.O. If one treats the avoidable costs as project benefits, the internal rate of return is about 18.2 percent.

### G. Sensitivity Analysis

For purposes of the sensitivity analysis, it's somewhat more informative to use as the base analysis the economic rate of return, rather than the net present worth concept. In view of the substantial differences between the acceptable marginal opportunity cost of capital of 10% and the calculated rate of return, it would require relatively large <sup>cost</sup> increases or benefit decreases to reduce the economic returns below the 10% level. For example, capital costs of the Wadi Al Khawd aquifer recharge project calculated by Stanley Consultants would have to increase by approximately 60% (from 6.2 million R.O. to 9.9 million R.O.) in order to reduce the rate of return to 10 percent. In order to meet this return criterion, the average annual level of water from the proposed project would have to be about 2.3 MCM per annum, rather than the 4.0 MCM postulated in this analysis. If the 4.0 MCM water increment was unavailable until 1986, rather than 1983 as shown in Table 2, the return would be reduced to 12.8%. Other sensitivity calculations can be presented but it requires improbably large variations in critical variables in order to generate unfavorable rate of return results.

### H. Summary and Conclusions

The Wadi Al Khawd aquifer recharge project as analyzed in this annex consists of the recharge dam and ancillary development to provide water to the urban grid. The total project/cost in 1982 prices is estimated to be 6.2 Million R.O. including <sup>capital</sup>

4.4 Million R.O. for the dam alone. Without the project, it has been assumed that the water demand forecast will be met by additional desalination capacity, early development of the dam and reservoir in Wadi Dayqah and later development of a major new groundwater supply 150 kilometers up the Batinah Coast. The 4.0 MCM yield from the Wadi Al Khawd project eliminates variable operating costs of the marginal sources. These cost savings are the project's primary benefits. Comparison of these avoidable costs with project costs yields substantial net present worth/at the opportunity cost of capital (10% discount rate). In internal rate of return (IRR) terms the project results in a 18.2% IRR, if avoidable costs are treated as project benefits.

TABLE 1

CAPITAL AREA WATER DEMAND PROJECTIONS

(1977 - 1995)

	1977	1980	1985	1990	1995
<u>Population</u>					
- Number	98,600	123,600	178,000	240,200	293,600
Rate of Growth	-	7.8	7.6	6.2	4.1
Rate of Growth			5.9		
<u>Water Demand</u>					
Cubic Meters per Day	N.A.	25,730	58,930	74,920	108,110
Annual Demand (MCM)	N.A.	9.39	21.51	27.35	39.46
Growth Rate			18.0	4.9	6.2

Source: Power and Urban Water Supply Study, Phase I, Preece, Cardew and Rider with Sir M. MacDonald and Partners, 1979, and Stanley Consultants, 1981.

Table 2  
 Load Cost Calculations OF WADI AL KHAWD Aquifer Recharge Project  
 1982-1998  
 (K.O. 000)

YEAR	COST SAVINGS IF				TOTAL 1982 PRICES (1)	WADI AL KHAWD 1982 PROJECT COSTS (2)	Miscellaneous COST DIFFERENCE (3)	Cost Difference to 1982 (4)
	EXISTING DESL. (5)	NEW DESAL. (6)	WADI DIJAH (7)	TOTAL (8)				
1982						3184	(3184)	(3184)
1983	246	9	0	246	327	3236	(2199)	(1799)
1984	0	946	16	962	1279	1147	1132	1931
1985	813	320	0	1133	1507	147	1360	1073
1986	779	136	0	1135	1510	147	1363	984
1987	1227	28	0	1157	1537	147	1392	865
1988	1160	0	0	1160	1543	147	1396	789
1989	0	478	87	565	151	47	204	310
1990	0	690	49	739	983	47	836	390
1991	0	978	0	978	1301	47	1154	499
1992	738	279	0	1007	1605	47	1158	562
1993	1304	0	0	1304	1734	47	1587	557
1994	1307	103	0	1410	1875	47	1728	551
1995	2079	0	0	1424	1894	47	1744	507
1996	2079	0	0	1424	1894	47	1744	461
1997	2079	0	0	1424	1894	47	1744	419
1998						(2705)	2905	632
							TOTAL	3671

Controlled + 10% per year for 1970-1979  
Solange index will equal base of 1970 - 30% for 1970-1979  
year 1970 = 100 for base and 1970 = 100 for 1970-1979

