OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : The Files

DATE: February 2, 1973

FROM : John W. Neave, ENGR/SP/UE

SUBJECT: Rahad Irrigation Project--Environmental Health Implications
January 17, 1973, 1000 hours, Room 623 Pomponio Plaza.

Present: Dr. Willard H. Wright, TA/H
Dr. Joe Stockard, TA/H
Mr. Edgar A. Smith, TA/H
Mr. Alvin Bishop, TA/AGR
Mr. R. H. Bell, AFR/DS
Mr. Ted Thompson, ENGR/OPNS/WR
Mr. A. Dale Swisher, ENGR/OPNS/SAN (also TA/H)
Mr. John W. Neave, ENGR/SP/UE

Dr. Stockard chaired the meeting and opened by saying TA/H had long hoped to be able to make their inputs at the planning stage of irrigation projects in order to assure adequate controls on environmental health, specifically as regarding schistosomiasis, malaria, onchoceriasis and other water-borne diseases. The AFR Bureau's request that Dr. Howard's office review the environmental health implications of the Pahad irrigation project seem to be the perfect opportunity to discuss what TA/H could do in the way of vector control on irrigation projects. Hence, Dr. Stockard called this meeting.

The fact that a similar project would be coming up shortly in Jordan was also mentioned and Ted Thompson said in view of that this meeting was extremely timely.

Dr. Stockard had a rough draft agenda for the meeting, the first topic of which was malaria. He asked for, and Edgar Smith, Malaria Specialist, gave, a rundown on the malaria transmitting mosquitoes common to the area and identified two species where the conditions of both still and flowing water would be optimum for their growth. Therefore, malaria was a real threat to the health of the people who ultimately would be settled on the irrigated land.

Next on the agenda was schistosomiasis. Dr. Wright gave an excellent briefing on the disease, how it was transmitted, the life cycle of the schistosome, and a description of control measures including both chemical and physical control. Physical control of the schistosome included design considerations, velocity of water flows, frequency of wetting and drying periods, etc.

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Next on the agenda was onchoceriasis but this topic was dismissed by Dr. Wright fairly quickly in that the relative slow flows connected with the irrigation project would not be conducive to the growth of this particular vector.

Following this, a general discussion took place relative to the type of control the World Bank would be insisting on, what controls could be reasonably expected through the Sudanese Government or the Corporation that would be managing the newly irrigated areas, and the capabilities of the Sudanese Dept. of Health to regulate these controls. Mr. Bell then read the section from the World Bank's draft loan paper which indicated the World Bank was requiring the Sudanese to have a plan drawn up indicating their method and extent of control. This plan would be due in late 1975, 3 years after construction began and roughly one year before the irrigation works became operational. In this discussion it was noted that loan money was set up for larvaecides for malaria control during the construction period but nothing was set up in the loan for continuing malaria control nor beginning schistosomiasis or snail control following the time when the irrigation scheme became operational.

At this time the discussion progressed to other matters mentioned in the World Bank's report summary on other aspects of physical vector control, namely the siteing of villages away from the canals, potable water supplies to all villages, latrines located well away from all canals, etc. At this point Neave thought it a good place to talk about the environment in a little broader sense. He brought up the fact that the Corporation which would be established by the Sudanese Government for management of the irrigated lands would be non-representative of the farmers actually tilling the land. The farmers would be tenants on the land and would be charged a water and land use charge on an increasing scale of up to 41% of their gross income at full development. The land would never revert to the farmer, the land being non-mortgageable. The purpose behind the scheme was to generate export earnings, not for feeding the people living on the land or for other domestic agriculture uses. In other words, AID would be contributing to a landlord-tenant type arrangement conceived to generate export profits. This seemed in direct opposition to AID's present policy in Vietnam, referred to as the "Land to the Tiller" program. Providing the Corporation was a benevolent corporation or a benevolent government entity, then the farmer could be well off; however, it seemed that AID would be promoting a landlord-tenant type arrangement that was prevalent in the southern states of the United States some 50 to 70 years ago as well as being prevalent in Vietnam prior to the "Land to the Tiller" program. Neave questioned the

advisability of A.I.D. assisting in the financing of such an arrangement. Mr. Bell said this had been considered previously and the issue was still not resolved. The only issue resolved was that A.I.D. had tentatively agreed to give the $10 million loan. A couple of rebuttal remarks to the landlord-tenant concept were given in the context of that is how it is done in Sudan, and that is how it is presently being done at Gizira. Neave said that regardless of how other schemes in Sudan were carried out, in addressing total environment this issue should be discussed in the environmental analysis.

Mr. Bell then said that the AFR Bureau is pushing to get the loan agreement signed in February but that the environmental analysis was still to be written. He feels that the next step would be to have a meeting with James Fowler to see if the information contained in the World Bank's study is sufficient to be included as an environmental annex or if further information would be required.

Dr. Stockard ended the meeting by indicating that the information supplied in the World Bank's summary and Annex 3 (circulated prior to the meeting) was insufficient to permit judgment whether the environmental health problem has been adequately studied and defined and whether adequate design consideration and other control considerations are to be included in the project.

(Additional comment by Neave: Both Mr. Bell and Dr. Stockard, during the course of the discussions, displayed what appeared to be ignorance as to SER/ENGR's office structure, organization, responsibilities, people, etc., and did not appear to understand at what point engineering input is necessary on a project.)

cc: Mr. Ted Thompson, ENGR/OPNS/WR

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UNITED STATES GOVERNMENT

Memorandum

Ted

TO : See Distribution

DATE: January 23, 1973

2/1/73

FROM : AFR/DP, Edward B. Hogan

SUBJECT: Sudan - Rahad Irrigation Project

Attached for review by the EPRC is a Capital Assistance Paper. The meeting is scheduled for Thursday, January 25 at 4:00 PM in the AFR Conference Room - 6944 N.S.

Attachment:
Sudan Draft

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SUDAN RAHAD IRRIGATION

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SUMMARY AND RECOMMENDATIONS

1. Borrower: Government of Sudan (GOS)

2. Amount: $11 million

3. Total Cost of Project:

A.I.D.	$12 million
IDA	40 million
Kuwait Development Fund	10 million
Government of Sudan	28 million
Total	$80 million

4. Terms: Maturity of 40 years including a 10-year grace period. Interest at 2% per annum during the grace period and 3% per annum thereafter. Principal and interest to be paid in U.S. dollars.

5. Project Description: The total project consists of U.S. equipment, and procurement services to support the development of about 310,000 acres of land for irrigated agriculture on the east bank of the Rahad River, near the Blue Nile in southwestern Sudan. Irrigation water will be pumped from below the Roseires Dam through a supply canal using electric pumps powered by electricity from the dam. The project will be carried out by the Rahad Corporation, a newly established semi-autonomous government agency which will provide the farmers with all necessary services and supporting infrastructure.

6. Purpose of the Loan: To finance the foreign exchange costs of machinery, equipment and procurement services to assist in the construction of the Rahad Irrigation scheme.

7. Background: In 1965 IBRD consultants prepared initial studies of the Rahad project to capitalize on the irrigation potential of water stored behind the Roseires Dam. The project has been refined by IBRD and GOS staffs, and was fully appraised by the IBRD in February 1972. An A.I.D. team visited Sudan in September 1972 to consider A.I.D. development programs and recommended A.I.D. participation in the Rahad project. The project is now ready for IBRD Board action and implementation, as soon as full financing is available and negotiations have been completed with the GOS.

The IBRD and the Kuwait Development Fund will provide the other donor financing. The GOS places highest priority on Rahad and has urged that it be implemented as soon as possible. If there is a delay in putting the financing package together, the project may lose a full crop year, representing a serious economic loss to Sudan. This paper is based upon the analysis of the IBRD appraisal report.

8. Project Justification: The IBRD staff appraisal shows an internal rate of return of 15%. The project will have beneficial income distribution and employment generation effects since it emphasizes benefits to small farmers and laborers.

9. Export-Import Bank Clearance: Received January , 1973.

10. Views of the Country Team: The country team strongly endorses the project.

11. Statutory Criteria: Satisfied. See Annex I.

12. Recommendations: Authorization of a development loan to the Government of the Sudan for $11 million.

CAPITAL ASSISTANCE COMMITTEE

Loan Officers: S. Klein/J. Lieberson, AFR/DS

Engineer: R. Henrikson, SER/ENG

Legal Counsel: R. Johnson, GC/AFR

Desk Officer: E. Wendt, AFR/NARA

I. INTRODUCTION

A. Summary Project Description

The project provides U.S. equipment and related services ($11 million) to support the development of approximately 310,000 acres from semi-desert land into irrigated agriculture. The International Development Association (IDA) and the Kuwait Development Fund (KDF) will be providing an additional $50 million ($40 million IDA and $10 million KDF) in parallel funding for other equipment and construction costs related to the Rahad Irrigation project.

The total project (including the A.I.D., IDA, and KDF portions) will utilize water stored by the Roseires Dam, on the Blue Nile, (see map, Annex I). Water will be moved by electric pumps from below the Roseires Dam through a 29 cu/sec supply canal 52 miles to the Rahad irrigation area.

The project involves the construction of the supply and distribution canals, drainage works, installation of agriculture processing equipment and storage facilities and settlement of about 13,700 tenants (70,000 people) with necessary infrastructure. The A.I.D. project will provide equipment and machinery to be used in the excavation of canals, construction of field distribution channels and general land leveling.

B. Background

1. Project History

In 1966 the Roseires Dam was completed a year ahead of schedule. The dam was constructed with financing from the World Bank, $32.5 million and $18.4 million from Germany. The dam was designed to increase irrigation intensity on over 1.9 million acres. The cropping intensity on this area increased 20% while specifically in the Gezira region it increased 50%.

The Roseires Dam was designed with additional capacity for future irrigation expansion. Alternative schemes for irrigation expansion were reviewed by appraisal teams in 1967, 1970 and 1972. These appraisals refined the scheme into a $86 million project which would be within prospective donor financing capability and also have a high economic rate of return, 15%.

In February 1972 a bank appraisal mission made a detailed project review and recommended that IDA consider financing a substantial portion of the scheme.

In September 1972 an A.I.D. survey team went to Sudan to identify assistance programs which could zero in on key development problems. The team approached its task of project identification within the context of A.I.D.'s new assistance style; special consideration to least developed countries; collaborative planning with the host country; working within a multi-lateral - multi-donor context; concentration on limited but key development sectors; emphasis on equity and employment; and a low U.S.G. profile. Rahad was at the top of the GOS's own list of priority development needs and clearly fit into A.I.D.'s approach to economic development. The team strongly recommended A.I.D. assistance for the Rahad project.

2. Other Irrigation Projects in the Sudan

In the early 1900's the British introduced irrigated agriculture to the Sudan. The Gezira project, managed by the Gezira Board, is one of the oldest irrigation schemes (started in 1925) and has been steadily expanded to its present two million acres. A number of other irrigation projects have been developed, all based on the proven pattern of development which has been tested and evolved in Gezira during the last 45 years.

Each irrigation area is a separate project, managed by a development board and offering a "full service" approach to farmers: supporting infrastructure, extension, training programs, insect and plant disease control, agriculture inputs, land preparation services, and marketing facilities. In addition to Gezira's two million acres there are other projects: Khashm el Girba - 415,000 acres; Wad-el-Haddad - 36,000 acres; Guneid extension - 47,000 acres; Es Suki - 88,000 acres; northwest Sennar - 54,000 acres.

Ranad will not be a unique or new venture. It will essentially duplicate the successful pattern developed at Gezira and other projects and will draw on a trained pool of irrigation experts and construction workers. There is also a readily available pool of equipment and construction machinery.

C. Relationship of the Project to A.I.D. Objectives in the Sudan

Prior to Sudan's break in diplomatic relations with the U.S.G. at the outbreak of the Arab-Israeli war of June 1967, Sudan, as a development emphasis country, received approximately $15 million per year in A.I.D. economic assistance. With the break, all assistance was promptly terminated, the staff reassigned and undisbursed amounts deobligated. Resumption of diplomatic relations occurred in late July 1972.

Reestablishment of diplomatic relations has been a major objective of the United States as one element in dealing with the entire Arab-Israeli situation. Resumption followed close upon other major developments: (1) a clear indication by the Nimeiri Government that it sought closer relations with the West following increasing disillusion with close ties which had existed since 1967 with the USSR and with Egypt; (2) a further Sudanese interest in addressing the pressing economic development needs of its people; and (3) a settlement of the rebellion in Southern Sudan which had afflicted the country since 1955. That settlement opened anew the prospects for more positive economic development efforts by the Sudan, and a renewed interest by donors such as IBRD, the British Government, the Germans and others in Sudanese economic development.

It was within this context that the U.S.G. indicated its willingness to send a Mission to Khartoum to discuss possible economic assistance programs in September 1972. Its purpose was to explore, with the Government, Sudan's own development plans and the areas in which the Sudanese Government would desire that such U.S. aid as might become available should be devoted.

The Sudanese Government indicated two major preoccupations to which it hoped the U.S. might be able to address itself. First was concern about short-term balance of payments problems which the Government expected to have to face in 1973 and 1974. Secondly was the Government's strong desire to move forward with development of the Rahad Development Scheme. While the Sudanese Government is concerned about the constraints on its economy posed by its immediate balance of payments problems, it also recognized clearly the importance of early initiation of this major development project. The Sudanese Government considered U.S. participation in this project to be particularly important if a U.S. commitment could be made in a sufficiently timely fashion so that the U.S. could join with the IBRD and other donors in meeting a time schedule that would allow work to begin early in 1973. The reason for this particular urgency was

that climatic and other conditions require the letting of initial contracts within the first two months of the year in order to avoid the loss of a full year of construction. Not only would delay negate the economic benefits of the project by a year, but it would cause considerable additional cost to the Sudanese Government because it has available construction equipment and a work force in place which must either be disbanded (with considerable potential social and economic consequences) or maintained by the Sudanese Government without effective utilization but a high cost.

Rahad fits U.S. economic development objectives in the Sudan:

(a) The Rahad Scheme is the Government of Sudan's first and foremost development priority.

(b) Participation in this project would be a collaborative effort between three donors in which the U.S. would play an important but secondary financing role. Provision of U.S. assistance will assure that the IBRD and the Kuwait Development Fund will make additional important contributions.

(c) U.S. assistance to this project would allow us to play a role in an important development project in support of our general objectives while keeping to a minimum U.S. supporting staff in the Sudan.

(d) The project will provide employment for 13,700 farm families and 90,000 seasonal laborers, meeting the A.I.D. objective of supporting projects which have an employment and equity affect.

II. Technical Analysis

A. Detailed Project Description

1. Total Project

a. Summary of Major Segments

--Major Engineering Works

1. 105 m^3/sec electrically powered pumping station at Meina on the Blue Nile, 200 km downstream from Roseires Dam;

2. a 105 m^3/sec supply canal, 84 km long from Meina to an out-fall on the Rahad River;

3. a barrage and head regulator on the Rahad, 6km downstream of the supply canal outfall; and

4. the irrigation distribution and drainage system supplying 310,000 acres net.

-- Headquarters, offices, and staff houses for the Rahad Corporation management with the necessary utilities and roads.

-- Transmission lines for the Central Electricity and Water Corporation:

1. across the Blue Nile at Meina supplied by a substation at Singha;

2. from a substation south of Wad Medani to project headquarters and the ginneries.

-- Agricultural equipment and processing facilities, including farm machinery, ginneries, decorticators, warehouses, and a light railway.

-- Public health facilities for new villages including village water supplies, a central hospital, six clinics and health centers, and an initial inventory of molluscicides and equipment for bilharzia and malaria control.

-- Settlement of the project area in three years at a rate of 103,000 acres/year including bush clearance and land leveling. Tenants will receive a settlement allowance, and a 24 acre allocation of land and will be required to follow a six crop rotation pattern pursuant to a tenancy agreement with the Rahad Corporation.

-- Seed production and research farms.

-- Consultants services for the project implementation including U.S. technical services to manage the procurement of A.I.D.-financed equipment.

-- A feasibility study for a second phase project, including studies on the optimum use of the Roseires storage waters.

b. Consulting Services

Sudan's Ministry of Irrigation (MOI) has considerable experience in the design and construction of distribution systems but limited experience of canals as large as the supply canal and in the design and construction of major structures. Consultants would be required to advise MOI engineers on the designs and location of the supply and main canals and to take full responsibility for design of the pumping station, supply canal structures and the Rahad barrage and headworks. In April 1972, MOI retained Sir M. MacDonald and Partners (UK) to prepare designs and tender documents for these works. IDA has GOS agreement that the Rahad Corporation will retain consultants, acceptable to IDA, to advise MOI; to evaluate bids and supervise all works awarded after international competitive bidding; and to certify all payment vouchers eligible for reimbursement from the proposed credit.

c. Water Supply

The water from the Blue Nile and Rahad rivers is of excellent quality, proven suitable for irrigation. The effective rainfall is small, and is negligible in the peak demand month of October. The pumping station on the Blue Nile and the distribution system would be designed to provide the peak monthly and the full annual requirement of the proposed cropping pattern at a cropping intensity of 84%, i.e. 100 m^3/sec and 1.4 milliard m^3 per year. If in the future it is considered advisable to increase the cropping intensity to 100% (by replacing fallow with 50% cotton and 50% mixed crops), the annual requirement of about 1.6 milliard m^3 could be delivered, but there might be a shortage of 8% in the peak month. Even this tolerable shortage probably would be eliminated either by the introduction of new crops or by changing the planting dates for cotton, both almost certain to occur in the future. Because of the nature of the soil, seepage losses from the unlined canals would be insignificant. The conveyance efficiency is estimated at 93% (86% in months of low flow) and, with basin irrigation, field efficiency at 70%, giving an annual overall efficiency averaging just under 65%. Although water from the Rahad would not be needed for the project, in practice Rahad water would be used whenever available to reduce pumping costs.

d. Irrigation and Drainage System

The consultant would check the alignment and design of the supply canal, which would be siphoned under the Dinder River and deliver water through an outfall structure into the Rahad River. Drainage escapes and about 10 bridges would be provided. After flowing

six kilometers down the Rahad, water would be diverted into the project main canal (100 m^3/sec) by a composite masonry concrete barrage 50 m wide with nine gates (to control level and release flood waters) and a 35 m wide head regulator controlling diversions to the main canal. Nine major canals and appropriate minor canals, controls and water courses would distribute water to the area. Drainage to the river would be provided for rainfall and excess irrigation and would also allow for drainage from future developments to the east of the main canal.

e. Agricultural Services

All irrigable land would be cleared and levelled before settlement. Equipment would be procured and the operating costs of initial levelling capitalized in project costs. The Rahad Corporation would provide a full range of mechanized cultivations as well as credit, advisory services, and crop processing and storage facilities.

2. A.I.D. Component of the Total Project

The A.I.D. project loan will provide equipment and related services for the excavation of the main supply canal, the field irrigation and drainage channels and for land leveling. Support vehicles (general purpose hauling trucks, dump trucks, and supply and maintenance vehicles) will also be included in the A.I.D. project loan. (See equipment list Annex III B).

B. Project Studies

The preliminary plans for the Rahad scheme were developed in 1965, by the IBRD consultants working on the Roseires Dam Project. (Sir Alexander Gibb and Partners and Sir M. MacDonald and Partners: United Kingdom).

A detailed study of the Rahad area was made by consultants (Sir M. MacDonald and Partners and Hunting Technical Services: United Kingdom) financed under the IBRD Group/KFW Loans and Credits for the Roseires Dam. They found that some 820,000 fed (1 fed = 1.038 acres) were irrigable and recommended several alternative schemes which were appraised by the Bank Group in February 1967. The project selected provided for gravity irrigation from Roseires of a first stage area of 410,000 fed, but included some investment required for a second stage of the same size, also supplied from Roseires. Key issues of the Bank appraisal resulting in deferral of the project at that time were: reliance on water from the Rahad River in the absence of agreement with the upstream riparian (Ethiopia); the size of the project in relation to fiscal and other resources; recovery of project costs; and project management and organization.

The World Bank Group reappraised this Stage I Gravity Project in February 1970. The revised appraisal report included modified cost and benefit estimates and cropping patterns but did not propose any major changes in the concept of the project. This revised report was discussed with the Government but no agreement was reached on a financing plan.

In September 1971, the GOS requested the Bank Group assistance in financing a different project with a first stage supplied from a pumping station at Meina on the Blue Nile. The Meina supply canal would be less than half the length of that from Roseires, but would command only 300,000 fed: the remainder of the Rahad area (520,000 fed) could be irrigated by gravity from Roseires at a later date. Neither stage would rely on use of Rahad water, although the first stage would use any available flow. (See Annex II for description of studies.)

C. Technical Services

1. Engineering:

The Rahad project was designed by consultants engaged under the IBRD Loan (284-SU) and Credit (2-SU) for the Roseires Dam Project. The Rahad Project would be constructed under the Supervision of Engineering Consultants financed by the IBRD (US $3 million). They will have full responsibility for major works, advise on location and design of large canals and certify work executed by the Ministry of Irrigation (MOI). Studies will be made for the second stage development of the Rahad project, including a review of the optimum utilization of Roseires water.

Consulting engineers would be appointed by the Rahad Corporation to implement the Rahad Irrigation Project. Their assignment would be in three levels of responsibility depending on the class of work.