Source: Table 5.11, *World Development Report 1980* and Table 5.14, *World Development Report 1980*,  
The World Bank, *World Development Report 1980*, *Transitional Report*, *Subsidiary Report*, Ministry  
of Agriculture and Forestry, *Study Commission*, December 1979

## COUNTRY CHECKLIST - OMAN

A. GENERAL CRITERIA FOR COUNTRY  
ELIGIBILITY

1. FAA Sec. 116. Has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can it be demonstrated that contemplated assistance will directly benefit the needy? No
  
2. FAA Sec. 113. Has particular attention been given those programs, projects, and activities which tend to integrate women into the national economies of developing countries, thus improving their status and assisting the total development effort? Yes
  
3. FAA Sec. 481. Has it been determined that the government of the recipient country has failed to take adequate steps to prevent narcotic drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported? No

through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?

4. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not dominated or controlled by the international Communist movement? Yes
5. FAA Sec. 620(c). If assistance is to a government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) the debt is not denied or contested by such government? No
6. FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities? No

7. FAA Sec. 620(a), 620(f), 620D; Continuing Resolution Sec. 511, 512 and 513; ISDCA of 1980 Secs. 717 and 72i. Is recipient country a Communist country? Will assistance be provided to Angola, Cambodia, Cuba, Laos or Vietnam? (Food and humanitarian assistance distributed directly to the people of Cambodia are excepted). Will assistance be provided to Afghanistan or Mozambique without a waiver? Are funds for El Salvador to be used for planning for compensation, or for the purpose of compensation, for the confiscation nationalization, acquisition or expropriation of any agricultural or banking enterprise, or property or stock thereof? No
8. FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression? No
9. FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property? No
10. FAA Sec. 620(k). Does the program furnish assistance in excess of \$100,000,000 for the construction of a productive No

enterprise, except for productive enterprises in Egypt that were described in the Congressional Presentation materials for FY 1977, FY 1980 or FY 1981?

11. FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason?

Oman has Investment Guaranty.

12. FAA Sec. 620(m). Is the country an economically developed nation capable of sustaining its own defense burden and economic growth and, if so, does it meet any of the exceptions to FAA Section 620(m)?

NO

13. FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters,

Oman has not seized any such boats.

a. has any deduction required by the Fishermen's Protective Act been made?

b. has complete denial of assistance been considered by AID Administrator?

14. FAA Sec. 620(a); Continuing Resolution Sec. 518.

(a) Is the government of the recipient country in default for more than six months on interest or principal of any AID loan to the country? (b) Is the country in default exceeding one year on interest or principal on any U.S. loan under a program for which the Continuing Resolution appropriates funds?

No

15. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking into Consideration" memo: "Yes, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

Yes, taken into account by the Administrator at time of approval of Agency OYB.

16. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral

No

assistance agreements been negotiated and entered into since such resumption?

17. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget?

Not in arrears.

18. FAA Sec. 620A; Continuing Resolution Sec. 521. Has the country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed an act of international terrorism? Has the country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed a war crime?

No

19. FAA Sec. 666. Does the country object, on the basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. who is present in such country to carry out economic development programs under the FAA?

No

20. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards?

No

Has it detonated a nuclear device after August 3, 1977, although not a "nuclear-weapon State" under the nonproliferation treaty?

B. FUNDING SOURCE CRITERIA FOR COUNTRY ELIGIBILITY

1. Economic Support Fund Country Criteria.

a. FAA Sec. 502B. Has the country (a) engaged in a consistent pattern of gross violations of internationally recognized human rights or (b) made such significant improvements in its human rights record that furnishing such assistance is in the national interest? No

b. FAA Sec. 532(f). Will ESF assistance be provided to Syria? No

c. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made? N/A

d. FAA Sec. 620B. Will ESF be furnished to Argentina? NO

PROJECT CHECKLIST

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

Yes

Yes

A. GENERAL CRITERIA FOR PROJECT

1. Continuing Resolution  
Unnumbered; FAA Sec. 634A;  
Sec. 653(b).

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

(a) This activity was contained in the FY 1982 Congressional Presentation.

(b) Yes

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

Yes

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

No such action required.
  
- 4. FAA Sec. 611(b); Continuing Resolution Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973?

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?

Certification is included in Project Paper.
  
- 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.

No

7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.
- Project should encourage (a) and (e). Creation of a steady supply of water should positively affect the efficiency of all types of enterprise in Oman.
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).
- Goods and services will be largely purchased from the U.S.
9. FAA Sec. 612(b), 636(h); Continuing Resolution Sec. 508. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.
- Oman is contributing 50% of the cost of the project.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and,
- No

if so, what arrangements have been made for its release?

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. Continuing Resolution Sec. 522. 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

Project Criteria Solely for Economic Support Fund

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

b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities? No

### STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

#### A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed? Yes
  
2. FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him? Yes
  
3. FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will commodities be insured in the United States against marine risk with a company or companies authorized to do a marine insurance business in the U.S.? Yes
  
4. FAA Sec. 604(e); ISDCA of 1980 Sec. 705(a). If offshore procurement of agricultural commodity or product is to be N/A

financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.)

5. FAA Sec. 603. Is the shipping excluded from compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S.-flag commercial vessels to the extent that such vessels are available at fair and reasonable rates?

No

7. FAA Sec. 621. If technical assistance is financed, to the fullest extent practicable will such assistance, goods and professional and other services be furnished from private enterprise on a contract basis? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

Yes

8. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or

property is financed on grant basis, will provision be made that U.S. carriers will be utilized to the extent such service is available?

Yes

9. Continuing Resolution Sec. 505. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States?

Direct contracts will contain such a provision.

3. Construction

1. FAA Sec. 601(d). If capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interests?

Yes

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?

Yes

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed \$100 million?

N/A

C. Other Restrictions

1. FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?

N/A

2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights?

N/A

3. FAA Sec. 620(h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries?

Yes

4. Continuing Resolution Sec. 514 If participants will be trained in the United States with funds obligated in FY 1981, has it been determined either (a) that such participants will be selected otherwise than by their home governments, or (b) that at least 20% of the FY 1981 fiscal year's funds appropriated for participant training will be for participants selected otherwise than by their home governments?

N/A

5. Will arrangements preclude use of financing:

- a. FAA Sec. 104(f). To pay for performance of abortions as a method of family planning or to, motivate or coerce persons to practice abortions; to pay for performance of involuntary sterilization as a method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization? Yes
- b. FAA Sec. 620(g). To compensate owners for expropriated nationalized property? Yes
- c. FAA Sec. 560. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? Yes
- d. FAA Sec. 562. For CIA activities? Yes
- e. FAA Sec. 536(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained. Yes
- f. Continuing Resolution Sec. 504. To pay pensions, annuities retirement pay, or adjusted service compensation for military personnel? Yes
- g. Continuing Resolution Sec. 506. To pay U.N. assessments, arrearages or dues. Yes
- h. Continuing Resolution Sec. 507. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to Yes

multilateral organizations for lending.)

i. Continuing Resolution Sec. 509. To finance the export of nuclear equipment fuel, or technology or to train foreign nationals in nuclear fields?

Yes

j. Continuing Resolution Sec. 510. Will assistance be provided for the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?

Arrangements will preclude the use of assistance for such purpose.

k. Continuing Resolution Sec. 516. To be used for publicity or propaganda purposes within U.S. not authorized by Congress?

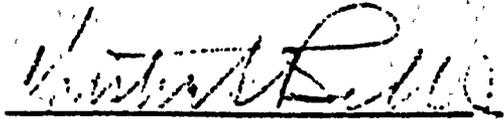
Yes

## ANNEX

CERTIFICATION PURSUANT TO SECTION  
611 (e) of FAA 1961 as AMENDED

I, Chester S. Bell, Jr., principal officer of the Agency for International Development in the Sultanate of Oman, do hereby certify that in my judgement the Sultanate of Oman has the financial capability and human resources to implement, maintain, and utilize the capital assistance to be provided for construction of the Wadi Al Khawd Aquifer Recharge Dam.

This judgement is based on the high priority the Government of Oman places on water resources and the importance of the project as a demonstration of the ability of such dams to augment water supplies. This is the first capital project in Oman to be assisted by the United States.

  
Chester S. Bell, Jr.,  
A.I.D. Representative

Feb. 20, 1982  
Date

UNITED STATES GOVERNMENT

*Montanari*  
memorandum

DATE: March 4, 1982

REPLY TO  
ATTN OF: NE/PD/ENGR, F. W. Montanari, P.E.