Category "A" level will mean full responsibility for design contract documents and construction supervision. Category "B" level will mean reviewing and approving designs and documents prepared by the Corporation or their agents and recommending changes if necessary, as well as, assisting in construction supervision. Category "C" level will mean giving advice as requested on any part of the project. All categories will include checking and certifying monthly contract payments.

2. Procurement

The A.I.D. Loan will include the financing of a procurement services contractor to assist the Rahad Corporation in preparing detailed specifications and bidding documents, advertising for competitive bids, reviewing bids, recommendation for awards, recommending spare parts requiring, and setting up preventative maintenance programs for the various pieces of equipment.

It is envisioned that one equipment specialist will be required full time in the Sudan until all the equipment and spare parts have been delivered and the maintenance program has been established. The time required for these services is estimated at two years.

D. Project Components

The A.I.D. financed equipment falls into the two major components for establishing the project. The first is the heavy equipment that will be used by the MOI to construct the main canal. The second is the agriculture equiment required to: clear and level the land, prepare it for farming, supporting vehicles for supplies and technical services, agriculture maintenance vehicles and groundnut harvesting equipment.

1. The heavy construction equipment will be used by the MOI to supplement their existing equipment and will be used in the construction of the main canals and civil works.

2. The agriculture equipment will be used initially to clear the land and prepare the area for settlement by the farmers. Upon completion of the project area, the equipment will be used by the Rahad Corporation to provide the farmers with the necessary mechanical equipment to prepare the land for planting and harvesting the crops.

E. Cost Estimate

1. The detailed cost estimate of the equipment to be procured is contained in Annex IIIB. The prices for the individual items reflect the January 1973 costs of the equipment (FOB) with an allowance of 20% provided for the delivered equipment costs. Because of the remoteness of the project and the limited dealer services which will be available, an allowance of 13.75% of the CIF equipment costs has been provided for spare parts to support the equipment.

The overall Rahad Project foreign source equipment requirement is in excess of U.S. $ 20 million. The detailed list outlined in Annex III B reflects those items immediately identifiable for procurement from A.I.D. Code 941 countries. The final list of equipment financed under this loan may differ slightly from the one in the Annex, but no major deviations are anticipated by the IBRD or A.I.D.

2. Detailed Project Estimate:

SUDAN

RAHAD IRRIGATION PROJECT

A.	Construction Vehicles and Equipment	
	1. Construction Vehicles	$1,059,400
	2. Construction Equipment	2,743,300
B.	Agriculture Vehicles and Equipment	
	1. Agricultural Equipment	1,419,600
	2. Transport Vehicle	145,440
	3. Blading and Deep Ploughing	466,000
	4. Maintenance Equipment	631,200
	5. Land Leveling	347,600
	6. Lubrication - Shop Equipment	252,000
	7. Vehicles	531,480
	Sub-Total	$7,596,020
	Spare Parts 15%	1,139,400
	Procurement Services	450,000
	Sub-Total	$9,185,420
	Contingencies and Misc. Items	1,243,280
	Sub-Total (A & B)	$10,428,700
C.	Decorticators	
	1. Equipment	$ 496,800
	2. Spare parts	74,500
	Sub-Total (C)	$ 571,300
D.	Total A.I.D. Project Cost (A, B, & C)	$11,000,000

F. Technical Soundness

The equipment to be financed under the loan has been identified by the A.I.D. engineer and the IBRD representative as the most likely items for procurement from Code 941 sources. The quantities of equipment needed has been reviewed by the IBRD and the GOS and reflect their agreement on the correct quantity to complete the project on schedule. A number of items have been changed or adapted to provide maximum inter-changeability of parts and components. Where possible, types of equipment were selected that have been previously used by the MOI work forces in constructing similar types of irrigation projects.

All technical and engineering requirements of the Foreign Assistance Act of 1961, as amended have been met, in that: (1) funds will be used in a technically sound manner; (2) the country's principal A.I.D. officer has certified that the country is capable of effectively maintaining and utilizing the project; (3) engineering plans necessary to carry out the project and a reasonably firm cost estimates have been completed; and (4) the loan agreement will provide for U.S. approval of the procurement contract terms and selection of firm.

III. Economic Analysis

A. Agriculture and the Sudanese Economy

1. General Agriculture Situation

Sudan, the largest country in Africa, has an area of 2.5 million KM^2 (600 million fed or 623 million acres) and a population of 15.7 million. With almost 40% of GDP, 80%-90% of total employment and 95% of exports in the agriculture sector, agricultural development is essential to Sudan's economic growth.

Half of the Sudan is desert or swamp, unsuitable for agriculture. The remaining land is sparsely populated due to limited year-round water supply and is used almost entirely by semi-nomadic tribesmen or subsistence farmers. Only about 3% of Sudan's total area is cultivated, about 17 million acres. Approximately 25% of the crop land is irrigated producing about 50% of agriculture production.

Present GOS policy is aimed at broadening the economic base by increasing the area under irrigation and by diversifying agricultural production. Crop diversification is still in the planning stage while the irrigation area has been greatly expanded and could be increased even further. During the last five years, the area under crops has expanded 3.7% a year, greatly supporting the annual 4.6% growth in crop production. Agriculture growth has been almost double the rate of population growth.

2. Agriculture Resource Base

Sudan is presently using only about half of its annual water allocation under the 1959 Egypt/Sudan Nile Water Agreement. The Roseires Dam, which was completed in 1966, was designed with reserve capacity of 650,000 acre feet of water. The marginal cost of using this water is almost zero. The climate and soil of the Rahad area are ideal for irrigated agriculture. The Blue Nile and Rahad river waters have a low salt content and the clay soil in the project area does not easily waterlog or turn alkaline. The IBRD estimates that a cropping intensity of 100%, with no leaching, could be carried out for more than 100 years before the land would deteriorate from alkalisation.

Sudan does not have either severe population pressures or an unemployment problem. There is some unemployment, but during peak agriculture seasons there is a labor shortage. Sudan's intensive development of irrigated agriculture requires a large labor force. The local population in the Rahad area, is now in non-intensive subsistence agriculture; this underutilized labor force comprises a positive asset to the Rahad project.

The labor shortage at peak harvest times requires some mechanization for land preparation, planting and crop protection. Even with mechanization the project will require 90,000 hired laborers in the peak season. The income benefits for the farmers and laborers will be substantial. Each farm family will earn $575-$690 a year, two to three times the average income in the area now.

B. Economic Benefits and Costs

The Bank's estimates on Rahad, which take into consideration the cost/benefit experience of Gezira and other successful schemes, indicate that the project will generate annual foreign exchange earnings of $42 million gross or $27 million net; a very substantial return for an $89 million investment. The project will generate income four years after the start of construction and maximum benefits after ten years.

Rahad will tap Sudan's most valuable, but still under-utilized, natural resources -- Nile waters and arable land - while improving productivity, income and the general living conditions of a large number of impoverished families who presently eke out a subsistence living. Income for the 16,000 farm families in the project area will be $575-$690 per year, two to three times present family income. The project will also provide seasonal employment for 90,000 laborers and will create 2,300 full time jobs (1000 unskilled) with the Rahad corporation. The project will provide productive utilization for MOI's construction equipment remaining from previous irrigation projects and for equipment which the GOS purchased for Rahad with its own resources. The alternative uses for this equipment and the large number of workers and farmers is extremely limited. The land to be irrigated is a sparsely populated, semi-desert-bush area producing little income now.

The IBRD's analysis of economic costs and benefits (see Annex VI) yields an economic rate of return of 15%. The future world market price of cotton will have the greatest effects on the rate of

return. Even under the most adverse conditions -- low cotton prices, increased capital costs, delays in project completion and reduced yields -- the rate of return would only drop to 10% -- still adequate to justify the project. If all factors are most favorable, the rate of return climbs to 18%. We think the IBRD has properly weighed the costs and benefits and a 15% rate of return justifies the investment.

C. Organization and Management

1. The Rahad Corporation

The Rahad Corporation, an independent corporation which will be responsible for the project, is modeled on the successful Sudan Gezira Board. The Rahad Corporation is governed by a council consisting of the managing directors or chairman, and 12 other members representing Government ministries, provincial governments, other government organization, and the tenants. Experience has shown that such a semi-autonomous set-up provides an effective means to coordinate activities of different ministries while giving the corporation the flexibility and incentives which are lacking in the normal departmental structure of a traditional government ministry.

The Rahad Council is responsible to the GOS Council of Ministers through the Minister of Agriculture who sits on the Rahad Council. The act establishing the Rahad Corporation was signed by President Nimairi on April 22, 1972.

2. Organization

The Managing Director is responsible for operation of the project assisted by two deputy managers, one for administration and the other for agriculture. In order to control the project area, it will be divided into three groups of 103,000 acres, which are further divided into three blocks each. The group staffs are responsible to the Deputy Manager Agriculture. Each group will be supervised by a Group Inspector and each block will be supervised by a Block Inspector. The village councils will be represented by Samads (468) selected by the Block Inspector on recommendation of the village councils. Again, this project organization is patterned after the successful Gezira scheme. The IBRD will require approval of the Managing Director, the two Deputy Managers, adn the appointment of other key personnel as a condition of its loan. The IBRD will also require an approved training program for the project staff.

3. Rahad Corporation/Tenancy Relationship

The Rahad Corporation has full powers to issue tenancies, control use of the land, provide a full range of services including land leveling, planting of crops and harvesting of groundnuts, and establishing a land and water charge for the tenants to reimburse the Corporation for its services. The tenancy agreement will require the tenant to grow only approved crops and in the Corporation's approved rotation. Initially, this pattern will be cotton: groundnuts: cotton: groundnuts: cotton: fallow. The IBRD and GOS have carried out detailed studies of the agricultural patterns and projected yields and have determined the above patterns and crops to be the most advantageous. The holding will include a small amount of land for fruits, vegetables and livestock. Each holding (about 24 acres) should be within 5 km of the family housing site. The tenants will turn over prescribed crops to the Corporation, which will market them on behalf of the tenants to gain marketing economies of scale. The tenants will market fruits, vegetables, and livestock, and the Corporation will make available advisory services.

The farmers in each irrigation scheme are by definition "tenants" but they have long-term tenancy rights making them the equivalent of landowners. They receive advice, services and support from the board but they must hire their own labor and manage their own farm. There has been a steady process of devolution or decentralization initiated by the Gezira and other boards to stimulate agriculture and civic responsibility in each village council and by each individual farmer.

IV. Financial Analysis

A. Financial Requirements

The A.I.D. project has a total financial requirement of $11.65 -- $11 million in foreign exchange costs and $0.65 million in local costs. The breakdown of foreign exchange items to be financed under the A.I.D. project is given in Section II D above.

Total costs for the entire Rahad irrigation project are $89.0 million. The foreign exchange component is $61 million and the local cost component is $28.0 million. In addition, $26.29 million of local taxes, duties and surcharges will be incurred by the project. The table below shows the major cost categories for the Rahad project broken down into their foreign exchange and local cost components:

TOTAL RAHAD IRRIGATION PROJECT

	($Millions)		
	Foreign Exchange	Local Cost	Total Cost
Irrigation Works*	24.00	11.38	35.38
Buildings, Services, Utilities	5.90	5.38	11.28
Transmission Lines	1.10	.43	1.53
Agricultural Equipment and Vehicles*	7.50	1.02	8.52
Processing and Storage,* Light RR	7.72	2.27	9.99
Public Health	1.67	.54	2.21
Settlements Seeds and Research	1.12	1.70	2.82
Administration and Overhead	.32	1.26	1.58
Consultants	2.44	.29	2.73
	51.77	24.27	76.04
Contingency	9.23	3.73	12.96
TOTAL	61.00	28.00	89.00
Duties and Surcharges		26.29	26.29

*The equipment A.I.D. is financing is included under the categories of irrigation works, vehicles, and processing and storage.

B. Financial Plan

The A.I.D. component of the Rahad project is as follows:

	($Millions)		
	Foreign Exchange	Local Costs	Total Costs
A.I.D.	11.0 (100%)	-	11.0 (94%)
GOS	-	.65 (100%)	.65 (6%)
	11.0 (94%)	.65 (6%)	11.65

The total Rahad Project financing plan is as follows:

Donor	($Millions) Foreign Exchange	Local Cost	Total Cost
IDA	40.0 (66%)	-	40.0 (45%)
A.I.D.	11.0 (18%)	-	11.0 (12%)
Kuwait Development Fund	10.0 (16%)	-	10.0 (11%)
GOS	-	28.0 (100%)	28.0 (32%)
	61.0 (69%)	28.0 (31%)	89.0 (100%)

A.I.D. will finance foreign exchange costs of specified machinery and equipment and related services from code 941 countries. Because the items to be financed are sophisticated machinery and equipment, A.I.D. expects that all procurement will be from the U.S. A.I.D. will finance the services of a consultant for procurement of the A.I.D. financed items. The IDA and Kuwait Development Fund will finance the remainder of the foreign exchange costs. The GOS will finance all local costs of the project. The GOS will also be responsible for the $26.9 million in duties and surcharges in addition to its contribution of $28 million for the local costs.

The terms of the A.I.D. loan will be: repayment in forty years, including a ten-year grace period for principal repayments; interest at 2% per year during the grace period and 3% thereafter; and repayment in U.S. dollars. The IDA loan terms call for repayment in fifty years, including a ten-year grace period for principal repayments, and a yearly credit fee of 3/4% for the life of the loan. The Kuwait Development Fund has not finalized the terms of its loan to the GOS. However, in early 1972 the KDF made a loan to the GOS at terms of: repayment in twenty-five years, including a five-year grace period and interest rate of 2-1/2%. The KDF loan for the Rahad project should be on similar terms.

E. Availability of Other Donor Financing

As noted above, the IBRD has studied the Rahad project extensively for the last seven years to determine the best means to utilize the irrigation potential of the Roseires Dam. In 1972, after much refinement, the Bank designed a project which met their technical and economic criteria. The project was too large, $89 million, for any one donor to finance but it had discrete sub-activities which could be financed by a number of donors.

At the September 1972 World Bank meeting, the Bank held a special session with Germany, Italy, the United Kingdom, Kuwait, Japan and the U.S. to review the Rahad proposal. The Bank stated that it planned to provide a maximum of $25 million and asked the other donors to supply the remaining $31 million -- total foreign exchange costs -- $56 million, the estimated foreign exchange costs at that time.

The project entailed a comprehensive irrigation works which had to be constructed in its entirety. A total financing package needed to be lined up before construction could proceed. In addition the financing package had to be lined up before the end of CY 1972 in order to avoid missing the next construction season. A number of countries were interested in the project, but only the U.S. and the Kuwait Development Fund were prepared at that time to indicate a financial commitment. A.I.D. is planning to finance up to $11 million and the Kuwait Development Fund has pledged $10 million with a possible increase to $11 million. After the Bank determined that no other donor financing would be available, the Bank agreed to increase its financing by $15 million up to a maximum of $40 million.

D. Export-Import Bank Clearance

The Export-Import Bank Board of Directors reviewed the project on January , 1973 and determined that it was not suitable for Ex-Im financing.

E. Repayment Prospects

1. Financial Position of GOS Through 1971

a. Public Sector Finances

The Sudanese public sector greatly expanded after the large scale nationalizations in 1970. The public sector now accounts for approximately 55% of gross output. This large public sector expansion accelerated an already deteriorating trend of budget deficits and stagnating development expenditures.

Central Government revenues almost doubled between FY 1967 and FY 1971, rising from about 18 percent to more than 26 percent of gross domestic product. As the IMF has noted, such a large revenue increase is a major achievement for any country. However, counter-balancing this rise in revenues was an almost equal increase in current expenditures.

A major problem has been deficits of government bodies and semi-autonomous corporations which increased from £S 4.7 million in FY 1967 to £S 18.5 million in FY 1971 (see Table). With only a marginal rise in the current account surplus and large deficits from Government corporations, there was little revenue available for the development budget. Development expenditures were £S 17.8 million in FY 1967 and only £S 18.8 million in FY 1971; a very minimal increase.

b. Debt Service and Foreign Exchange

From 1968 to 1971 external debt outstanding increased 39% from $213 million to $296 million and yearly debt service tripled from $13 million to $39 million (see ANNEX V). Of the outstanding debt, 15% had an original maturity of five years or less and 19% had an original maturity of ten years or less.

Even with Sudan's steady growth in export earnings, a large build-up of debt carrying stiff terms increased the debt service ratio from 5.7% in 1968 to 13.1% in 1971. During the same period, net foreign exchange reserves declined from plus $6 million to minus $62 million. IMF drawings and short-term commercial borrowings were all that kept Sudan liquid.

2. Future Financial Prospects

The present financial situation is extremely tight but GOS financial reforms and the basic economic potential of the country are good. There is considerable unused potential in the country -- agriculture and water resources -- for an expansion of both rainfed and irrigated farming. In addition, livestock products and minerals (chrome, iron ore and copper) have yet to be developed. With proper economic policies, Sudan's long-run growth prospects are good.

The Nimmiri Government has moved away from an ideologically oriented nationalistic policy to a more pragmatic attitude with emphasis on a mixed economy. The World Bank judges Sudan's long-run prospects as good and is providing financing for a number of projects. The IMF has provided stand-by credits ($353 million) to support the GOS stabilization program.

When in full production the Rahad project will generate $27 million a year in foreign exchange earnings over the foreseeable future. These revenues will clearly service the Rahad loan obligations

of the IBRD, Kuwait Development Fund and A.I.D. In addition, the long-run growth prospects for the economy as a whole give reasonable prospects for repayment.

V. Other Considerations

A. Impact on the U.S. Economy

This loan will result in the procurement of approximately $11 million in equipment, materials and services, all of which are expected to be purchased in the U.S. It is also anticipated that U.S. exports will benefit from follow-on purchases by the Sudanese of replacement and spare parts.

B. Cotton Production

Sudan specializes in the production of long and extra long staple (ELS) cotton. It also produces medium long (Acala) and short staple cottons. In 1970/71, Sudan's cotton production totalled 1.3 million bales, of which 1.1 million was long and extra long, 189,000 Acala and 28,000 short staple. All of the short staple and part of the Acala production (59% in 1971) is consumed domestically; most of the long staple is exported.

Cotton production in the Rahad project will be of the Acala variety exclusively, with production at full development (1980) expected to be approximately 220,000 bales per year. This emphasis on Acala type cotton represents an effort to diversify since medium long cotton has been less affected by competition from man-made fibers and the technology of improved spinning machinery than have the longer varieties.

1. Competition With U.S. Cotton

This project is not expected to result in any increase in cotton exports to the U.S. In the first 9 months of 1972, for example, Sudan exported only 6,000 bales to the U.S. compared with 8,000 bales the year before. All of this was long/extra long staple; the Rahad project will produce medium long, none of which is scheduled for export to the U.S.

New production of medium long cotton will, however, make Sudan more competitive with U.S. exports, but only to a very minor degree. A portion of the 220,000 bales of Acala to be produced by 1980 will be consumed domestically, but even assuming that the entire amount is exported, the impact on the world market would be

insignificant: less than a 2% increase in world exports if measured against the 1971/72 level of approximately 18 million bales and less than a one percent increase if measured against the USDA's 1980 estimate of 23 million bales. While the Sudan has recently, with some degree of success, attempted to shift its markets more toward free world countries, particularly Western Europe, the relative insignificance of the Rahad volume, as noted above, indicates that the Rahad project will have little measurable impact on U.S. exports of cotton.

2. Assisting Production of a Surplus Non-Food Crop

Substantial intentional cutbacks in U.S. cotton acreage and low yields in the United States and other key producing countries in 1970/71 resulted in short supplies and the highest prices in nearly 20 years. It appears that cotton is not now in world surplus. The incentive of higher prices combined with more favorable growing conditions is serving to ease the tight supply situation, with cotton production increasing by more than 2.5 million bales in 1971/72. An increase of similar magnitude is projected by USDA in 1972/73. By 1980 when the Rahad project is scheduled to reach full production, the World Bank is projecting that the cotton market will have returned to a marginal 5%-7% surplus situation. USDA in its publication "World Demand Prospects for Cotton in 1980" projects a range of 67 to 69 million bales for supply and demand. With demand at the lower figure and supply at the higher figure, a 3% surplus is possible using USDA projections; of course the opposite might be the case.

While this project would indeed be assisting in the production of a non-food commodity which may possibly experience a surplus market over the next decade, it seems clear that the relatively small volume of cotton from the Rahad project will have little affect on world supply one way or the other.

One additional factor to be noted is that production in this project will not be limited to cotton: two new food crops, groundnuts and vegetables, will also be introduced to the area -- groundnuts for export and vegetables for domestic consumption.

C. Ecology and Public Health

The project will have a significant impact on the ecology of the region, particularly on health. The greatest problems are malaria and bilharzia (schistosomiasis) which may increase as a result of this project.

1. Malaria

Malaria control measures are well understood in the Sudan and aerial spraying of crops has been the general practice. Sudan's mosquitoes have developed a very high resistance to common insecticides as a result of long exposure to low dosages from drifting residues. Therefore, control measures will concentrate on potential breeding grounds with treatment by larvicidal oils. The World Bank believes this is practical and has included financing of larvicides for the project during the four-year construction period. Mosquito control will continue after the construction is completed.