SUBJECT: Oman, Al Khawd Aquifer Recharge Project - Sec 611 b Requirements

TO: NE/PD/SJILO, Dan Mackell

It is evident that the requirements of Sec 611 b have been met in intent and principle for the Al Khawd Project:

- 1 - As described in the project paper, the economic, social and environmental impacts have been addressed and indicate the project will provide appropriate improvements without unacceptably high costs;
- 2 - The economic evaluation and internal rate of return are those of a good project as the paper portrays; and
- 3 - The design process evaluated alternatives and provided for selection of the best physical solution for the need to save and store rain runoff.

cc: NE/PD/ENGR:JWHabron  
GC/NE:MAKleinjan

BORROWER'S LETTER OF REQUEST

P 251120Z APR 82  
FM AMEMBASSY MUSCAT  
TO SECSTATE WASHDC PRIORITY 0404

UNCLAS MUSCAT 1869

AIDAC

E. O. 12065: N/A  
SUBJ: WADI AL-KHAWD AQUIFER RECHARGE PROJECT - LOAN REQUEST;  
LAND RIGHTS

REF: STATE 099701

1. AMENDED LOAN REQUEST FOR DOLS 7.5 MILLION HAS BEEN RECEIVED. IT IS ADDRESSED TO U. S. AGENCY FOR INTERNATIONAL DEVELOPMENT AND STATES QUOTE FURTHER TO MY LETTER FB 2/4/7 OF 10 FEBRUARY 1982. I AM INFORMED THAT DISCUSSIONS BETWEEN THE MINISTRY OF AGRICULTURE AND FISHERIES AND THE OMANI-AMERICAN JOINT COMMISSION HAVE RESULTED IN A HIGHER ESTIMATE OF THE COST OF CARRYING OUT THE WADI AL KHAWD AQLFER RECHARGE PROJECT.

WE CONCUR IN THE REVISED COST ESTIMATE AND ACTING ON BEHALF OF THE GOVERNMENT OF THE SULTANATE OF OMAN, WE HEREBY REQUEST U. S. A. I. D. TO PROVIDE A LOAN OF \$7.5 MILLION TO ASSIST IN THE FINANCING OF THE PROJECT. UNQUOTE

IT IS DATED 25 APRIL 1982 AND SIGNED BY MOHAMED MUSA, UNDER SECRETARY FOR FINANCE.

11/11  
File

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Sultanate of Oman  
Directorate General of Finance



سَيِّدَةُ عُومَانِ  
المديرية العامة للمالية  
مكتب الوكيل

Under Secretary's Office

No. : FB 2/4/7

الرقم : \_\_\_\_\_

Date : 15 February 1982

التاريخ : \_\_\_\_\_

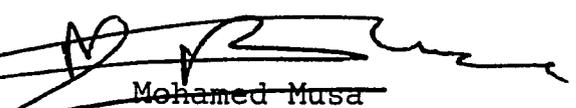
United States Agency for International  
Development

After Compliments,

This will confirm the discussions which the Ministry of Agriculture & Fisheries has had with you and your representatives concerning the preparation of the Wadi Al-Khawd Aquifer Recharge Demonstration Project to be financed by the Government of the Sultanate of Oman and the United States Government.

We concur in the Project and acting on behalf of the Government of the Sultanate of Oman, we hereby request U.S. A.I.D. to provide US\$ 6.5 million loan to assist in the financing of the Project.



  
Mohamed Musa  
Under Secretary for Finance

REC'D FEB. 16 1982

Omani - American Joint Comm. for Economic and Technical Cooperation

bh

ANNEX L

Documents available in NE/PD Files for Reference

1. Final Feasibility/Design Report: Wadi Al Khawd Aquifer Recharge Project, Stanley Consultants, December 21, 1981. Construction IFB: Bidding Requirements/Conditions: Technical Specifications.
2. Draft Final Feasibility Design Report: Stanley Consultants, August 17, 1981, and Addendum No. 1, September 3, 1981.
3. Environmental and Natural Resources Profile of the Sultanate of Oman: Arid Lands Information Center, Office of Arid Lands Studies, University of Arizona, August, 1981.
4. Corps of Engineers Nov. 1979, Report on Water Resources Study, Phase II, and Technical Proposal for Construction of Water Recharge Projects.
5. Public Authority for Water Resources May, 1980, Preliminary Engineering Design for Wadi Al Khawd Recharge Scheme.
6. Project Implementation Document (PID), in the form of an Appraisal/ Issues Paper

NEAC PID APPROVAL

The NEAC met August 20, 1981 and reviewed the Wadi Al Khawd Water Recharge demonstration project as presented in an "Appraisal/Issues paper". The NEAC approved proceeding with the preparation of the Project Paper. The major issues posed were contained in State 225120:

"SUBJECT: NEAC Reporting Cable - Water Recharge Project Appraisal/Issues Paper

REF: State 215620

1. NEAC met 8/20 to review subject paper as advised reftel. The presentation was augmented by points which were culled from partial review of Stanley draft final report which was received August 17.