2. Bilharzia

Surveys in the Sudan have shown that bilharzia in non-irrigated areas has infected 7%-8% of the population, while in irrigated areas it has infected as much as 62%-100% of the population. The main method of controlling the disease is by elimination or reduction of the snail population, the alternate host of the bilharzia parasite, through treatment of the irrigation water with molluscicides. Copper sulfate is the only molluscicide now in routine use in the Sudan. Other synthetic molluscicides, however, are being used experimentally. For example, results to date with Frescon, an organic molluscicide produced by Shell Chemical, have indicated that effective control may be attainable with only three applications per year at minimal cost. Public health and hygiene measures along with hospital and clinical facilities will also be required. These control and treatment measures which are included in the project are estimated to cost as follows:

	($000)		
	FX	Local	Total
Village Water Supplies			
Material	$ 660	$ 56	$ 716
Construction	30	258	288
Hospital and Clinics	230	170	400
Inventory of Chemicals*	605	14	619
Vehicles	145	42	187
Total	$1,670	$540	$2,210

*Includes larvicides for Malaria control

3. Effect on Migratory Game

The Dinder Game Park is located approximately 120 km south of the project area. The present site of the main supply canal should pose no threat to migratory wildlife. Water from the project area, which could contain pullutants, does not flow into the park.

4. Insecticide Spraying

Cotton would not be profitable in the Sudan without chemical pest control. The Bank study recognizes the risks to health but concludes that adequate safeguards are in effect to protect the local inhabitants and to prevent insecticide pollution of the rivers.

A more detailed analysis of the ecological impact of this project is contained in Annex VIII.

5. Conclusion

The Bank's appraisal of the project clearly recognizes that irrigation will significantly increase the incidence of malaria and schistosomiasis if proper controls and health measures are not instituted. After examining the problems involved, the measures required to control the spread of disease and the experience and capability of the Sudanese, the Bank has concluded that it will be possible to establish an effective control program for malaria and schistosomiasis. As a further assurance in this regard, the Bank will ask the Government of Sudan to submit, prior to completion of construction, a satisfactory program for control and treatment of these diseases. Preparation of this program will require further intensive analysis of the scope of the problems involved and evaluation of alternative solutions available as well as definitive understandings within the government as to responsibility for financing recurring costs of control and for implementation.

A.I.D. is satisfied that the ecological impact of this project has been adequately recognized by the Bank and that the GOS is interested in and capable of establishing the required control programs. A.I.D. is equally satisfied that the non-health aspects of the ecological impact have also been adequately considered by the Bank.

VI. Implementation

A. Schedule

Extremely high settlement rates have been achieved on previous irrigation schemes, averaging 98,000 acres a year from 1966 to 1971. The proposed rate for this project, 104,000 acres per year, is ambituous but still below the peak of 141,000 acres achieved in 1967/68.

The main supply canal will be completed 3 years after the start of construction. Settlement of farmers and the construction of the distribution system, housing and infrastructure will start in the third year.

Annex Table IX illustrates the World Bank's implementation schedule for the total Rahad Irrigation schemes. Excavation of the Supply Canal was scheduled to start in October 1972. The majority of equipment for excavation will be provided under this loan and is scheduled to arrive in the Sudan by February 1974. The GOS will use equipment already on hand to start part of the excavation, but probably there will be some slippage from the Bank's time table.

The following is the estimated implementation schedule for the A.I.D. loan:

February 1973	Loan Authorized
February 1973	Loan Negotiated
February 1973	Loan Agreement Signed
February 1973	Advertisement for Procurement Services
April 1973	CP's met
May 1973	Selection of Procurement Advisor
June 1973	Contract for Procurement Services Signed
September 1973	Invitation for Bids (IFB)
November 1973	Award of Contracts for Equipment
December 1973	First Disbursement/Shipment
February 1974	Delivery of First Equipment in the Sudan
October 1974	Final Delivery of Equipment

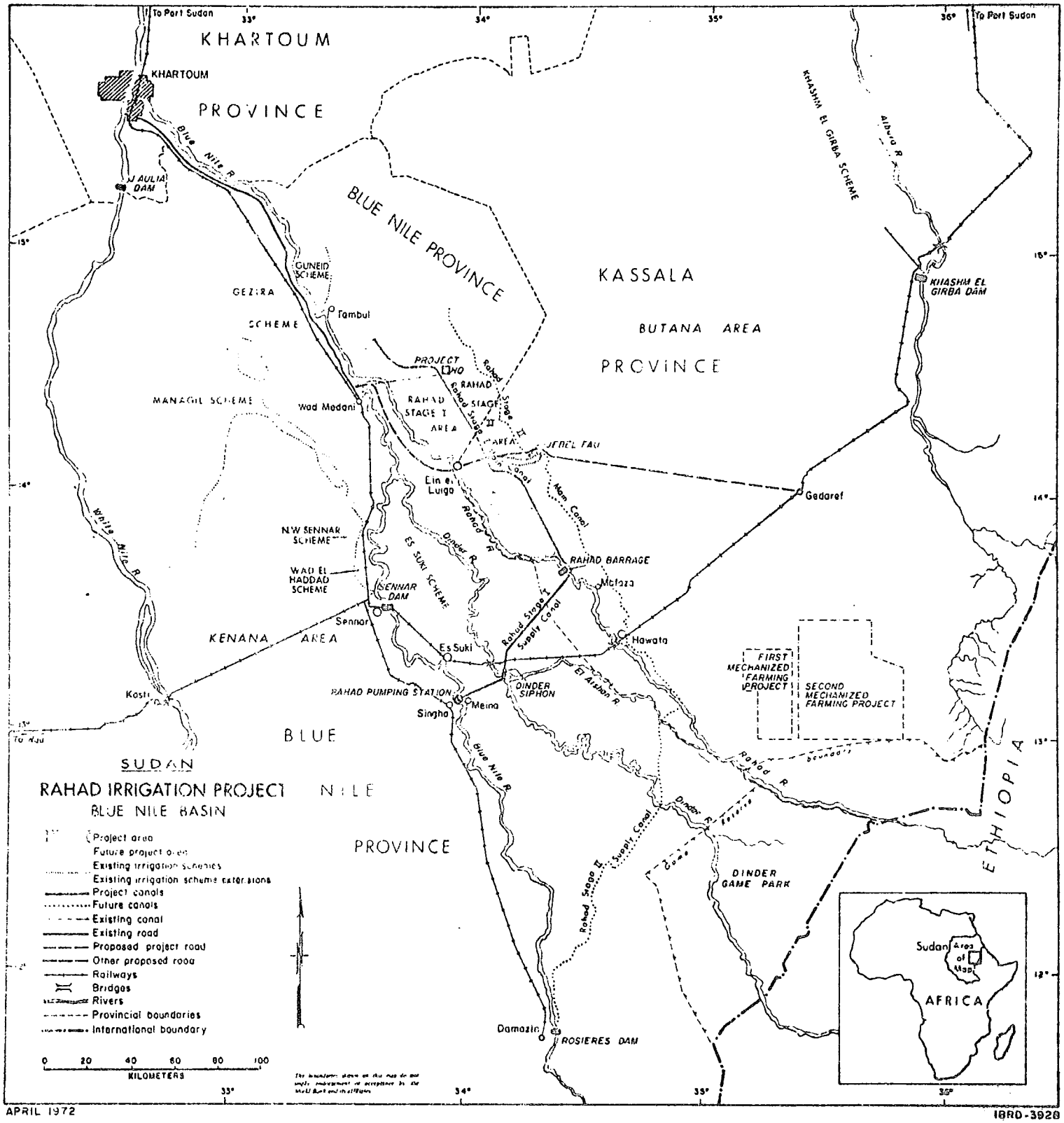
B. Responsibility

The GOS and the IBRD staff have developed the project to its present stage. Accordingly, A.I.D. will continue to rely upon the IBRD for assuring that the details of the total project are successfully carried out by the Rahad Corporation and the GOS. A.I.D. will work out with the IBRD, KDF, and GOS the reporting requirements so that the GOS will be able to prepare one report for all donors.

The A.I.D. loan includes financing for a firm to provide procurement services for the A.I.D.-financed equipment. The firm will assist the GOS in preparation of specifications, evaluating bids, and monitoring delivery to Sudan, including inspection prior to shipment. A.I.D. staff will approve the tender documents and awards for the A.I.D.-financed equipment. On a periodic basis, A.I.D. will monitor the utilization of equipment financed by the A.I.D. loan but the major burden of project monitoring will rest with the IBRD as explained above.

The IDA and KDF loans will finance the contracting work under international competitive bidding procedures. The Ministry of Irrigation (MOI) staff will carry out with its own staff land leveling, water supply canals, and the distribution system. The MOI already has 5,000 people on its staff to carry out this work. The IBRD appraisal concludes this staff has the capability to carry out this work and it is presently available to do so. The design will be approved by the IBRD financing engineering consultant which will also monitor payments.

MAP 1



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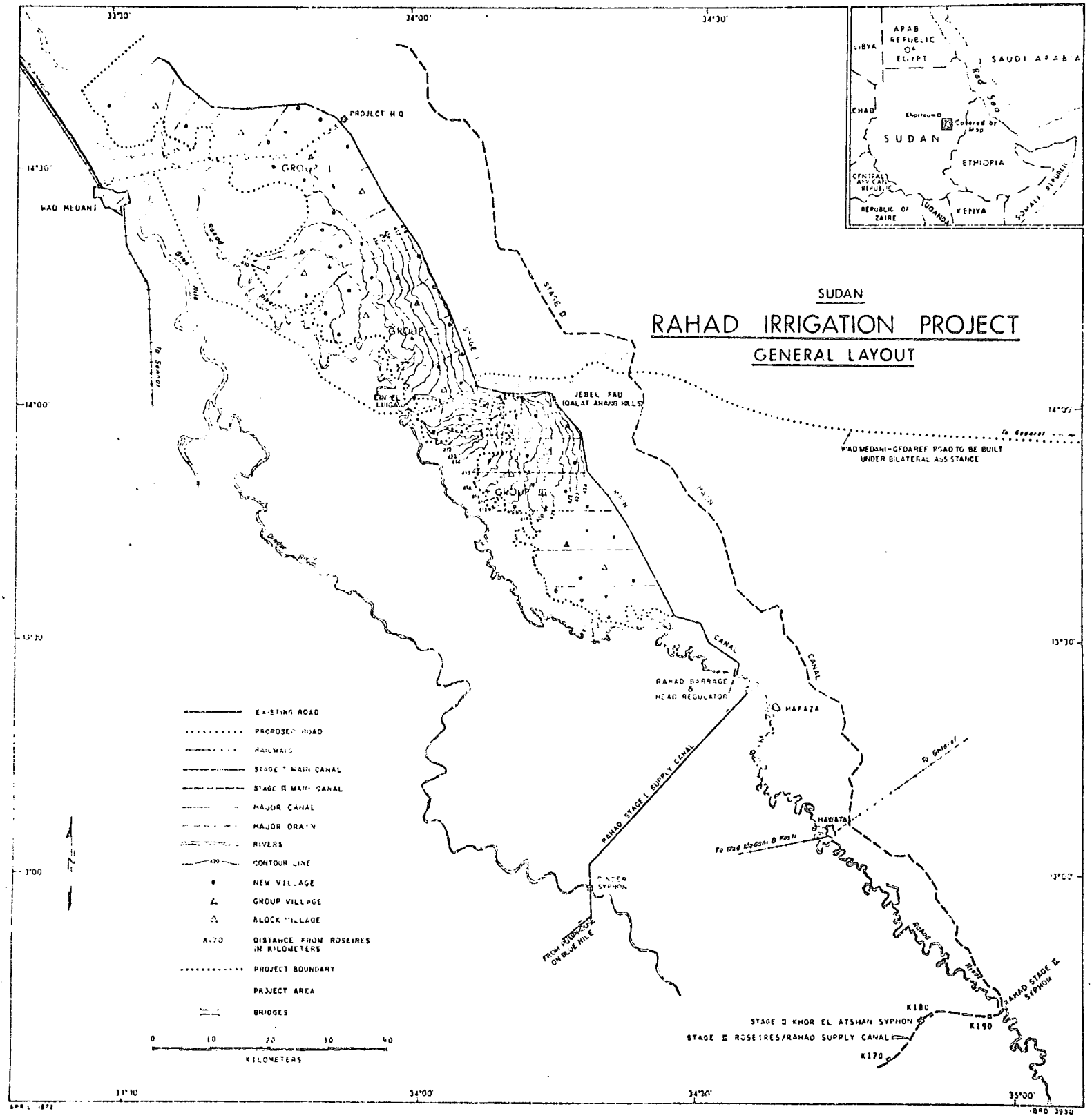
MAP 2


SUDAN
RAHAD IRRIGATION PROJECT
GENERAL LAYOUT
PROJECT HQ
WAD MEDANI
GROUP I
GROUP II
GROUP III
JEBEL FAU (QALAT ARANG HILLS)
WAD MEDANI-GEDAREF ROAD TO BE BUILT UNDER BILATERAL ASSISTANCE
STAGE D
MAIN CANAL
RAHAD BARRAGE & HEAD REGULATOR
MAFAZA
HAWATA
RAHAD STAGE I SUPPLY CANAL
SYPHON
FROM KUSHUK ON BLUE NILE
RAHAD STAGE II SYPHON
STAGE II KHOR EL ATSHAN SYPHON
STAGE II ROSEIRES/RAHAD SUPPLY CANAL
K170
K180
K190
EXISTING ROAD
PROPOSED ROAD
RAILWAYS
STAGE I MAIN CANAL
STAGE II MAIN CANAL
MAJOR CANAL
MAJOR DRAIN
RIVERS
CONTOUR LINE
NEW VILLAGE
GROUP VILLAGE
BLOCK VILLAGE
DISTANCE FROM ROSEIRES IN KILOMETERS
PROJECT BOUNDARY
PROJECT AREA
BRIDGES
KILOMETERS
ARAB REPUBLIC OF EGYPT
LIBYA
SAUDI ARABIA
CHAD
SUDAN
ETHIOPIA
CENTRAL AFRICAN REPUBLIC
REPUBLIC OF ZAIRE
UGANDA
KENYA
SOMALI REPUBLIC
Red Sea
Khartoum
Covered by Map
APRIL 1972
IBRD 3930

ALTERNATIVE TECHNICAL APPROACHES CONSIDERED FOR THE RAHAD IRRIGATION PROJECT

1. The 1968/70 Gravity Scheme

The consultants submitted two interim reports and a final report describing four alternative designs for the Rahad Project. All of these designs made use of the flow of the Rahad river, but included a supply canal from the Roseires Dam on the Blue Nile. The designs fell into two groups - those in which one main canal served both phases of the project, and those in which each phase was served by a separate canal. Each group was subdivided into designs which did or did not provide a gravity supply to the existing pump schemes in the Guneid area to the north of the project.

The consultants worked out detailed proposals for the alternative designs which allowed comparisons to be made. At 1970 prices, the combined cost of Stages I and II served by two separate canals was approximately ESd 65.9 million and the cost per fed about ESd 80.52. The one-canal design cost slightly more - ESd 66.4 million - but the canal commanded an additional 46,000 fed, resulting in a lower cost per fed - ESd 76.80. However, the land would be brought into cultivation at a rather slower rate than the one-canal design and there was practically no difference between the estimated benefit/cost ratios or rates of return of the alternative designs.

The Bank therefore accepted the gravity, two-canal design, and the project considered during the 1967 and 1970 appraisals consisted of:-

> Stage I, 410,000 fed, fed by gravity by a 190 km long, 150 m^3/sec capacity, supply canal from Roseires. From the supply canal, water would flow down the Rahad channel to a barrage where it would be diverted into a 163 km main canal with a capacity of 140 m^3/sec in the head reach. This stage would be completed in six years and benefits would begin in the fifth year.
>
> Stage II, 410,000 fed, fed by gravity by a second 150 m^3/sec supply canal. Water would be siphoned under the Rahad to a 200 km main canal, also with a head-reach capacity of 140 m^3/sec. This stage would be completed in a further six years with benefits accruing from the fifth year.

In 1970, the total cost of Stage I was estimated at ESd 38 million (US$109 million) with a foreign exchange component of 60%. The economic rate

of return (ERR) was estimated at 12%: while a combination of adverse circumstances might have reduced the ERR to 7%, the appraisal report concluded that the most likely range was 10-14%. Because the cost of the supply canal and barrage would not be much affected by changes in the irrigated area, it was not possible to reduce markedly the size or cost of Stage I. Equally, it was not possible to devise an acceptable financial plan which would divide Stage I into two self-sufficient tranches. Since the cost of the gravity scheme was formidable in relation to Sudan's resources, MOI engineers began in 1970 to study alternative designs which would be supplied by pumping from the Blue Nile. The rationale was that (a) power for pumping would be generated by release of the water needed for Rahad through the newly-installed generators at Roseires dam, and (b) the pumps and supply canal could be sited so that the supply canal would be shorter and the irrigated area smaller.

2. The 1971 Pump Scheme (Present Scheme)

Several different proposals were evolved and reviewed and in September 1971 Government submitted to the Association an outline of a project comprising:-

> Stage I, 300,000 fed, supplied through an 84 km 105 m^3/sec canal from a pumping station at Meina on the Blue Nile. The station would have 13 electric pumps, supplying a total of 105 m^3/sec against 10 m head, drawing power from the Roseires hydro-electric plant. From the supply canal water would pass six kilometers down the Rahad channel before being diverted by a barrage into a main canal with a capacity of 100 m^3/sec in the head reach. This stage would be completed in five years and benefits would begin in the fourth year.
>
> Stage II, 520,000 fed, fed by gravity by a 190 km 190 m^3/sec canal from Roseires. Water would be siphoned under the Rahad to a main canal, constructed on the same line as that for the gravity scheme, but with an initial capacity of 180 m^3/sec. This stage would be completed in a further seven years with benefits accruing from the fifth year.

This proposal, together with proposals for agricultural management, formed the basis of the present appraisal. However, before accepting it, the Association made a detailed comparison of the economic viability of the gravity and pump alternatives. Analyses were based on 1970 costs, prices, yields and management proposals and the figures in the following extract from the report of the study therefore differ in detail from the final figures given in this appraisal report:-

> "....Benefit cost analyses indicate that the margin of difference between the gravity and pump schemes is small enough that the choice between them can be made on other criteria.

On the basis of our cost estimates, and considering the Roseires Dam as a sunk cost, the economic rate of return (ERR), of the gravity scheme is about 12%, or the same as that shown in the 1970 appraisal report. With similar assumptions the ERR of the pump scheme is about 12.5% if Rahad flood water is used or 12% if all water is pumped. If only the first stages are considered, the pumping scheme has a slightly higher ERR, 13% as against 12% for Stage I of the gravity scheme.

The gravity and pump schemes have similar benefit/cost (B/C) ratios at discount rates of 8this remains true whether the B/C ratio is calculated on the basis of net benefits over investment costs or gross benefits over gross expenditure. At discount rates of 8%-15%, the present value of net benefits from the pump scheme exceeds those from the gravity scheme by about £Sd 2 million.

If only the first stages are considered, the present value of net benefits from the gravity scheme exceeds those of the pump schemes by £Sd 2.8 million at 8% discount rate. However, at 10% and 12% discount rates, which approximate more closely to the opportunity cost of capital in the Sudan, the position is reversed: the present value of net benefits from Stage I of the pump scheme exceeds those of Stage I of the gravity scheme by about £Sd 1 million at 10%, and about £Sd 3 million at 12%. At 15% discount rate, the gap widens to £Sd 5 million.

Varying our assumptions altered the magnitude but not the direction of differences; the pump scheme gave values equal to or higher than those of the gravity scheme. Similarly, apart from the exception noted in the previous paragraph (present value of net benefits at 8% discount), the values for Stage I of the pump scheme were higher than those of Stage I of the gravity scheme.

RAHAD IRRIGATION PROJECT

DETAILED COST ESTIMATES
(000's of Dollars)

	FOREIGN	LOCAL	TOTAL
Preliminaries	30	370	400
Irrigation Works			
Supply canal, pumping station and barrage	10,122	3,460	13,582
Distribution, drainage, roads	5,520	6,920	12,440
Materials	400	30	430
MOI Equipment	3,530	150	3,680
Equipment and vehicles	4,398	450	4,848
SUBTOTAL	24,000	11,380	35,380
Buildings, services and utilities	5,900	5,380	11,280
Transmission lines	1,100	430	1,530
Agricultural equipment and vehicles	7,500	1,020	8,520
Ginneries and Warehouses	3,591	1,178	4,769
Decorticators	571	86	657
Light Railway	3,561	1,006	4,567
SUBTOTAL	22,223	9,100	31,323
Public health	1,670	540	2,210
Settlement, seeds, and research	1,120	1,700	2,820
Administration and overhead	320	1,260	1,580
Consultants	2,440	290	2,730
SUBTOTAL	5,550	3,790	9,340
Contingency			
physical	4,510	2,020	6,530
price escalation	3,500	1,710	5,210
SUBTOTAL	9,230	3,730	12,960
TOTAL (w/o duties)	6,100	28,000	8,900
Surcharges	-	9,790	9,790
Duties	-	16,500	16,500
Total Surcharges and Duties	-	26,290	26,290

DETAILED COST ESTIMATE - A.I.D. PORTION, RAHAD PROJECT

A. Construction Vehicles and Equipment

	F.O.B.	CIF	No. of Units	Total
1. Vehicles				
a. 4-wd drive Pick-up	$ 3,250	$ 3,900	40	$ 156,000
b. 5-ton Truck, chassis	6,300	7,560	65	491,000
c. 7-ton Dump Truck	12,600	15,100	10	151,000
d. 1,000 gal. Tanker	3,500	4,200	25	105,000
e. 50-60 ton Low-boy Truck	26,000	31,200	5	156,000
		Sub-Total		$1,059,400
2. Construction Equipment				
a. 380 HP Tractor, blade, gripper	$105,600	$126,000	10	$1,260,000
b. 180 HP Tractor, blade	48,000	57,500	20	1,150,000
c. Concrete Mixer	750	900	30	27,000
d. Vibrator	150	180	30	4,500
e. Steel Bending Machine	300	360	4	1,440
f. Steel Cutting Saw	700	840	4	3,360
g. Backhoe	30,000	36,000	4	120,000
h. Front End Loader	15,000	18,000	3	45,000
i. Mobile Workshop	30,000	36,000	3	108,000
j. Engineering Equipment	20,000	20,000	Lot	24,000
		Sub-Total		$2,743,300

B. Agricultural Equipment and Vehicles

1. Farm Equipment				
a. Groundnut Combines	$ 6,500	$ 7,600	156	$1,185,600
b. Groundnut Digger-Shakers	1,250	1,500	156	234,000
		Sub-Total		$1,419,600

	F.O.B.	CIF	No. of Units	Total
2. Material Transports				
a. 4-wd Tipping Trailers	$ 2,400	$ 2,880	13	$ 37,440
b. 4-wd Trailers	2,000	2,400	10	24,000
c. 1500 gal. Fuel Tankers	3,500	4,200	10	42,000
d. 1500 gal. Water Tankers	3,500	4,200	10	42,000
			Sub-Total	$145,440
3. Blading and Deep Plowing				
a. 270 HP Crawler Tractor	$67,500	$80,000	5	$400,000
b. Heavy Plows	5,000	6,000	5	30,000
c. Nutgrass Blades	6,000	7,200	5	36,000
			Sub-Total	$466,000
4. Maintenance Equipment				
a. 270 HP Crawler Tractors	$67,500	$80,000	4	$320,000
b. Ditchers	10,000	12,000	4	48,000
c. Motor Graders	30,000	36,000	4	144,000
d. Scraper Blades	250	300	24	7,200
e. 4-wd Drive Mechanic Trucks	11,500	14,000	8	112,000
			Sub-Total	$631,200
5. Land Levelling				
a. Motor Grader	$30,000	$36,000	3	$108,000
b. Offset Disc Harrow	1,300	1,600	20	32,000
c. Land Planes	2,100	2,400	28	67,200
d. Mobile Workshop - Van Type	30,000	36,000	3	108,000

ANNEX XII

CAPITAL ASSISTANCE LOAN AUTHORIZATION

Provided from: Development Loan Funds
Sudan - Rahad Irrigation Project

Pursuant to the authority vested in the Administrator of the Agency for International Development (hereinafter called "A.I.D.") by the Foreign Assistance Act of 1961, as amended, and the delegations of authority issued thereunder, I hereby authorize the establishment of a Loan pursuant to Part I, Chapter 2, Title I, the Development Loan Fund, to the Government of Sudan ("Borrower"), of not to exceed Eleven Million Dollars ($11,000,000) to assist in financing the foreign exchange costs of equipment, machinery and related services to be used in the construction of the Rahad Irrigation Project in Sudan. This loan is subject to the following terms and conditions:

1. Interest and Terms of Repayment.

   Borrower shall repay the Loan to A.I.D. in U.S. dollars within forty (40) years from the date of the first disbursement under the Loan, including a grace period of not to exceed ten (10) years. Borrower shall pay to A.I.D. interest at the rate of two percent (2%) per annum during the grace period and three percent (3%) per annum thereafter.

2. Other Terms and Conditions.

   a. Commodities and services financed under the Loan shall be procured from the United States or other Code 941 Countries.

   b. The Loan shall be subject to such other terms and conditions as A.I.D. may deem advisable.

_____
Assistant Administrator for Africa

_____
Date

	F.O.B.	CIF	No. of Units	Total
5. Land Levelling (Cont'd)				
e. 1500 gal. Water Tanker	$ 3,500	$ 4,200	3	$ 12,600
f. 1500 gal. Fuel Tanker	3,500	4,200	3	12,600
g. 5-ton Trailer	2,000	2,400	3	7,200
			Sub-Total	$347,600
6. Lubrication - Shop Equipment				
a. 4x4 Truck Mount Lub. Unit	$10,000	$12,000	16	$192,000
b. Central Repair Shop Equipment	50,000	60,000	Lot	60,000
			Sub-Total	$252,000
7. Vehicles				
a. 4-wd Drive Pickups	$ 3,250	$3,900	82	$ 319,800
b. 5-ton Truck Chassis	6,300	7,560	28	211,680
			Sub-Total	$ 531,480
			TOTAL	$7,596,020

RAHAD PROJECT CONSTRUCTION EQUIPMENT LIST

U.S., SUDANESE AND WORLD BANK FINANCING
(DOLLARS)

World Bank (IDA) Financing		
Vehicles		
4- wheel drive station wagons	6@ $3,667	$22,000
Farm Equipment		
65-75 hp tractors	336 @ 3,250	1,092,000
Four row planters	350 @ 2,150	752,500
Five bottom ridgers	280 @ 680	190,400
Disc plows	65 @ 650	42,225
Disc Harrows	58 @ 1,400	81,200
Ditchers	16 @ 400	6,400
Land Planes	24 @ 2,300	55,200
Land Leveling Equipment		
Cross Ridgers	30 @ 800	24,000
70 h.p. tractors	54 @ 3,250	175,500
Crop Protection		
Sprayer attachments	15 @ 2,400	36,000
Hand Sprayers	1,000 @ 36	36,000
Vehicles for Project Headquarters		
4- wheel drive Station Wagons	14 @ 3,667	51,000
SUB-TOTAL		$ 2,564,425
Spare Parts 15%		384,663
World Bank Financed Equipment		2,949,088
A.I.D. Financed Equipment		9,185,420
TOTAL Construction Equipment and Machinery		$ 12,134,508 1/

1/ This corresponds to total for Annexes 5 & 6 of IBRD Appraisal Report

SUDAN

CENTRAL GOVERNMENT FINANCES
(In Millions of Sudanese Pounds)

	ACTUAL FY 1967	ACTUAL FY 1970	ACTUAL FY 1971	BUDGET FY 1972
CENTRAL GOVERNMENT CURRENT ACCOUNT				
Current Revenue	85.0	136.4	160.7	186.6
Current Expenditure	83.9	134.3	156.3	172.3
Current Surplus	+1.1	+ 2.1	+ 4.4	+14.3
OTHER PUBLIC SECTOR DEFICIT	-4.7	-16.3	-18.5	- 6.5
Current Operations Surplus or Deficit	+2.4	- 4.7	-10.7	+ 5.2
Net Expenditures of Government Corporations	-7.1	-11.6	- 7.8	-11.7
CURRENT ACCOUNT DEFICIT	-3.6	-14.2	-14.1	+ 7.8
DEVELOPMENT EXPENDITURES	17.8	17.2	18.8	54.3
TOTAL DEFICIT	-21.4	-31.4	-32.9	-46.5
FINANCING OF THE DEFICIT	21.4	31.4	32.9	46.5
Internal Domestic Borrowing	15.0	22.6	20.2	8.3
External Gross Foreign Loans and Grants	10.7	10.7	12.7	38.2
Errors and Omissions	-4.3	-1.9	-	-

Source: IMF, Sudan Economic Survey of 3/14/72

One Sudanese Pound (S£) = $2.87

SUDAN

DEBT AND DEBT SERVICE
(Millions of $'s)

	1968	1969	1970	1971	
External Debt 1/	213	227	266	296	
Debt Service 2/	13	19	28	39	
Export Earnings 2/	227	260	284	298	
Debt Service as % of of Export Earnings	5.7%	7.3%	9.9%	13.1%	
Foreign Exchange Reserves 3/					
Government Foreign Exchange Holdings	+59	+39	+39	-31	-66 4/
Sudanese Commercial Bank FX Liabilities	-14	-15	- 6	-10	- 9 4/
IMF Position	-39	-40	-34	-21	-16 4/
Net Foreign Exchange Reserves	+ 6	-16	- 1	-62	-91 4/

1/ For Year ending September 30
2/ For Fiscal Year ending June 30
3/ As of June 30
4/ As of November 1971

Source: IMF, Sudan Economic Survey of 3/14/72

SUDAN

RAHAD IRRIGATION PROJECT

Economic Analysis*

1. The economic rate of return (ERR) has been calculated using export values of commodities delivered to Port Sudan (fob less port handling costs). These values are based on price projections cif European ports, made by the Trade policies and Export Projection's Division, less actual 1972 shipping costs. Export duties have not been deducted since these are a part of the value to the national economy. The Sudanese government expects to export all of the production (except garden produce) from the project. Project costs are net of import duties and surcharges, and without price escalation. All costs are included up to the point of delivery to Port Sudan. The following specific assumptions were made (except where otherwise stated in the sensitivity analysis):

(a) That present production on project lands is small, consisting of only scattered subsistence agriculture, and is adequately compensated for in the analysis by including all farm labor, including that of the tenants, in the cost of production.

(b) That the official rate of exchange, ESd 1.00 = US$2.872, is applicable.

(c) That one-third of the project lands can be settled and brought into production in the fourth year and an additional one-third each of the succeeding two years.

(d) That full projected yields will be attained for cotton in the eight year and for groundnuts in the tenth year.

(e) That Rahad River water will not be available to the project, that all water must be pumped from the Blue Nile.

(f) That the project economic life will be at least 50 years.

(g) That all taxes, surcharges, and import and export duties are internal financial transfers and do not represent true economic costs.

2. Under the above assumptions, the project would have an economic rate of return of 15.10%. The sensitivity of the project to variations in the above assumptions was tested for those conditions which have the greater

* SOURCE: IBRD Appraisal of the Rahad Irrigation Project, July 21, 1972.

possibility of occurrence. The project was relatively insensitive to most variations but was moderately sensitive to commodity price variations. However, none of the variations tested resulted in an unacceptable ERR. The results of the sensitivity analysis are shown in Table 1 of this Annex.

3. The derivation of project benefits is shown in Tables 2 to 6.

4. The derivation of the economic construction costs, from the cost estimates, is shown in Table 7.

5. The cost and benefit flows, as shown in Table 8, were used to derive the "best estimate" economic rate of return, and served as the basis from which to vary in all sensitivity tests.

May 12, 1972

SUDAN

RAHAD IRRIGATION PROJECT

Sensitivity Tests

Test	Description	ERR
Base	No Rahad River water is available to the project - all water is pumped from the Blue Nile - projected prices (1980) and yields of cotton and groundnuts - exchange rate of £Sd 1.00 = US$2.872 - costs are without escalation - costs of Ministry of Irrigation equipment and overhead included.	15.10
1:	Same as Base, except Rahad River water assumed available - pumping costs are £Sd 320,000 per year less at full development - pump replacements are £Sd 10,000 per year less	16.00
2:	Same as Base, except part of the costs of Roseires Dam are included as sunk costs.	13.86
3:	Shadow price local construction labor and all O&M labor at zero, and off-peak crop production labor at 50%.	16.79
4:	Vary prices of commodities produced:	
	A. Prices 10% above Base analysis	18.57
	B. Prices 10% below Base analysis.	11.35
5:	Vary yields - costs of production varied accordingly:	
	A. Yields 10% above Base.	17.51
	B. Yields 10% below Base.	12.58
6:	Delay start of benefits, with no recovery to Base schedule - some accompanying stretch-out of costs:	
	A. Delay of 1 year	13.6[illegible]
	B. Delay of 2 years	12.45
7:	Combination of adverse effects: 1 year delay in start of benefits; 10% decrease in prices of commodities; and 10% increase in capital costs.	9.66

May 8, 1972

ANNEX VI
Table 2

SUDAN

RAHAD IRRIGATION PROJECT

Cotton Production

Crop Year	Cultivated fed	Yield K/fed	Production Kantars 1/	Production m tons Lint
1				
2				
3				
4	46,000	3.5	161,000	9,131
5	93,000	4.5	418,500	23,735
6	140,000	5.0	700,000	39,700
7	140,000	5.5	770,000	43,671
8	140,000	6.0	840,000	47,641
9	140,000	6.0	840,000	47,641
10	140,000	6.0	840,000	47,641

1/ 1 Kantar seed cotton = 312 lb (125 lb lint, 184 lb seed, 2 lb scarto, 1 lb dust or waste)

SUDAN

RAHAD IRRIGATION PROJECT

Cottonseed Production

Crop Year	Cropped Area Fed	Yield K/Fed	Production Seed Cotton Kantars 1/	Production Cottonseed m tons
1				
2				
3				
4	46,000	3.5	161,000	13,441
5	93,000	4.5	418,500	34,938
6	140,000	5.0	700,000	58,439
7	140,000	5.5	770,000	64,283
8	140,000	6.0	840,000	70,127
9	140,000	6.0	840,000	70,127
10	140,000	6.0	840,000	70,127

1/ 1 Kantar seed cotton = 312 lb (184 lb cotton seed)

SUDAN

RAHAD IRRIGATION PROJECT

Groundnut Production

Crop Area	Cropped Area fed	Yield t/fed	Production - Metric Tons In shell	Production - Metric Tons Shelled Basis 1/
1				
2				
3				
4	30,000	0.40	12,000	7,200
5	61,000	.50	30,500	18,300
6	93,000	.60	55,800	33,480
7	93,000	.70	65,100	39,060
8	93,000	.80	74,400	44,640
9	93,000	.85	79,050	47,430
10	93,000	.90	83,700	50,220

1/ 60% turnout

SUDAN

RAHAD IRRIGATION PROJECT

Benefits

	Crop Year	Production	Value f.o.b. Port Sudan	Value Net Export
			..... L Sd'000	
Cotton Lint				
	1		1/	2/
	2			
	3			
	4	9,131	1,907	1,856
	5	23,735	4,956	4,824
	6	39,700	8,290	8,069
	7	43,671	9,132	8,876
	8	47,641	9,948	9,683
Cottonseed				
	1			
	2		3/	4/
	3			
	4	13,441	368	348
	5	34,938	957	904
	6	58,439	1,601	1,512
	7	64,283	1,761	1,664
	8	70,127	1,921	1,815
Groundnuts				
	1			
	2		5/	6/
	3			
	4	7,200	396	383
	5	18,300	1,005	972
	6	33,480	1,839	1,779
	7	39,060	2,146	2,076
	8	44,640	2,452	2,372
	9	47,430	2,606	2,520
	10	50,220	2,759	2,669

1/ At LSd 208.810 per ton

2/ At LSd 203.246 per ton (f.o.b. less port handling costs)

3/ At LSd 27.388 per ton.

4/ At LSd 25.878 per ton (f.o.b. less port handling costs)

5/ At LSd 54.937 per ton

6/ At LSd 53.137 per ton (f.o.b. less port handling costs).

SUDAN

RAHAD IRRIGATION PROJECT

ANNEX VI
Table 6

Unit Prices of Commodities

Projected Prices c.i.f. Liverpool

Cotton Lint	-	US$ .29 per lb
Cottonseed	-	US$103.39 per metric ton 1/
Groundnuts (shelled)	-	US$180.94 " " " 1/

(a) Cotton Lint

Per lb c.i.f. European ports	US$ .29
	ESd .10097 2/
Shipping costs	.00626
f.o.b. Port Sudan	.09471
Port handling costs	.00252
Net export value to the economy	.09219
Export duties	.00808
Price, delivered to Port Sudan	.08411

(b) Cottonseed

Per metric ton c.i.f. European Ports	US$103.39
	ESd 36.000 2/
Shipping costs	8.612
f.o.b. Port Sudan	27.388
Port handling costs	1.510
Net export value to the economy	25.878
Export duties	1.000
Price, delivered to Port Sudan	24.878

(c) Groundnuts

Per metric ton c.i.f. European Ports	US$180.94
	ESd 63.000 2/
Shipping costs	8.063
f.o.b. Port Sudan	54.937
Port handling costs	1.800
Net export value to the economy	53.137
Export duties	2.200
Price, delivered to Port Sudan	50.937

(d) Cotton Lint

Per metric ton c.i.f. European Ports 3/	US$639.33
	ESd222.610 2/
Shipping costs	13.800
f.o.b. Port Sudan	208.810
Port handling costs	5.564
Net export value to the economy	203.246
Export duties	17.806
Price, delivered to Port Sudan	185.440

1/ Projections made in £ Sterling per long ton and as a range. These values were converted to ESd, averaged, then rounded, and converted to US$.

2/ At rate of ESd 1.00 = US$2.872.

3/ 1 metric ton = 2,204.6 lb

Note: Projections are current price forecasts for 1980.

SUDAN

RAHAD IRRIGATION PROJECT

Annual Capital Expenditure for Economic Analysis

(LSd '000)

Item	FY: 1 F	1 L	2 F	2 L	3 F	3 L	4 F	4 L	5 F	5 L	Totals Foreign	Totals Local	Totals Total
Total capital cost 1/	390	210	4,360	2,425	7,850	3,595	3,550	1,880	3,190	1,650	19,340	9,760	29,100
Capital cost w/o escalation		530		5,985		10,745		5,230		4,810			27,300
Feasibility Study for for Stage 2				110		120							230
Transmission Line to Pumps 2/				195		190							385
Transmission Line to H.Q. 2/						50		60					110
Public Health Services 3/						240		240		230			710
Allowance for Spare Parts 4/								380					380
Residual Value of Equipment 5/										230			230
Total Deductions				305		600		680		460			2,045
Economic Capital Costs		530		5,680		10,145		4,550		4,350			25,255
Min of Irrig. Equipment 6/				640		640							1,280
Min. of Irrig. Overhead 7/		60		100		100		100		100			460
Total Sunk Costs		60		740		740		100		100			1,740
E.C.C. Less Sunk Costs		470		4,940		9,405		4,450		4,250			23,515

1/ From Capital Cost Estimate without duties and surcharges.
2/ Included in Power Rate.
3/ Will be needed with or without the Project.
4/ Covered in annual Agricultural (Crop Production) costs.
5/ Value of remaining life of equipment for use on other works.
6/ Sunk cost - equipment already on hand(probably no alternative use)
7/ Cost will be incurred anyway - not additional cost because of Rahad.

ANNEX VI
Table 7

SUDAN

RAHAD IRRIGATION PROJECT

Cost and Benefit Flows
(ESd '000)

Fiscal Year	Costs 1/						Benefits 2/					
	Investment Costs	Annual Costs 3/				Total Costs	Export Value 4/			Net Value of Gardens 5/	Total Benefits	Net Benefits
		Crop Production 6/	Agricultural Management	Irrigation O&M	Pump Replacement		Cotton	Cotton seed	Groundnuts			
1	530					530						- 530
2	5,680					5,680						-5,680
3	10,145					10,145						-10,145
4	4,550	1,990	170	340	80	7,130	1,855	350	385	60	2,650	-4,480
5	4,350	4,430	350	690	80	9,900	4,825	905	970	130	6,830	-3,070
6		7,060	520	1,040	80	8,700	8,070	1,510	1,780	190	11,550	2,850
7		7,430	520	1,040	80	9,070	8,880	1,665	2,075	320	12,940	3,870
8		7,810	520	1,040	80	9,450	9,685	1,815	2,370	450	14,320	4,870
9		7,860	520	1,040	80	9,500	9,685	1,815	2,520	550	14,570	5,070
10		7,920	520	1.040	80	9,560	9,685	1,815	2,670	640	14,810	5,250
11-50		7,920	520	1,040	80	9,560	9,685	1,815	2,670	640	14,810	5,250
Total	25,255											

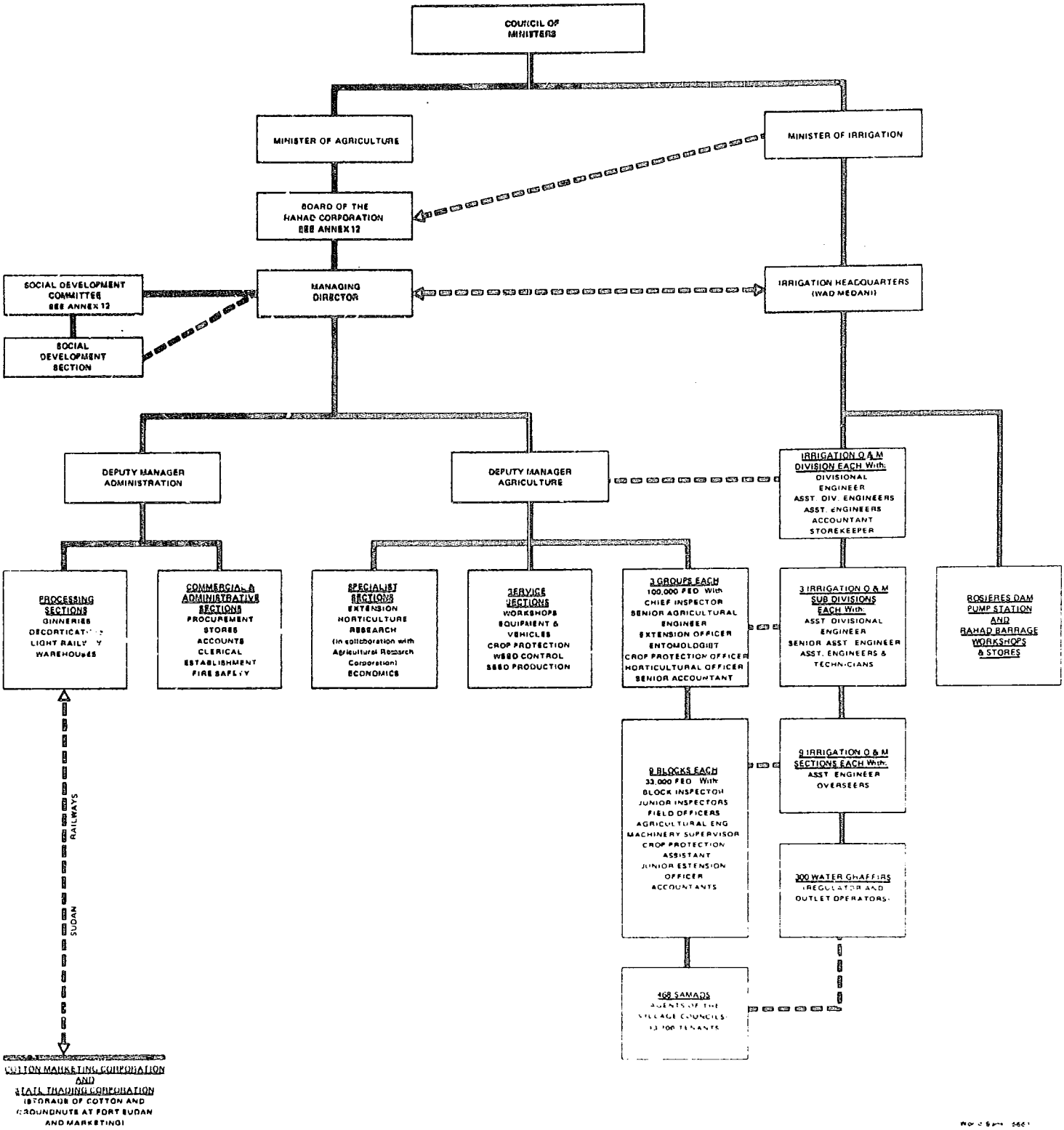
Economic Rate of Return: 15.10%

1/ Economic costs:excluding price escalation, import duties and surcharges.
2/ Including export duties.
3/ Replacements, other than pumps, are included as a part of maintenance costs.
4/ Value f.o.b. Port Sudan less port handling costs.
5/ From 20,000 fed
6/ Includes tranportation to Port Sudan.