2. NEAC approved proceeding with preparation of project paper.

3. Major issues NEAC posed follow:

A. Stanley's report estimates costs for proposed water recharge project is \$15,219,000 (\$13,445,000 construction and \$1,774,000 engineering supervision). As AID/GOVOMAN have agreed in principle to share cost we should consider AID contribution at this point to be approximately \$7,609,000, i.e. 50 percent.

B. In proceeding with contract for engineering supervision to be performed by Stanley after further consideration NE Bureau would be prepared to consider waiver to permit continuation of engineering design contractor to perform supervision. Proceeding in this manner assumes that AID Rep. and Oman Government satisfied with Stanley performance.

C. In view of uncertainty of timing of FY 82 fund availability AID/W prepared increase amount Stanley contract to provide continuation their current workorder to cover any additional costs to end November.."

In subsequent discussions with representatives of the Government of the Sultanate of Oman, (1) the contribution of the GOVOMAN was confirmed as 50% of the costs of the engineering supervision and construction contracts including the cost for drilling of the test wells and purchase of the test well recording equipment, and (2) The GOVOMAN requested that Stanley Consultants<sup>WAO</sup> (SCI) did the design work be engaged as the engineering supervision contractor. The GOVOMAN's request is contained in Muscat 4233.

A waiver to permit AID funding of Stanley as the engineering supervision contractor is required as Stanley was the grant funded AID IQC design contractor. A waiver request is included for NEAC consideration.

*Dup*

**SUBACTIVITY AUTHORIZATION**

Name of Country: Oman (United States Oman Joint Commission on Economic and Technical Cooperation)

Name of Subactivity: Technical Assistance Program (In Conjunction with the Wadi Al Khawd Aquifer Recharge Project)

Number of Subactivity: 272-0101.2

1. In accordance with Project Implementation Letter No. 5, Section IC9, for Grant No. 272-0101, dated September 28, 1980 between the United States of America and the Sultanate of Oman (the "Grant"), setting forth procedures for selecting subactivities under the Grant, I hereby authorize financing of the Technical Assistance Program (in conjunction with the Wadi Al Khawd Aquifer Recharge Project) Subactivity (the "Subactivity") under the Grant in an amount not to exceed \$1,000,000 over a 3 year period from the date of this authorization, subject to authorization and availability of funds in the Grant in accordance with the A.I.D. OYB/allotment process.

2. The Subactivity consists of a technical assistance program to complement the Wadi Al Khawd Aquifer Recharge Project by assisting the Ministry of Agriculture and Fisheries, Directorate of Water Resources and Irrigation (the "Ministry") to further develop and strengthen its staff through training and the provision of consultants for evaluating the results of the project and analyzing water resources data.

3. The Subactivity shall be carried out, and any subgrant agreements shall be negotiated and executed subject to the following essential terms and provisions.

**B. Terms and Conditions**

**a. Conditions Precedent to Execution of Subgrant Agreement**

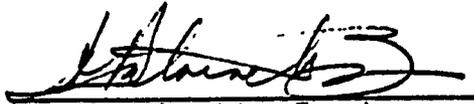
Prior to execution of the Subgrant Agreement, the Sultanate of Oman shall furnish in form and substance satisfactory to A.I.D. evidence that the two Joint Commissioners have approved the Subactivity.

**b. Conditions Precedent to Disbursement**

Prior to any disbursement, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, for consultants' services, the Ministry shall furnish to the Joint Commission, in form and substance satisfactory to A.I.D., except as A.I.D. may otherwise agree in writing, a signed contract for such services.

**c. Covenant**

The Ministry shall covenant that the Subactivity will be carried out in accordance with the terms and conditions of the Grant.



W. Antoinette Ford  
Assistant Administrator  
Bureau for Near East

22 MAY 1982

Date