ANNEX VI
Table 8

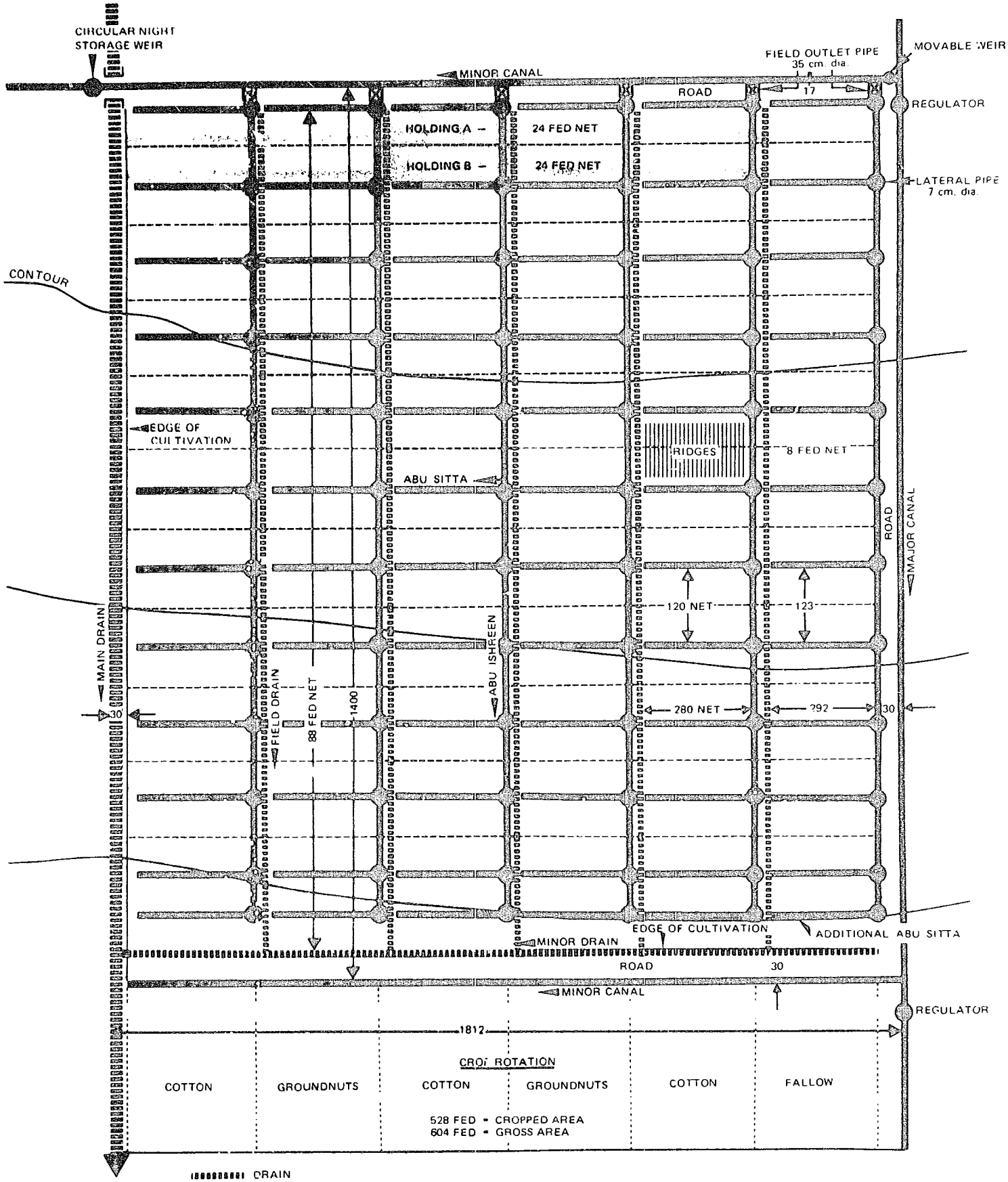
May 8, 1972

SUDAN
RAHAD IRRIGATION PROJECT
OPERATING ORGANIZATION



BEST AVAILABLE

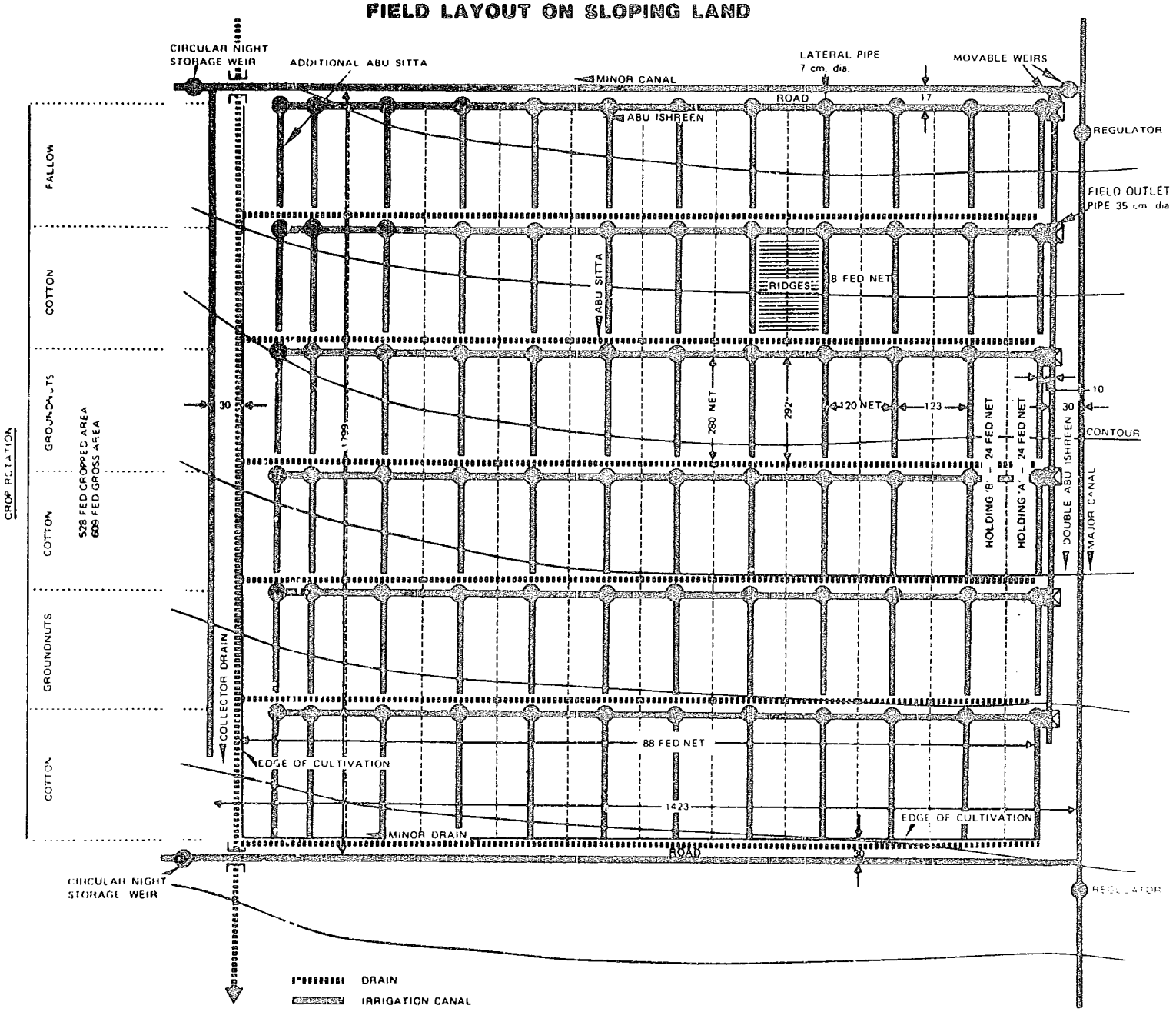
SUDAN
RAHAD IRRIGATION PROJECT
FIELD LAYOUT ON FLAT LAND



DRAIN
IRRIGATION CANAL
CROPPING UNIT BOUNDARY

NOTES: 1 All distances in meters unless otherwise stated.
2 Not to Scale.
3 Measurements are center to center, except where net.
4 ABU SITTA and ABU ISHREEN are watercourses.

SUDAN
RAHAD IRRIGATION PROJECT
FIELD LAYOUT ON SLOPING LAND



NOTES: 1 All distances in meters unless otherwise stated
2 Not to Scale.
3 Measurements are center to center, except where not.
4 ABU SITTA and ABU ISHREEN are watercourses.

World Bank 6659(R)

Environment Annex -- Sudan

Analysis of the Project's Ecological Impact*

The following sections (A & B) have been extracted from Annex 3 of the Bank's Appraisal of the Rahad Project.

A. Public Health

Many diseases are endemic in the region but malaria and schistosomiasis (bilharzia) probably cause the most human misery and economic loss. Both these diseases are associated directly with water and irrigation of the project area would cause a great increase in their incidence. The project would include control measures against the mosquitoes and snails which are the vectors and alternate hosts of the causative parasites. The Ministry of Health, which would be represented on the Social Development Committee, would be responsible for execution of control measures as well as for the staffing and operation of the project hospital and clinics.

*

Malaria Control measures against the mosquito vector are well understood and widely practiced in the Sudan. Aerial spraying of crops has been general practice in the Gezira and pump schemes for ten years. Mosquitoes have developed very high resistance to common insecticides as a result of long exposure to low dosages from drifting residues. Control measures therefore center on identification of potential breeding grounds and treament with larvicidal oils applied with simple sprayers. The project would include purchase of larvicides during the four-year construction period.

Bilharzia Schistosomiasis is a parasitic disease. It is caused by worms that lodge in the blood vessels in the intestine and around the urinary bladder and lay millions of eggs, some of which are excreted in the urine and feces of the infected person. If the eggs reach fresh water, they hatch into larvae (miracidia) that infect snails living there. The miracidia multiply inside the snail, and develop into a different kind of larva, called a cercaria, which is shed by the snail by the thousands and can swim. If the cercaria reaches a person in contact with the water, it can dissolve its way through the skin and migrate through the circulatory system to its permanent resting and breeding places.

Although WHO has estimated that 150 million people world-wide suffer from schistosomiasis, the feeling among most experts is that in

* SOURCE: IBRD Appraisal of the Rahad Irrigation Project; July 21, 1972.

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areas where schistosomiasis is endemic, an equilibrium is set up between the infected person, the schistosome worms inside the body, and the many other debilitating conditions affecting that person, including malnutrition and other parasites. Under these conditions, it becomes difficult to separate out the effects of schistosomiasis in such a way as to prove its economic effects.

1. The most critical problem comes when a new population is infected with schistosomiasis, for example, as a result of a new irrigation project. This can come about in two ways. Either previously infected snails spread into new habitats created by the project, or else new (human) migrants encouraged by the project, move in and infect previously uninfected snails, thus infecting the adult population previously resident in the area. Thus introduced into a new population, schistosomiasis becomes a severely debilitating disease.

Bilharzia (primarily S. Haematobium) has been present in the Sudan since ancient times but it's history prior to 1925 is not well documented. The disease attracted attention when it reached endemic proportions with the start of irrigation from Sennar Dam in 1925. Construction of dams at Jebel Aulia on the While Nile; Roseries, Blue Nile; and Khashm el Girba, Atbara River; and the extension of the irrigated area have increased the hazard while the annual migrations of cotton harvesters, other laborers and nomads have spread bilharzia to every part of the Sudan.

Ministry of Health statistics show that in 1970 there were 92,115 cases and 2,989 deaths from bilharzia in the Sudan. Several authorities consider that these official statistics reveal only the "tip of the icebergs" and that bilharzia is second only to malaria as a cause of morbidity. As noted above, bilharzia is associated with irrigation, which provides the ideal habitat for the snail vectors. Floating snails are spread by water movement in canals. The human population is exposed to infection while in the fields and while carrying out domestic chores, such as laundry, or bathing in canals. Children are often infected while playing or swimming: in one survey the marked difference in prevalence between 7-10 year old urban boys (30%) and girls (almost nil) was attributed to social customs which do not allow girls to bathe in the public canals.

There have been no "before and after" studies in the Sudan but two surveys give an indication of the influence of irrigation:

- in 1964, 19,000 people were examined in the then undeveloped riverine area which is now submerged by the reservoir of Roseires dam. The prevalence of bilharzia was men, 7%; women, 5% and children, 9%.

- recent surveys in southern Gezira, which has been irrigated for 40 years, showed that the prevalence of bilharzia ranged between 62% and 100% in some villages.

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Experience at Khashm el Girba has followed the same pattern. Before the dam and irrigation scheme were constructed, the Atbara River was free of snails and there was little or no bilharzia. Now, after six crop seasons, snails are very common and bilharzia has been brought in by settlers from Wadi Halfa.

Control of Snails. The main method of controlling the disease is by reducing or eliminating the population of snails, which are the alternate host of the causative organism. Since snails are most abundant in the presence of aquatic weeds, good canal maintenance is a prerequisite for control but is not enough by itself. The two main control methods are trapping floating snails and use of chemicals (molluscicides). Both methods have been used since about 1940 in the Gezira, although it was not until 1955 that a major snail control program, with annual budgets which reached £Sd 250,000, was launched. Snail traps are still used but there is controversy over their effectiveness. One official claims that it costs £10,000 to trap 5,000 snails. The wire mesh of the traps is comparatively fragile and maintenance costs are high.

Copper sulfate is the only molluscicide now in routine use in the Sudan: cloth bags containing crystals are suspended in the water at each canal regulator for one day twice per year. The aim is to obtain a concentration of 20-30 parts per million (ppm) throughout the canal but copper sulphate is absorbed by mud and does not travel far.

Two new synthetic organic molluscicides, Bayluside (Bayer) and Frescon (Shell), are effective in killing snails in the laboratory and, under some conditions, in the field. It is possible under laboratory conditions to kill snails with concentrations of molluscicides that do not harm fish and other wildlife. Under field conditions, fish will be killed at least near the dispensers. There is no evidence that these synthetic molluscicide formulations affect humans, even when canals are used as sources of drinking water. However, the Association would require the Ministry of Health to review toxicological tests of any formulation and its decomposition products before authorizing its use in the project's control program.

Trials with Frescon are being carried out in the Northern Group of the Gezira scheme. Frescon, an emulsifiable concentrate containing 16-1/2% of the active ingredient (n-trityl morpholine), is fed into a canal with a simple constant-flow dispenser to obtain a concentration of 0.075 ppm. The active ingredient is almost insoluble in water and travels in the form of minute crystals. Under certain conditions (ph 6) it hydrolyses rapidly to an inactive chemical (triphenyl carbinol) and it is also precipitated out on silt particles. In the Gezira experiment, the half-life has been estimated at 30-40 hours.

In the Gezira trials, Frescon has been found to travel 40 km under favorable flow conditions, i.e. when the irrigation demand is high. Over 100,000 fed have been treated from a dispenser on the main canal with boosters at appropriate points. The optimum regime has not yet been established but results to date suggest that effective control may be attainable with three applications per year at a cost, for chemical alone, of £Sd 0.350 per fed.

Public Health Measures. Control of snails must be complemented by sanitary engineering measures including:

(a) Siting of villages and, particularly, latrines so as to reduce the danger of contamination of canals and drains;

(b) Arrangements which minimize the need for people to come in contact with water in canals, fields and drains. Most important of these are suitable water supplies which make it unnecesary to draw water directly from canals; and

(c) provision of carefully sited bathing and laundering places.

The Corporation would exercise due care in selecting sites for new villages and the project includes provision of water supplies for both existing and new villages in the project area. Provision of other facilities, and also for providing health education, would be the responsibility of the Social Development Committee and the Corporation's Social Development office.

Rural Health Service

The Ministry of Health would provide treatment for bilharzia at a 60-bed rural hospital, situated at Project Headquarters; Health Centers at each of three Group Headquarters; and at 15 dispensaries situated in major villages. Existing government designs of appropriate standard would be used. The buildings and vehicles would be provided by the project but the equipment, staff and operating costs would be financed from the Ministry's annual budget.

B. Other Considerations

The public health aspects of modifying the ecology of the area have been discussed above. Other changes in the flora and fauna of the area may occur but are unlikely to be of major significance. Three aspects of the project, however, are noteworthy; its effect on the Dinder Game Park, the use of aerial spraying, and the possibility of development of alflatoxin on groundnuts.

The Dinder Game Park

The Dinder Game Park, about 120 km south of the southern end of the project (Map 1) was established in 1935 and covers 2,470 sq km. While it is the nearest Park to Europe, it is not very accessible and can be reached only by a rather arduous drive or by light aircraft. The resident species (bucks, kudu, warthog, buffalo, lion, and hyaena) normally stay within the boundaries of the park and would not be affected by the project. However, concern was expressed in 1965 that the gravity proposal then being considered by the MOI would interfere with the migration of four species; tiang (Damaliscus korrigum); roan antelope (Hippotragus equinus); giraffe; and ostrich. Two further immigrant species, Sommering Gazelle and Singa Gazelle, were not thought to be threatened since they migrate north-eastwards to Butana area.

In 1967, the Ministry of Planning asked UNDP to provide a wildlife expert to review the problem. His report, and subsequent studies by the Game Department and resident UNDP experts emphasized that the problem was related to the supply canal from Roseires Dam to the Rahad and not to the irrigated area itself. There was general agreement that the best solution was to move the supply canal as far north as possible since alternative solutions (bridges 300 m wide every 10 km; broad, shallow reaches in the canal) would be very expensive, or impractical.

The design of the present project moves the supply canal almost 100 km north of the old route where it will pose no threat to game. While the area through which it passes is not densely populated there is much movement of people, especially along the railway, and any wild animals which penetrated so far north would be hunted for food.

Aerial Spraying

Irrigated schemes in the Sudan provide an ideal habitat for crop pests. Since the earliest days of the Gezira scheme, crop hygiene methods have been adopted to try to reduce carry-over of pests from one year to the next. Cotton planting dates have been prescribed by law and weeds which are alternative hosts have been destroyed. Serious attempts to control pests by spraying were started in the 1950's. Tractor-mounted sprayers were only moderately successful, causing much damage to the crop and being unable to work on newly-irrigated fields.

In the mid-1950's, experiments had been made with helicopter spraying and, by the early 1960's fixed wing spraying aircraft were in general use on all government, and most private, schemes. The Plant Protection Department's small fleet of aircraft is used mainly for training and special tasks such as water hyacinth control. Spraying of cotton and wheat is done by contractors, mostly from Europe. Ground equipment is deployed in August and the aircraft arrive in mid-September when the unchanging, perfect flying conditios permit very high utilization of equipment.

Much research has been done on the use of different insecticides. During the 1970/71 season in Gezira, the basic regime was five applications of DDT and/or Dimethoate. Various other formulations were used in selected areas, e.g. DDT and/or Endosulfan; Sevin-Anthio; DDT and/or Bidrin. Some areas received eight applications.

Because spraying has been the general practice for nearly two decades, it is difficult to assess the reductions in yield and quality that would occur if the practice were stopped. However, an indication is given by the results of large scale trials of different insecticides in the Gezira in 1970/71.

	kantars per fed
Average yield, all Gezira	5.4
Best insecticide treatment	7.4
Worst insecticide treatment	3.9

It is certain that cotton would not be profitable in the Sudan without chemical pest control and that aerial spraying will continue until satisfactory alternatives, such as biological control, have been fully proven. Widespread spraying entails inevitable long-term risks but the chances of accidental short-term exposure are reduced by several factors. The contractors personnel are highly experienced: their equipment is well maintained and both air and ground crews are adequately protected. Since all tenants live in villages, the Block Inspectors are able to ensure that nobody is in the fields during spraying. Under the terms of the contracts, aircraft must fly 2-3 meters above the crop, minimizing drift. Finally, during the spraying there is no drainage at all from the fields and thus little chance that chemicals will find their way into the river.

So long as chemical control is necessary, aircraft are the safest, as well as the most efficacious method of spraying. A very large number of tractor-mounted sprayers would be needed to obtain equivalent coverage, thus increasing the personnel exposed to hazard. Further, since the high-volume tractor sprayers are filled directly from canals, there would be a greatly increased risk of contaminating the water supply by spillage. Knapsack sprayers would involve unacceptable risks, not only because the operators clothes would be saturated by spillage but also because supplies of insecticide would have to be distributed in advance to each tenant and there would be no control over its use.

Aflatoxin on Groundnuts

Importers of groundnuts are now well aware of the dangers associated with aflatoxin, a substance produced by the common fungus Aspergillus flavus. UNDP financed a study of Aflatoxin in the Sudan during the 1969/70 harvest season. Contrary to expectations, it was found that there was a higher level of contamination in samples from rain lands than in artificially dried samples from irrigated areas. The critical factor in development of the fungus is proper drying of the nuts during the first week after harvest. In the past the normal practice on the Gezira scheme has been to irrigate the fields just before harvest, to soften the soil, and to wash the harvested nuts in canals to remove mud. The practice makes proper drying difficult. In the Rahad project groundnuts would be harvested by machine, eliminating the need for pre-irrigation and washing and it is not expected that Aflatoxin will be a serious problem.

C. Related Project Costs

Capital costs for health facilities and supplies to be financed under this project are estimated at $2.2 million, of which $1.7 million is foreign exchange. These costs include construction of the 60-bed rural hospital, 3 health centers, 3 health offices and 15 dispensaries, village water supply equipment (mostly tube well materials, pumps and motors), an initial inventory of molluscicides (type yet to be identified but according to Bank officials probably Frescon) and larvacicides for schistosomiasis and malaria control, and vehicles. Cost estimates for these items are summarized as follows:

	($000)		
	FX	LOCAL	TOTAL
Hospital and Clinics	$ 230	$ 170	$ 400
Villages Water Supplies			
Material	660	56	716
Construction	30	258	288
Chemicals	605	14	619
Vehicles	145	42	187
TOTAL	$1,670	$ 540	$2,210

Operating costs of the hospital and clinics, as well as, the cost of chemicals required beyond the initial inventory will be financed, as noted earlier, from the Ministry of Health's annual budget.

D. Implementation of Control Measures

Bank officials are persuaded that the Government of Sudan because of its long experience in dealing with malaria and schistosomiasis and a performance record that is superior to other African countries is alert to the importance of these diseases and is capable of implementing a program of effective control. To provide additional assurances in this regard, the Bank will require as a condition to its loan agreement that

> " The Borrower shall: (i) prepare and send to the International Development Association (IDA) for its comments not later than December 31, 1974 or such other date as the Association may determine, a program satisfactory to the Association for the control and treatment of bilharzia and malaria in the area of the Project, and (ii) promptly after the receipt of the Association's comments take such measures as may be necessary for the implementation of the program." (From Section 3.08 of Bank's draft agreement dated 12/20/72).

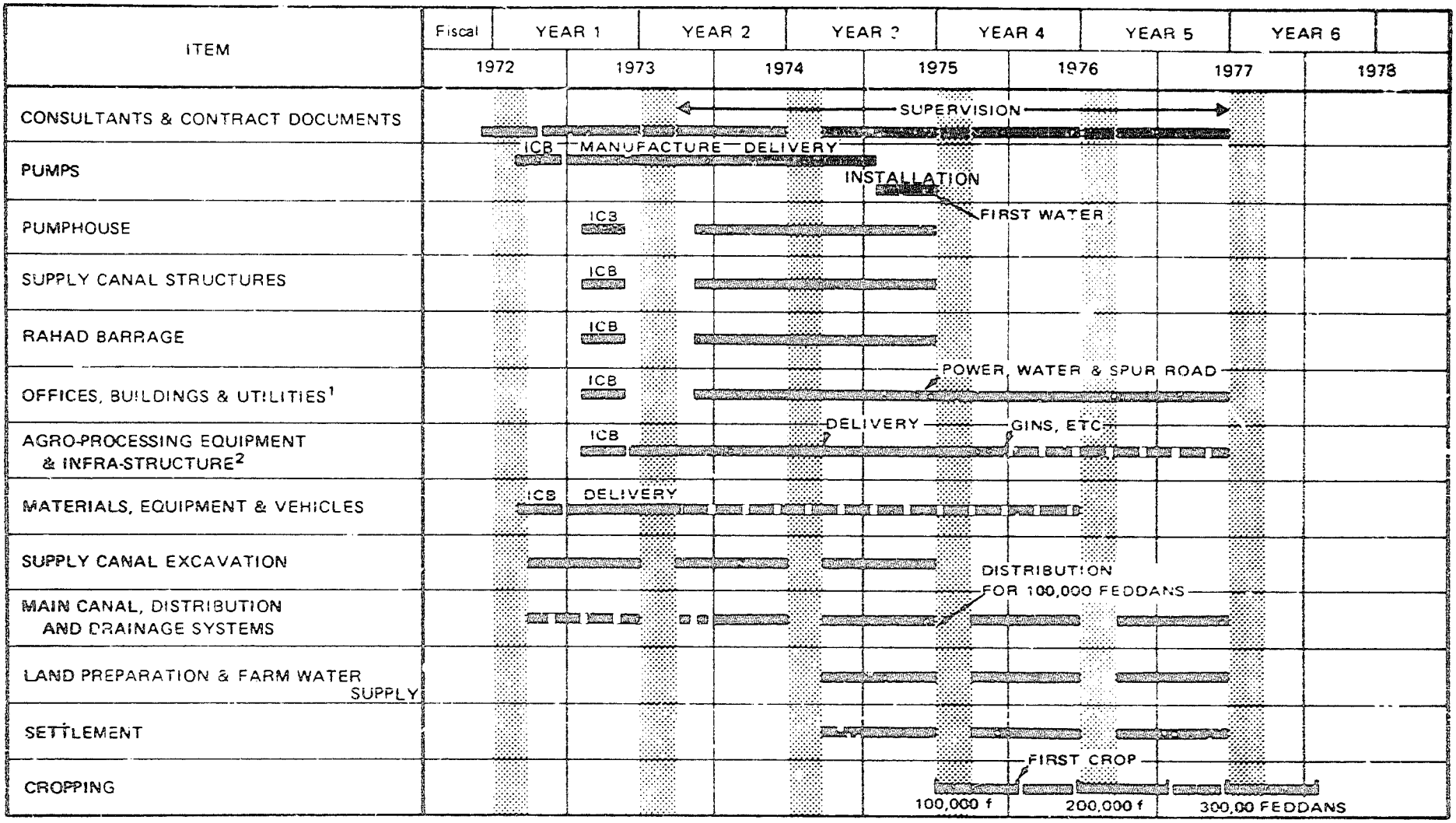
This submission will include inter alia specific information as to the types of control programs to be established, the estimated costs and source of financing and the staffing requirements.

E. Conclusions

The Bank's appraisal of the project clearly recognizes that irrigation will significantly increase the incidence of malaria and schistosomiasis if proper controls and health measures are not instituted. After examining the problems involved, the measures required to control the spread of disease and the experience and the capability of the Sudanese, the Bank has concluded that it will be possible to establish an effective control program for malaria and schistosomiasis. As a further assurance in this regard, the Bank will ask the Government of Sudan to submit, prior to completion of construction, a satisfactory program for control and treatment of these diseases. Preparation of this program will require further intensive analysis of the scope of the problems involved and evaluation of alternative solutions available, as well as, definitive understandings within the government as to responsibility for financing recurring costs of control and for implementation.

A.I.D. is satisfied that the ecological impact of this project has been adequately recognized by the Bank and that the GOS is interested in and capable of establishing the required control programs. A.I.D. is equally satisfied that the non-health aspects of the ecological impact have also been adequately considered by the Bank.

SUDAN
RAHAD IRRIGATION PROJECT
IMPLEMENTATION SCHEDULE



RAINY SEASON (July-Sep.)

[1]Utilities include water supply to administrative centres & villages, sub-stations & transmission lines to pumps & gins, distribution lines to admin. centres, light railway network, highway spur road & bridge & farm roads.

[2]Infra-structure includes warehouses, seed multiplication & research farm, fertilizer, pesticide & seed distribution system

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ANNEX IX

CHECKLIST OF STATUTORY CRITERIA
DEVELOPMENT LOAN FUND

Many of the questions require only yes or no answers. Others, however, must be answered more fully. In those cases, a specific reference to explicit discussion of the matter in the loan paper will suffice. But where the loan paper does not deal explicitly with a matter that clearly requires more than a yes or no response, sufficient response must be made to indicate that the matter has been appropriately considered.

The following abbreviations are used in the checklist:

FAA - Foreign Assistance Act of 1961, as amended, incorporating amendments effected by the Foreign Assistance Act of 1971.

App. - Foreign Assistance and Related Agencies Appropriations Act, 1971.
MMA - Merchant Marine Act of 1936, as amended
Space for answers is provided in the margin to the right of each question.
This form must be made a part of the Capital Assistance Paper.

I. COUNTRY PERFORMANCE

A. Progress Towards Country Goals

1. FAA §§201(b)(5), 201(b)(7), 201(b)(8), 208. Discuss the extent to which the country is:

(a) Making appropriate efforts to increase food production and improve means for food storage and distribution.	The GOS is making substantial efforts in this direction. The Rahad project will produce sorghum, fruits and vegetables. Efforts are underway to increase food production on both irrigated and rainfed acreage.
(b) Creating a favorable climate for foreign and domestic private enterprise and investment.	The present government has reversed a number of confiscations made by the previous government in 1970. The GOS has stated that it welcomes and encourages private enterprise and investment.
(c) Increasing the people's role in the developmental process.	The various irrigation and agriculture development boards have encouraged local village decision making and civil participation in community development.

(d) Allocating expenditures to development rather than to unnecessary military purposes or intervention in other free countries' affairs.	Sudan maintains good relations with neighboring countries. With an end to the rebellion in the South, military expenditures are being kept in check.
(e) Willing to contribute funds to the project or program.	The GOS has agreed to cover all local costs of this project.
(f) Making economic, social, and political reforms such as tax collection improvements and changes in land tenure arrangement; and making progress toward respect for the rule of law, freedom of expression and of the press, and recognizing the importance of individual freedom, initiative, and private enterprise.	The GOS record in these respects is satisfactory.
(g) Responding to the vital economic, political, and social concerns of its people, and demonstrating a clear determination to take effective self-help measures.	The GOS is showing increasing ability to take self-help measures in these areas.

B. *Relations with the United States*

1. FAA §620(c). Is the government indebted to any U.S. citizen for goods or services furnished or ordered where: (a) such citizen has exhausted available legal remedies, including arbitration, or (b) the debt is not denied or contested by the government, or (c) the indebtedness arises under such government's, or a predecessor's unconditional guarantee?	No, so far as is known.
2. FAA §620(d). If the loan is intended for construction or operation of any productive enterprise that will compete with U.S. enterprise, has the country agreed that it will establish appropriate procedures to prevent export to the U.S. of more than 20% of its enterprise's annual production during the life of the loan?	No exports to the U.S. from this project are anticipated.

3. *FAA §620(e)(1). Has the country's government, or any agency or subdivision thereof, (a) nationalized or expropriated property owned by U.S. citizens or by any business entity not less than 50% beneficially owned by U.S. citizens, (b) taken steps to repudiate or nullify existing contracts or agreements with such citizens or entity, or (c) imposes or enforced discriminatory taxes or other exactions, or restrictive maintenance or operation conditions? If so, and more than six months has elapsed since such occurrence, identify the document indicating that the government, or appropriate agency or subdivision thereof, has taken appropriate steps to discharge its obligations under international law toward such citizen or entity? If less than six months has elapsed, what steps if any has it taken to discharge its obligations?*

No. such seizure is known

4. *FAA §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, and failed to take appropriate measures to prevent a recurrence and to provide adequate compensation for such damage or destruction?*

No.

5. FAA §620(l). Has the government instituted an investment guaranty program under FAA §221(b)(1) for the specific risks of inconvertibility and expropriation or confiscation?

6. FAA §620(o): Fisherman's Protective Act of 1954, as amended, Section 5. Has the country seized, or imposed any penalty or sanction against, any U.S. fishing vessel on account of its fishing activities in international waters? If, as a result of a seizure, the U.S.G. has made reimbursement under the provisions of the Fisherman's Protective Act and such amount has not been paid in full by the seizing country, identify the documentation which describes how the withholding of assistance under the FAA has been or will be accomplished.

No.

7. FAA §620(q). Has the country been in default, during a period in excess of six months, in payment to the U.S. on any FAA loan?

No. There are no arreages.

8. FAA §620(t). Have diplomatic relations between the country and the U.S. been severed? If so, have they been renewed?

Diplomatic relations were severed on June 5, 1967, during the Arab/Israel War. Diplomatic relations were renewed on July 25, 1972.

C. *Relations with Other Nations and the U.N.*

1. *FAA §620(i). Has the country been officially represented at any international conference when that representation included planning activities involving insurrection or subversion directed against the U.S. or countries receiving U.S. assistance?*	No, as far as is known.
2. *FAA §§620(a), 620(n); Has the country sold, furnished, or permitted ships or aircraft under its registry to carry to Cuba or North Viet-Nam items of economic, military, or other assistance?*	No, as far as is known.
3. *FAA §620(u); App. §108 What is the status of the country's U.N. dues, assessments, or other obligations? Does the loan agreement bar any use of funds to pay U.N. assessments, dues, or arrearages?*	Sudan is not delinquent in any U.N. obligations. The loan funds can only be used for the project purposes.

D. *Military Situation*

1. *FAA §620(i). Has the country engaged in or prepared for aggressive military efforts directed against the U.S. or countries receiving U.S. assistance?*	No.

2. FAA §620(s). What is (a) the percentage of the country's budget devoted to military purposes, and (b) the amount of the country's foreign exchange resources used to acquire military equipment? Is the country diverting U.S. development assistance or P.L. 480 sales to military expenditures? Is the country diverting its own resources to unnecessary military expenditures? (Findings on these questions are to be made for each country at least once each fiscal year and, in addition, as often as may be required by a material change in relevant circumstances.) Has the country spent money for sophisticated weapons?

Defense expenditures represent approximately 23% of the 1971/72 recurrent and capital budgets. The Sudan is not diverting DL or PL 480 funds to military purposes.

II. CONDITION OF THE LOAN

A. General Soundness

-- *Interest and Repayment*

1. FAA §§201(d), 201(b)(2). Is the rate of interest excessive or unreasonable for the borrower? Are there reasonable prospects for repayment? What is the grace period interest rate; the following period interest rate? Is the rate of interest higher than the country's applicable legal rate of interest?	The proposed terms are considered reasonable. There are reasonable prospects for repayment, see Section IV D of CAP.

-- *Financing*

1. FAA §201(b)(1). To what extent can financing on reasonable terms be obtained from other free-world sources, including private sources within the U.S.?	We are not aware of other sources of financing for this loan at this time, on reasonable terms. See CAP Section IV C.

-- *Economic and Technical Soundness*

1. FAA §§201(b)(2), 201(e). The activity's economic and technical soundness to undertake loan; does the loan application, together with information and assurances, indicate that funds will be used in an economically and technically sound manner?	Yes, See CAP Sections II, III, and IV.

2. *FAA §611(a)(1). Have engineering, financial, and other plans necessary to carry out assistance, and a reasonably firm estimate of the cost of assistance to the U.S., been completed?*	Yes, see Section II of CAP.
3. *FAA §611(b); App. §101. If the loan or grant is for a water or related land-resource construction project or program, do plans include a cost-benefit computation? Does the project or program meet the relevant U.S. construction standards and criteria used in determining feasibility?*	Yes, Section II and CostBenefit Annex of CAP.
4. *FAA §611(e). If this is a Capital Assistance Project with U.S. financing in excess of $1 million, has the principal A.I.D. officer in the country certified as to the country's capability effectively to maintain and utilize the project?*	Yes.

B. *Relation to Achievement of Country and Regional Goals*

-- *Country Goals*

1. *FAA §§207, 281(a). Describe this loan's relation to:*

a. *Institutions needed for a demoractic society and to assure maximum participation on the part of the people in the task of economic development.*	The Rahad Corporation's Governing Council will include tennant representation. Local village Councils will be encouraged.

b. Enabling the country to meet its food needs, both from its own resources and through development, with U.S. help, of infrastructure to support increased agricultural productivity.	This loan will increase directly food production. Farm income will double or triple and national foreign exchange earnings will increase to $27 million a year.
c. Meeting increasing need for trained manpower.	The Rahad Corporation will train farmers and employees.
d. Developing programs to meet public health needs.	Hospitals, dispensaries, malaria control and bilharizin control are included in the total project.
e. Assisting other important economic, political, and social development activities, including industrial development; growth of free labor unions; cooperatives and voluntary agencies; improvement of transportation and communication systems; capabilities for planning and public administration; urban development; and modernization of existing laws.	Not directly applicable.
2. *FAA §201(b)(4). Describe the activity's consistency with and relationship to other development activities, and its contribution to realizable long-range objectives.*	The project will increase Sudan's irrigated acreage and thus agriculture output. Agriculture is key to Sudan's future growth.

3. *FAA §201(b)(9). How will the activity to be financed contribute to the achievement of self-sustaining growth?*	The production will increase agriculture production and generate substantial foreign exchange earnings.
4. *FAA §201(f). If this is a project loan, describe how such project will promote the country's economic development, taking into account the country's human and material resource requirements and the relationship between ultimate objectives of the project and overall economic development.*	See CAP Section III A.
5. *FAA §201(b)(3). In what ways does the activity give reasonable promise of contributing to development of economic resources, or to increase of productive capacities?*	See CAP Section III.
6. *FAA §281(b). How does the program under which assistance is provided recognize the particular needs, desires, and capacities of the country's people; utilize the country's intellectual resources to encourage institutional development; and support civic education and training in skills required for effective participation in political processes.*	The project has top GOS priority. The Rahad Corporation will develop human resources through a number of educational and governmental institutions.

7. FAA 0601(a). How will this loan encourage the country's efforts to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions?

See CAP Section III.

8. FAA 0202(a). Indicate the amount of money under the loan which is: going directly to private enterprise; going to intermediate credit institutions or other borrowers for use by private enterprise; being used to finance imports from private sources; or otherwise being used to finance procurements from private sources.

All imports will be from private sources. The Rahad Corporation, a quasi-government organization, will execute the loan. No money is expected to go directly to the Sudanese private sector.

9. FAA 0611(a)(3). What legislative action is required within the recipient country? What is the basis for a reasonable anticipation that such action will be completed in time to permit orderly accomplishment of purposes of loan?

The Rahad Corporation was created by the GOS on April 22, 1972.

-- *Regional Goals*

1. FAA §619. If this loan is assisting a newly independent country, to what extent do the circumstances permit such assistance to be furnished through multilateral organizations or plans?	Sudan is not newly independent. The World Bank is participating in the project.
2. FAA §209. If this loan is directed at a problem or an opportunity that is regional in nature, how does assistance under this loan encourage a regional development program? What multilateral assistance is presently being furnished to the country?	Not a Regional program. Sudan receives assistance from the World Bank and the UNDP.

C. Relation to U.S. Economy

-- *Employment, Balance of Payments, Private Enterprise*

1. FAA §§201(b)(6); 102, Fifth. What are the possible effects of this loan on U.S. economy, with special reference to areas of substantial labor surplus? Describe the extent to which assistance is constituted of U.S. commodities and services, furnished in a manner consistent with improving the U.S. balance of payments position.	It is anticipated that all goods and services purchased with the loan will be from the U.S., thus assisting the U.S. economy.

2. FAA §§612(b), 636(h). *What steps have been taken to assure that, to the maximum extent possible, foreign currencies owned by the U.S. and local currencies contributed by the country are utilized to meet the cost of contractual and other services, and that U.S. foreign-owned currencies are utilized in lieu of dollars?*

There is no U.S. owned Sudanese local currency available to support this project. GOS will provide all local currency required.

3. FAA §301(d); App. §109. *If this loan is for a capital project, to what extent has the Agency encouraged utilization of engineering and professional services of U.S. firms and their affiliates? If the loan is to be used to finance direct costs for construction, will any of the contractors be persons other than qualified nationals of the country or qualified citizens of the U.S.? If so, has the required waiver been obtained?*

U.S. firms will provide all professional services required under this loan.

4. FAA §608(a). *Provide information on measures to be taken to utilize U.S. Government excess personal property in lieu of the procurement of new items.*

The Loan Agreement contains a provision allowing the use of U.S. Government excess personal property.

5. FAA §602. *What efforts have been made to assist U.S. small business to participate equitably in the furnishing of commodities and services financed by this loan?*

Normal A.I.D. procedures will be followed to provide notice of intended procurement to U.S. small business.

6. FAA §621. If the loan provides technical assistance, how is private enterprise on a contract basis utilized? If the facilities of other Federal agencies will be utilized, in what ways are they particularly suitable; are they competitive with private enterprise (if so, explain); and how can they be made available without undue interference with domestic programs?	See CAP implementation Section V.
7. FAA §611(c). If this loan involves a contract for construction that obligates in excess of $100,000, will it be on a competitive basis? If not, are there factors which make it impracticable?	Does not involve construction.

-- *Procurement*

1. FAA §604(a). Will commodity procurement be restricted to U.S. except as otherwise determined by the President?	Yes, Code 941 Countries.
2. FAA §604(b). Will any part of this loan be used for bulk commodity procurement at adjusted prices higher than the market price prevailing in the U.S. at time of purchase?	No.

3. *FAA §604(e). Will any part of this loan be used for procurement of any agricultural commodity or product thereof outside the U.S. when the domestic price of such commodity is less than parity?* — No.

D. *Other Requirements*

1. *FAA §201(b). Is the country among the 20 countries in which development loan funds may be used to make loans in this fiscal year?* — Not Applicable.

2. *App. §106. Does the loan agreement provide, with respect to capital projects, for U.S. approval of contract terms and firms?* — Not Applicable.

3. *FAA §620(k). If the loan is for construction of a productive enterprise, with respect to which the aggregate value of assistance to be furnished will exceed $100 million, what preparation has been made to obtain the express approval of the Congress?* — Not Applicable.

4. *FAA §§620(b), 620(f): Has the President determined that the country is not dominated or controlled by the international Communist movement? If the country is a Communist country (including, but not limited to, the countries listed in FAA §620(f)) and the loan is intended for economic assistance, have the findings required by FAA §620(f) been made and reported to the Congress?*	Sudan is not controlled by the International Communist Movement.
5. *FAA §620(h). What steps have been taken to insure that the loan will not be used in a manner which, contrary to the best interest of the United States, promotes or assists the foreign aid projects of the Communist-bloc countries?*	The Loan Agreement contains the standard A.I.D. clauses in this regard.
6. *App. §110. Will any funds be used to finance procurement of iron and steel products for use in Viet-Nam other than as contemplated by §110.*	No.
7. *FAA §636(i). Will any part of this loan be used in financing non-U.S.-manufactured automobiles? If so, has the required waiver been obtained?*	No, to first question.

8. *FAA §§620(a)(1) and (2), 620(p); Will any assistance be furnished or funds made available to the government of Cuba or the United Arab Republic?* — No.

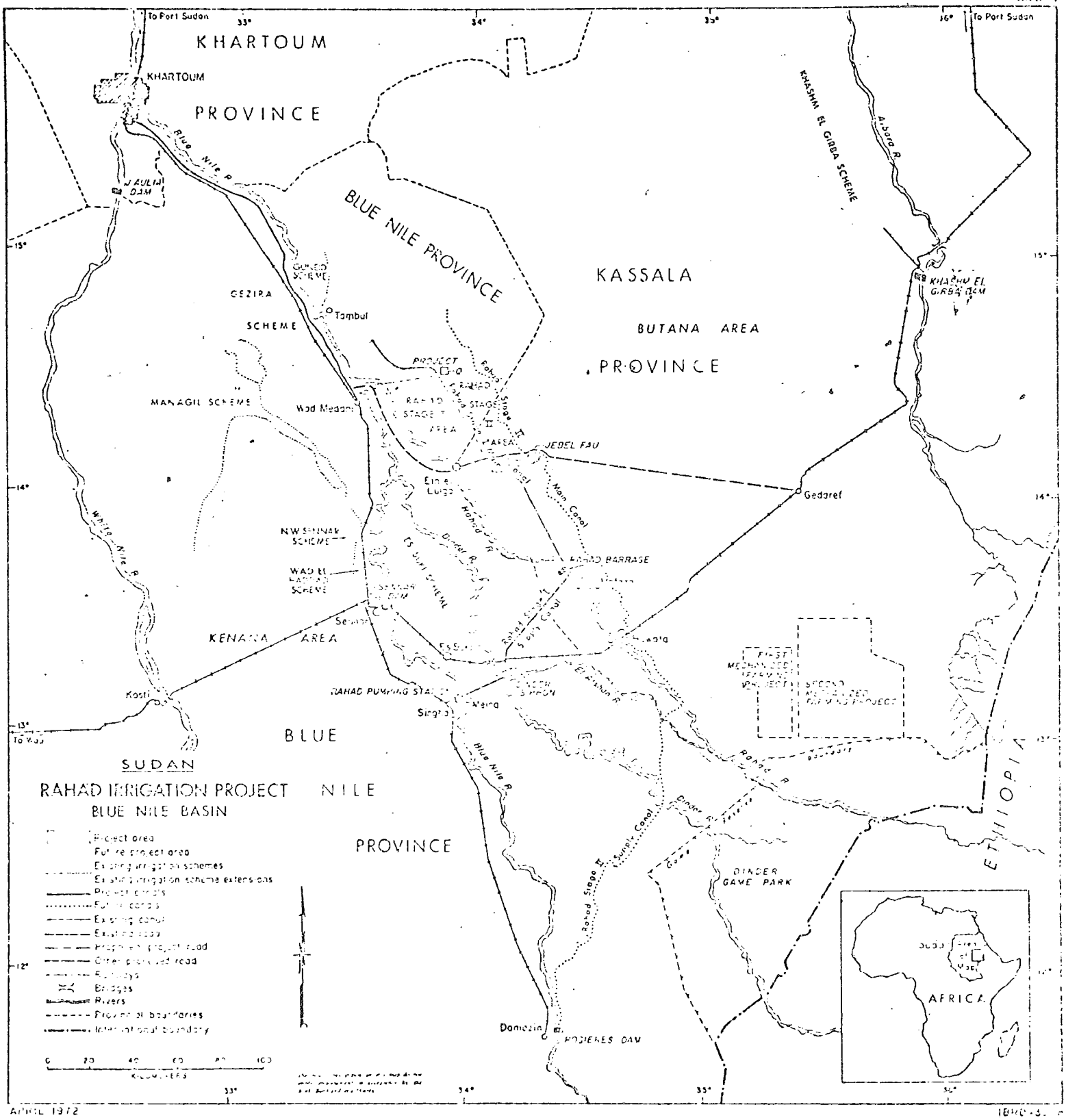
9. *FAA §620(g). Will any part of this loan be used to compensate owners for expropriated or nationalized property? If any assistance has been used for such purpose in the past, has appropriate reimbursement been made to the U.S. for sums diverted?* — No.

10. *FAA §201(f). If this is a project loan, what provisions have been made for appropriate participation by the recipient country's private enterprise?* — None.

11. *App. §104. Does the loan agreement bar any use of funds to pay pensions, etc., for persons who are serving or who have served in the recipient country's armed forces?* — Yes.

12.	MMA §§ 901.b. Does the loan agreement provide, for compliance with U.S. shipping requirements, that at least 50% of the gross tonnage of all commodities financed with funds made available under this loan (computed separately by geographic area for dry bulk carriers, dry cargo liners, and tankers) be transported on privately owned U.S.-flag commercial vessels to the extent such vessels are available at fair and reasonable rates for U.S. flag vessels. Does the loan agreement also provide for compliance with U.S. shipping requirements, that at least 50% of the gross freight revenues of goods shipped under this loan must be earned by privately owned U.S.-flag commercial vessels to the extent such vessels are available at fair and reasonable rates for U.S.-flag vessels?	Yes.
13.	FAA. Section 481. Has the country failed to take adequate steps to prevent narcotic drugs from entering the U.S. unlawfully?	No.
14.	FAA. Section 604.e. Has there been compliance with restriction against procuring with AID funds agricultural commodities outside the U.S. when the domestic price of such commodity is less than parity.	No agriculture commodities will be procured with funds provided under this loan.

MAP 1


To Port Sudan
KHARTOUM
KHARTOUM
PROVINCE
Blue Nile R.
JAULIA DAM
BLUE NILE PROVINCE
KASSALA
BUTANA AREA
PROVINCE
KHASHM EL GIRBA SCHEME
Atbara R.
KHASHM EL GIRBA DAM
GEZIRA
SCHEME
Tambul
MANAGIL SCHEME
Wad Medani
JEDEL FAU
Gedaref
N.W. SENNAR SCHEME
WAD EL HADI SCHEME
Main Canal
RAHAD BARRAGE
KENANA AREA
Kosti
RAHAD PUMPING STATION
Singa
BLUE
NILE
PROVINCE
White Nile R.
Blue Nile R.
Rahad R.
Dinder R.
Sunaik Canal
Rahad Stage II
DINDER GAME PARK
ETHIOPIA
Damazin
ROSIERES DAM
SUDAN
RAHAD IRRIGATION PROJECT
BLUE NILE BASIN
Project area
Future project area
Existing irrigation schemes
Existing irrigation scheme extensions
Project canals
Future canals
Existing canal
Existing roads
Proposed project road
Other proposed road
Railways
Bridges
Rivers
Provincial boundaries
International boundary
KILOMETERS
AFRICA
APRIL 1972

ITEMS PERTAINING TO HEALTH EVALUATION OF IRRIGATION SYSTEMS IN AFRICA

Vector-borne diseases

Malaria

Trypanosomiasis

Filariasis

Onchocerciasis

Yellow Fever

Other arbo-virus diseases?

Snail-borne diseases

Schistosomiasis - human and animal

Fascioliasis - sheep and cattle

The irrigation project per se

New or old?

Water impoundment?

- Source of water?
- Area impounded?
- Forestration to surround impoundment?
  - Extent
  - Type

Area to be irrigated?

- Extent - acres - hectares
- Capacity of main canal - M^3

Flow rate

Main channel

Other channels

Irrigation channels?

Type of

Main canal

Lined?

Unlined?

Width?

Depth?

Second and tertiary channels

Flow - continuous or intermittent?

Drains

Extent?

Location?

Probable type of vegetation?

Utilization of land

Crops

Kind?

Rotation?

Snail-borne diseases

Schistosomiasis - Human and animal

Presently endemic? Species present?

Prevalence - incidence - morbidity

Clinical gradients?

Intensity of infection (egg counts)?

Related to present irrigation or not?

Relation to proposed irrigation system?

Possibilities of spreading to the new area?

Transmission patterns

Snail species involved?

Vectors of human schistosomiasis?

Vectors of animal schistosomiasis?

Ecological factors and breeding requirements of vectors?

Relative abundance of vectors?

Degree of infection in vectors?

Degree and points of water contact?

Social mores as related to infection?

Sanitary condition - fecal and urine disposal?

Occupational hazards? (types of agriculture)

<u>Fascioliasis</u>

Prevalence - Incidence?

Abbatoir observation?

Percent liver condemnation?

Snail vectors?

Economic impact?

Other water related diseases which may affect project?

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

OFFICE OF
THE ADMINISTRATOR

A.I.D. Loan No. 650-H-017
Cap. Asst. Paper No. AID/DLC/P-1064
Project No. 650-22-130-100

CAPITAL ASSISTANCE LOAN AUTHORIZATION

Provided from: Development Loan Funds
Sudan - Rahad Project

Pursuant to the authority vested in the Administrator of the Agency for International Development (hereinafter called "A.I.D.") by the Foreign Assistance Act of 1961, as amended, and the delegations of authority issued thereunder, I hereby authorize the establishment of a loan pursuant to Part I, Chapter 2, Title I, the Development Loan Fund, to the Government of Sudan ("Borrower"), of not to exceed Eleven Million Dollars ($11,000,000) to assist in financing the foreign exchange costs of equipment, machinery and related services to be utilized in the multi-donor financed development of the Rahad Irrigated Agriculture Scheme in Sudan. This loan is subject to the following terms and conditions:

1. Interest and Terms of Repayment.

   Borrower shall repay the Loan to A.I.D. in U.S. dollars within forty (40) years from the date of the first disbursement under the Loan, including a grace period of not to exceed ten (10) years. Borrower shall pay to A.I.D. interest at the rate of two percent (2%) per annum during the grace period and three percent (3%) per annum thereafter.

2. Other Terms and Conditions.

a. Commodities and services financed under the Loan shall be procured from the United States or other Code 941 Countries.

b. The Loan shall be subject to such other terms and conditions as A.I.D. may deem advisable.

Administrator

16 FEB 1973

Date

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

February 5, 1973

Minister of Planning
Ministry of Planning
Democratic Republic of the Sudan
Khartoum, Sudan

Subject: A.I.D. Loan No. 650-H-017
Rahad Irrigation Project
Implementation Letter No. 1

Dear Mr. Minister:

This letter, which is effective upon the signing of the Loan Agreement, sets forth the procedures for utilizing the proceeds of the loan and provides information to facilitate the implementation of the project in accordance with the Loan Agreement. Nothing in this letter and its attachments alters the scope of the Loan Agreement or the terms of the specific sections of the Loan Agreement that are referred to or explained in this communication. This letter and its attachments may be supplemented or modified by subsequent implementation letters to meet special situations that may arise.

I. Conditions Precedent to Disbursement of Loan Proceeds. The conditions precedent to financing under the Loan Agreement are found in Sections 3.01 and 3.02. Although these provisions are largely self-explanatory, the following information is provided to assist you in complying with them:

A. Conditions Precedent to Initial Disbursement (Section 3.01)

1. Attachment A, Guide for Counsel of Borrower Government, will assist you in preparing the legal opinion required in Section 3.01(a).

2. Attachment B. A.I.D. Capital Projects Guidelines for Borrower Procurement of Engineering and Other Professional Services, describes procedures acceptable to A.I.D. in preparing a contract meeting the requirements of Section 3.01(c) of the Loan Agreement, which covers contractual arrangements for commodity procurement services for the project.

B. Condition Precedent to Disbursement for Other Than Commodity Procurement Services (Section 3.02)

Attachment C, A.I.D. Capital Project Guidelines for Borrower Procurement of Equipment and Materials, provides instructions for selecting and preparing contract(s) for procurement of equipment, materials and related services for the project. A list of the equipment eligible for financing under this loan is included in Attachment D.

C. Please note that under Section 3.03 of the Loan Agreement the terminal date for fulfillment of initial conditions precedent (Section 3.01) is 120 days from the date of the Agreement, while the terminal date for fulfillment of the additional condition precedent (Section 3.02) is 150 days from the date of the Agreement.

II. Procurement of Goods and Services

The commodity procurement services firm, to be financed under the loan pursuant to Section 5.02 of the Agreement, will assist you in the preparation of equipment specifications and bid documents, evaluation of bids and monitoring of equipment delivery to Sudan. Prior A.I.D. approval will be required for the procurement services contract as well as for equipment tender documents and contract awards. Detailed procurement instructions are provided in Attachments B and C.

A. Source of Procurement

All goods and services to be financed under the loan must have their source and origin in countries included in Code 941 of the A.I.D. Geographic Code Book in accordance with Section 5.01 of the Loan Agreement. For instructions, definitions and further information concerning the source and origin of goods and services to be financed under the loan, your attention is directed to Section 4 of Attachment B and Section 5 of Attachment C. Please note that A.I.D. legislation requires that procurement of vehicles be restricted to the United States.

B. Notification to Potential Suppliers (Loan Agreement Section 5.09)

Attachments B and C, Section 2, include procedures for advertising for and selection of contractors and equipment suppliers.

C. Geographic Code Classification of Source Countries for All Goods and Services Connected with the Project

Codes 935 and 941, referred to in various sections of the Loan Agreement, are described in Attachment C. At the current time, Code 935 includes all "Free World" countries and excludes the following countries: Albania, Hungary, Bulgaria, Mainland China, Cuba, Czechoslovakia, East Germany, Estonia, North Korea, Latvia, Lithuania, Outer Mongolia, Poland, Rumania, North Vietnam and Union of Soviet Socialist Republics. Code 941 includes the United States and all lower-income countries with which the United States has friendly relations.

D. Ocean Shipping Limitations (Loan Agreement Section 5.08)

1. In regard to the provisions of Section 5.08 of the Loan Agreement, ocean vessels included in the latest "List of Free World and Polish Flag Vessels Arriving in Cuba since June 1, 1963" and/or the latest "List of Free World or Polish Flag Vessels Arriving in North Vietnam on or about January 25, 1966" are ineligible to carry A.I.D. financed cargoes from the United States. These lists are published from time to time in the Federal Register of the United States by the Maritime Administration of the Department of Commerce. A.I.D. maintains a current listing of such ineligible vessels which it will furnish upon request. Please take such steps as may be appropriate to make certain that no shipment financed under the loan is made on an ineligible vessel.

2. A.I.D. requires that at least 50% of gross tonnage of all goods financed hereunder shipped on ocean vessels be shipped on United States flag vessels and at least 50% of gross freight revenues generated by goods financed hereunder and shipped on ocean vessels be paid to or for the benefit of United States flag vessels. Ocean freight may be financed under the loan to the extent that vessels of Code 941 countries are utilized for the shipment of eligible items.

E. Information and Marking (Loan Agreement Section 5.11)

Arrangements shall be made for marking goods and shipping containers and for placing signs at the project sites bearing the A.I.D. emblem. Attachment C, Sections 4.6 and 4.6.2, will assist you in complying with these requirements.

III. Taxation (Loan Agreement Section 4.05)

To the extent that any of the items financed under this loan are not exempt from taxes, tariffs, duties and other levies imposed under the laws of Sudan, A.I.D. should be advised in writing as to the procedures by which the Borrower proposes to pay or reimburse the project for these charges.

IV. Disbursement Procedures and Documentation (Loan Agreement Section 6.01)

Foreign Exchange Costs. A.I.D. anticipates the issuance of Letters of Commitment to assist in financing the foreign exchange cost of services and equipment contracts. The procedure for requesting issuance of Letters of Commitment, actions to be taken after they are issued, and the documentation required by A.I.D. as a basis for disbursement of loan funds are described in Attachment E, Disbursement of Loan Funds: Letter of Commitment Procedure. Banking charges incurred in connection with Letters of Commitment and Letters of Credit shall be for the account of the Borrower and shall be financed under the loan unless the Borrower otherwise advises A.I.D. in writing.

V. Records and Reports

A. Records

The records required under Section 4.09 of the Loan Agreement, which relate to the acquisition of services and equipment financed under the loan and with project operations, shall be maintained for at least three years after the final disbursement under the loan.

B. Reports

1. Progress Reports. A.I.D. plans to coordinate its progress report requirements with the World Bank and the Kuwait Development Fund so that a single reporting procedure will satisfy the needs of each organization. Additional instructions regarding format, frequency of preparation and number of copies will be forthcoming from A.I.D. after these arrangements have been concluded

2. Quarterly Shipping Reports. This report is required until all shipping under the loan has been completed and should be submitted within thirty days of the end of each calendar quarter. Attachment F, Borrower's Shipping Statement, contains the format for this report. The Summary Statement Part I, should give the cumulative actual tonnages shipped, beginning with the initial report through the month of the last report, for United States and non-United States Flag vessels, by category of vessels, as applicable.

If the summary indicates a lag in compliance with Section 5.08 of the Loan Agreement, a statement should be included indicating how the deficit in shipping on United States flag vessels will be made up. If no shipping occurs during a particular calendar quarter, a statement to that effect must be submitted.

3. Annual Financial and Operations Reports. For five years following final disbursement under the loan, the Corporation shall submit annual financial and operations reports to A.I.D. A.I.D. is prepared to discuss the content, format and timing of these reports with your Government to assure consistency with your reporting requirements for the World Bank and the Kuwait Development Fund.

VI. Correspondence

All documentation, reports and correspondence concerning this loan should be forwarded to the A.I.D. East Africa Regional Economic Development Services Office (REDSO/EA), Nairobi, Kenya.

We will be pleased to discuss with you or your representatives any aspect of the project, or any matter relating to this letter or the attachments hereto.

Sincerely yours,

Princeton Lyman

Princeton Lyman
Director
Office of Development Services
Bureau for Africa

Attachments:

Attachment A - Guide for Counsel of Borrower Government (6/64)

Attachment B - A.I.D. Capital Projects Guidelines for Borrower Procurement of Engineering and Other Professional Services, M.O. 1442.1 (3/71)

Attachment C - A.I.D. Capital Projects Guidelines for Borrower Procurement of Equipment and Materials, M.O. 1442.3 (3/71)

Attachment D - Eligible Equipment List

Attachment E - Disbursement of Loan Funds: Letter of Commitment Procedure (7/69)

Attachment F - Borrower's Shipping Statement (10/62)

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

Attachment A

GUIDE FOR COUNSEL OF BORROWER GOVERNMENT

Among the conditions precedent to financing under the Loan Agreement, A.I.D. requires an opinion of the Legal Counsel of the Borrower Government to the effect that the Loan Agreement is legal and binding insofar as the Government is concerned. In preparing the required legal opinion please be guided by the following criteria:

1. A.I.D. prefers the opinion of the senior legal officer of the Government (the Attorney General of the Government or other counsel satisfactory to A.I.D.).

2. The legal opinion should reach, in substance, the essential conclusions concerning the legality and enforceability of the Loan Agreement that are specified under "Conditions Precedent" in the Loan Agreement.

3. A.I.D. will look for an explanation of the legal basis on which such conclusions were reached. This should include a citation of the basic legal authority for entering into the Agreement, a verification of the authority of the Government signator to sign for the Government, and an affirmative representation that all requirements of law have been met to make the Loan Agreement or the actions taken pursuant to it valid and binding.

4. A.I.D. will expect counsel to include relevant excerpts in English from the Constitution, statutes, executive orders or decrees, public notices, etc., relied upon in such opinion.

Two copies of the legal opinion, in English, should be provided to A.I.D. by the Borrower without delay so as to facilitate disbursement of Loan proceeds.

AFR/CDF:6/64

BEST AVAILABLE

Attachment B

(M.O. 1442.1)

A.I.D. CAPITAL PROJECTS GUIDELINES

BORROWER PROCUREMENT
OF
ENGINEERING AND OTHER PROFESSIONAL SERVICES

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

M.O. 1442.1
MARCH 1971

Attachment C

A.I.D. CAPITAL PROJECTS GUIDELINES

BORROWER PROCUREMENT

OF

EQUIPMENT AND MATERIALS

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

M.O. 1442.3
MARCH 1971

(M.O. 1442.3)

ELIGIBLE EQUIPMENT LIST

A. Construction Vehicles and Equipment

	No. of Units
1. Vehicles	
a. 4-wd drive Pick-up	40
b. 5-ton Truck, chassis	65
c. 7-ton Dump Truck	10
d. 1,000 gal. Tanker	25
e. 50-60 ton Low-boy Truck	5
f. Motor Grader	3
g. Motor Grader/Elev.	5
2. Construction Equipment	
a. 380 HP Tractor, blade, gripper	10
b. 180 HP Tractor, blade	20
c. Concrete Mixer	30
d. Vibrator	30
e. Steel Bending Machine	4
f. Steel Cutting Saw	4
g. Backhoe	4
h. Front End Loader	3
i. Mobile Workshop	3
j. Engineering Equipment	Lot
k. 7 Ton Crane	2

B. Agricultural Equipment and Vehicles

1. Farm Equipment	
a. Groundnut Combines	156
b. Groundnut Digger-Shakers	156
c. Decorticators	Lot

	No. of Units
2. Material Transports	
a. 4-wd Tipping Trailers	13
b. 4-wd Trailers	10
c. 1500 gal. Fuel Tankers	10
d. 1500 gal. Water Tankers	10
3. Blading and Deep Plowing	
a. 270 HP Crawler Tractor	5
b. Heavy Plows	5
c. Nutgrass Blades	5
4. Maintenance Equipment	
a. 270 HP Crawler Tractors	4
b. Ditchers	4
c. Motor Graders	4
d. Scraper Blades	24
e. 4-wd Drive Mechanic Trucks	8
5. Land Levelling	
a. Motor Grader	3
b. Offset Disc Harrow	20
c. Land Planes	28
d. Mobile Workshop - Van Type	3

	No. of Units
5. Land Levelling (Cont'd)	
e. 1500 gal. Water Tanker	3
f. 1500 gal. Fuel Tanker	3
g. 5-ton Trailer	3
6. Lubrication - Shop Equipment	
a. 4x4 Truck Mount Lub. Unit	16
b. Central Repair Shop Equipment	Lot
7. Vehicles	
a. 4-wd Drive Pickups	82
b. 5-ton Truck Chassis	23

ATTACHMENT E

AGENCY FOR INTERNATIONAL DEVELOPMENT

Washington, D. C. 20523

DISBURSEMENT OF LOAN FUNDS
LETTERS OF COMMITMENT PROCEDURE

Under AID loan agreements the borrower may request AID to issued letters of commitment to banking institutions in the United States, designated by the borrower, as a basis for disbursing loan funds. The procedures to be followed by the borrower to obtain the issuance of letters of commitment and by suppliers to obtain payment pursuant to letters of credit or other orders for payment issued under the letter of commitment are as follows:

A. Form and Content of Request for Letter of Commitment. Requests for the issuance of letters of commitment shall be submitted to AID in duplicate in the English language, shall set out the AID number of the loan, and shall contain the following:

1. The U.S. dollar amount of the letter of commitment;

2. The name of the U.S. banking institution to which the letter of commitment is to be issued;

3. The name and address of the approved applicant (the borrower or a person or organization, such as a bank in the borrower's country, authorized by the borrower to request the U.S. banking institution to open letters of credit or to make payment to suppliers by other means);

4. The expiration date to be stated in the letter of commitment. In no case may this be later than the date specified in the loan agreement as the final date for submitting documentation to the U.S. banking institution as a basis for disbursements against the letter of commitment;

5. An identification of the items to be financed under the letter of commitment. Equipment and materials shall be described by categories in commercial terminology or in terms of the AID 3-digit commodity code, showing estimated quantities and dollar costs, whether costs include delivery to the borrower's country, and whether the borrower wishes to provide for any flexibility between individual category amounts within the total amount of the letter of commitment. In the case of services, three copies of the governing contract shall be submitted with the request for issuance.

B. Notification of and Action After Issuance of Letter of Commitment. Upon issuance of a letter of commitment, a copy will be sent to the borrower as notification of such issuance. After such notification, the borrower or its approved applicant may request the designated U.S. banking institution to open commercial letters of credit or to provide for payment to suppliers by other means. Each such request shall include the AID serial number of the loan and of the pertinent letter of commitment. The request, and instructions to U.S. banking institutions in connection therewith, may include any special directions, consistent with the terms of the letter of commitment, that the borrower may specify.

C. Documentation for Payment. AID requires that claims by suppliers for payment pursuant to letters of credit or other orders for payment issued under an AID letter of commitment be supported by the following documents, except when waived in writing by AID.

1. Costs of Goods, Including Costs of Freight and/or Marine Insurance Where Paid by the Supplier. (See paragraphs 3 and 4 below for documentation to support prepayments and progress payments under contracts.)

a. Voucher SF 1034. Original and three copies, normally prepared by the U.S. banking institution.

b. Supplier's Detailed Invoice. One copy or photostat, showing quantity, description, gross sales price, net sales price (after deducting discounts and purchasing agents' commission), and basis of delivery (e.g., C&F, FAS) of the goods or details of the services. Such invoice shall be accompanied by a certificate from a banking institution indicating that payment has been made. Where the invoice covers goods shipped from a free port or bonded warehouse, it shall include an endorsement so indicating and designating also the country or area from which shipment was made to the free port or bonded warehouse. Where an invoice covering costs of freight and/or marine insurance is rendered separately (i.e., where these costs are not billed on the invoice covering the costs of the goods), an appropriate reference must be furnished to the voucher (SF 1034) and invoice under which the cost of the goods was paid.

c. Source/Origin Provision. Suppliers are required to certify that the commodities shipped hereunder have a source and an origin in a country or area included in the AID Geographic Code indicated in the loan agreement. The term "source" means the country or area from which a commodity is shipped to the cooperating country. When, however, a commodity is shipped from a free port or bonded warehouse in the form in which received therein, "source" shall mean the country or area from which commodity was shipped to the free port or bonded warehouse. The term "origin" means the country or area where the commodity was mined, grown or produced through manufacturing, processing or assembly; provided, however, that neither a commodity produced in an authorized source country which contains components from a Free World source (AID Geographic Code 899) other than authorized source countries, the total costs (delivered at the point of production) of which amounts to more than 10% of the lowest price (excluding the cost of ocean transportation and marine insurance) at which the supplier makes the commodity available for export sale (whether or not financed by AID) nor a commodity containing any components from a source not included in AID Geographic Code 899 will be considered to be of eligible "origin." In addition, any commodity transaction which is prohibited by U.S. Treasury Department Foreign Assets Control Regulations or Cuban Assets Control Regulations will not be eligible for AID financing.

The following certification on "source" and "origin" must be attached to or endorsed on each invoice presented for payment and must be signed by the supplier or his authorized representative:

> I (We) hereby certify that the source and origin (as defined by AID) of the commodities listed on the attached invoice or invoiced herein is as shown below and as shown on the AID Supplier's Certificate and that such invoiced commodities were mined, grown or produced in a country or countries covered by AID Geographic Code ____. (Insert the Geographic Code number specified by the borrower.)
>
> I (We) further certify that, to the best of my (our) information and belief, with respect to any produced commodity invoiced, the cost of components (delivered to point of production) the source of which is a Free World country other than countries authorized as sources in the Agreement, does not exceed in total cost 10 percent of the lowest price (excluding the cost of ocean transportation and marine insurance) at which I (we) make the commodity available for export, that the produced commodity does not contain any components imported from countries not included in Geographic Code 899 or prohibited by FAC or CAC Regulations.

SOURCE OF COMMODITIES _____

AUTHORIZED SIGNATURE OF SUPPLIER _____

TITLE _____

DATE _____

d. Evidence of Shipment

(1) Bill of Lading or Substitute. One copy or photostat of ocean or charter party bill of lading, airway, bill, parcel post receipt, or other commercially acceptable documentation.

(2) Bank Certificate for Shipments from United States. In the case of any commodity shipped from the United States and financed by A.I.D. under a letter of commitment to a U.S. banking institution, A.I.D. will accept in lieu of the documents referred to in d.(1) above, a certificate from the banking institution to the effect that it has been informed by the approved application or supplier that the sale is on an FOB or FAS basis and it is impracticable to furnish an ocean or charter party bill of lading, airway bill, or parcel post receipt, and that either:

(a) Shipment Document Sent by Bank. The banking institution has received a common carrier bill of lading, negotiable warehouse receipt, mate's receipt, master's receipt, dock receipt, or domestic parcel post receipt (if in nonnegotiable form, showing that the goods have been consigned to or are being held for a person or organization designated by the approved applicant); it has delivered or sent the same, in accordance with instructions of the approved applicant, to a person or organization designated by the approved applicant; and it has in its possession a written undertaking of such person or organization (1) to arrange for ocean shipment and to deliver to the banking institution a copy (or photostat) of the ocean or charter party bill of lading, airway bill, or parcel post receipt for forwarding to A.I.D., or (2) if unable to arrange for ocean shipments within 90 days of the date of the undertaking, to so notify A.I.D., Washington, D.C., and at such time as A.I.D. may request, to deliver to the banking institution for forwarding to A.I.D., a common carrier bill of lading or warehouse receipt in negotiable form for the commodity; or

(b) Shipment Document Held by Bank. The banking institution has received a common carrier bill of lading or warehouse receipt in negotiable form and is in possession of the same; it has been unable to deliver the same to a person or organization designated by the approved applicant against the written undertaking described in (2)(a)(1) above, and it is holding the negotiable common carrier bill of lading or negotiable warehouse receipt subject to the instructions of A.I.D. and will forward same to A.I.D. when and if so instructed, except that if it becomes possible before any such instructions are received, it will proceed in accordance with (2)(a)(1) above.

(3) Banking Certificate for Shipments from Outside United States. In the case of commodities financed by A.I.D. under a letter of commitment to a U.S. banking institution and shipped to a borrower, by means other than ocean vessel or aircraft, from an authorized source country or other area other than the United States, in lieu of the documents referred to in subdivision d.(1) of this subparagraph A.I.D. will accept (1) a certification from the banking institution to the effect that it has been informed by the approved applicant or the supplier that it is impracticable to furnish any of the documents described in (2)(a) above, and (2) such other documents evidencing shipment to or receipt by the borrower as are acceptable under good commercial practice (such as railway, barge, or truck bills of lading or importers' receipts).

e. A.I.D. Supplier's Certificate and Invoice-and-Contract Abstract. The original and two copies of the A.I.D. Supplier's Certificate and Invoice-and-Contract Abstract, executed by the supplier, covering the following:

(1) The cost of the commodity, including the cost of ocean freight and/or marine insurance (including war risk insurance) when such costs are paid by the supplier for his own or the buyer's account, to be executed by the supplier of the commodity.

(2) The cost of ocean freight, to be executed by the ocean carrier.

(3) The cost of marine insurance (including war risk insurance) to be executed by the insurer, insurance broker, or underwriter.

f. Other Documentation. Such additional or substitute documentation as A.I.D. may require.

2. Costs of Services

a. Voucher SF 1034. Original and three copies, normally prepared by the U.S. banking institution.

b. Supplier's Detailed Invoice. One copy or photostat, describing the services performed and itemizing in detail the costs for which payment is invoiced (except in the case of lump-sum contracts in which case the invoice shall identify the covering contract and the section or paragraphs which provide for such payment and the terms of payment), setting out separately costs of travel, materials, and equipment, if any. Such invoice shall be accompanied by a certificate from a banking institution indicating that payment has been made.

c. Certificate of Performance. This must be executed by an authorized representative of the borrower, as follows:

> The undersigned certifies that (1) the services for which reimbursement is requested have been satisfactorily rendered; (2) the costs thereof are properly reimbursable and the fees earned, in accordance with the terms of the contract; (3) any reports or recommendations required under the terms of the contract have been received and are in accordance with the terms of the loan agreement.

Signed _____

Date _____ Title _____
Authorized Representative

d. A.I.D. Supplier's Certificate and Invoice-and-Contract Abstract. The original and two copies of the A.I.D. Supplier's Certificate and Invoice-and-Contract Abstract, executed by the supplier, covering the total amount for which reimbursement is requested.

e. Other Documentation. Such additional or substitute documentation as A.I.D. may require.

3. Prepayments and Progress Payments Under Contracts. Where prepayments and/or progress payments are required under a contract with a supplier (and such financing has been approved by A.I.D. in advance), the value thereof may be financed under a letter of commitment, subject to prior performance of such special provisions as may be required by A.I.D. Documentation to support disbursements covering prepayments and progress payments is as follows:

a. Voucher SF 1034. Original and three copies, normally prepared by the U.S. banking institution.

b. Supplier's Detailed Invoice. One copy or photostat of the invoice, identifying the covering contract and showing (a) the total value of the contract (excluding escalation); (b) the total of amounts previously received and/or claimed as prepayment or progress payments, detailed by amounts and dates; (c) the amount being invoiced for payment; (d) the total value of goods delivered (including shipping and related costs) and separately the total value of technical or other noncommodity-related services performed under the contract as of the date of the invoice; and (e) the total value of goods delivered (including shipping and related costs), broken down by calendar year and quarter of shipment, since the date of the previous invoice, and the total value of technical or other noncommodity-related services performed since the date of the previous invoice.

The copy or photostat of the invoice shall be marked "PAID" by the supplier or shall be endorsed by or accompanied by a certificate of a bank certifying that payment has been made in the amount shown on the invoice.

c. AID Supplier's Certificate and Invoice-and-Contract Abstract. The original and two copies of the AID Supplier's Certificate and Invoice-and-Contract Abstract, executed by the supplier, covering the total amount for which reimbursement is requested.

d. Works Progress Certificate. For progress payments, one copy of a Works Progress Certificate, signed by the supplier, in the following form attached to, or endorsed on, the invoice.

> The undersigned certifies that (1) the amount expended for engineering services, labor, materials, and payments on account of commitments for materials and services supplied or to be supplied under contract [or order] No._____ are in excess of the total payments already received or claimed against this contract [or order] including payments claimed against this invoice; (2) the value of said contract [or order] excluding escalation is _____; (3) the undersigned is complying with the terms and conditions of the subject contract [or order]; (4) the commodity is presently under the General License, or, if not, a validated export license has been issued by the Department of Commerce covering the commodity, and the undersigned has not received notice that it has been canceled or terminated; and (5) the commodity is being specially manufactured or produced for the importer under the contract [or order], does not conform to the undersigned's standard specifications for domestic or foreign sale, or if it does, is not of a type normally manufactured by or for the undersigned for inventory, and to the best of the undersigned's belief, would, in the event of nondelivery, neither be resaleable nor convertible for resale at, or above, the contract price.
>
> Signature_____
>
> Date_____ Title_____
> Authorized Representative

e. Other Documentation. Such additional or substitute documentation as AID may require.

4. Partial or Final Payments Where Prepayments or Progress Payments Have Been Made. Where prepayments or progress payments have been made under a contract financed out of AID loan funds, in addition to documentation as provided in section 1 of this part, a certification, signed by the supplier, in the following form is required to be attached to or endorsed on the invoice.

> The undersigned certifies that (1) the sales value of the equipment covered by this invoice, plus the value of equipment already delivered, plus the sales value of engineering services, labor, and purchased material for which expenditures have been made, plus the amount expended on account of commitments for equipment remaining to be supplied under the subject contract are not less than the total payments already received or claimed against this contract [or order] including payments claimed under this invoice, and (2) it is complying with the terms and conditions of the subject contract [or order].
>
> Signature_____
>
> Date_____ Title_____
> Authorized Representative

5. Final Payment Where Amount Previously Withheld Under Contract. Where a contract financed out of AID loan funds authorizes final payment for goods upon acceptance by the purchaser, certification by the purchaser's engineer, or other comparable condition, documentation to support such final payment shall be as follows:

a. Voucher SF 1034. Original and three copies normally prepared by the U.S. banking institution.

b. Supplier's Detailed Invoice. One copy or photostat identifying the covering contract and showing (a) the total value of the contract (excluding escalation), (b) total of amounts previously received as payments under the contract, and (c) the amount invoiced for final payment. Such invoice shall be accompanied by a certificate from a banking institution indicating that payment has been made.

c. Certificate of Acceptance. There shall be attached to or endorsed on the supplier's invoice a certification substantially as follows, executed by the borrower or its authorized representative.

> The undersigned certifies that the [machinery-equipment] for which final payment is invoiced, meets in all respects the specifications prescribed in the covering contract, and the amount invoiced is properly due and payable to the supplier under the contract.
>
> Signature_____
>
> Date_____ Title_____
>
> Authorized Representative

d. AID Supplier's Certificate and Invoice-and-Contract Abstract. The original and two copies of the AID Supplier's Certificate and Invoice-and-Contract Abstract executed by the supplier, covering the total amount for which reimbursement is requested.

e. Other Documentation. Such additional or substitute documentation as AID may require.

ATTACHMENT F

BORROWERS SHIPPING STATEMENT

To: Agency for International Development
Washington, D. C. 20523

Our progress in meeting our obligation under the Loan Agreement to ship on U.S. flag vessels at least fifty percent of the gross tonnage of loan financed goods transported on ocean vessels is as shown in the following tabulation.

2. Borrower

3. Loan Number

4. Date Submitted

5. For Quarterly Period Ended (Date)

FOR A.I.D. USE

Attachment

Implementation Letter

Date Received

Date Copy to Trans.

Signature

Title

1. Shipments From

PART I - SUMMARY STATEMENT	Gross Tonnage: Total Long Tons	Gross Tonnage: U.S. Vessels: Long Tons	Gross Tonnage: U.S. Vessels: Percent of Total	Freight Cost (U.S. Dollar Equivalent): Total	Freight Cost (U.S. Dollar Equivalent): Paid With Loan Funds	Supplier Invoice Reference: 1. Number and Date 2. F.O.B. Value of Goods (U.S. Dollar Equivalent)
Cumulative Totals - Shipments in Previous Quarters.....						----------
Total - Shipments This Quarter.....						----------
Cumulative Totals Through This Quarter.....						----------

PART II - SHIPMENTS THIS QUARTER			(d)	(e)	(f)	(g)	(h)	(i)
Vessel	Ports	Bill of Lading						
1. Name 2. Registry	1. Exit 2. Destination	1. Date 2. Description of Cargo						
(a)	(b)	(c)						

Instruction: Two statements are required: one for shipments from the U.S.; one for shipments from other sources. Identify the statement by inserting in Block 1 either "The United States" or "Areas Other Than The United States."

Mail two copies of each statement to:

Agency for International Development
Bureau for Africa and Europe
Office of Capital Development and Finance
Washington, D. C. 20523

If the tabulation requires more than one page, use continuation sheet(s) in the form illustrated on reverse side of this form.

OCT 15 1962

Continuation Sheet | BORROWERS SHIPPING STATEMENT for Quarter Ended: | Shipments From:

Vessel	Ports	Bill of Lading	Gross Tonnage			Freight Cost (U.S. Dollar Equivalent)		Supplier Invoice Reference
			Total Long Tons	U.S. Vessels				1. Number and Date 2. F.O.B. Value of Goods (U.S. Dollar Equivalent)
1. Name 2. Registry	1. Exit 2. Destination	1. Date 2. Description of Cargo		Long Tons	Percent of Total	Total	Paid With Loan Funds	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)

UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
EAST AFRICA REGIONAL ECONOMIC DEVELOPMENT SERVICES OFFICE

UNITED STATES POSTAL ADDRESS
NAIROBI (ID)
DEPARTMENT OF STATE
WASHINGTON, D.C., 20521

INTERNATIONAL POSTAL ADDRESS
POST OFFICE BOX 30261
NAIROBI, KENYA

July 18, 1973

Minister of Planning
Ministry of Planning
Democratic Republic of the Sudan
Khartoum, Sudan

Subject: A.I.D. Loan No. 650-H-017
Rahad Irrigation Project
Implementation Letter No. 2
Notice of New Address

Dear Mr. Minister:

Inasmuch as A.I.D. has now established an office in Khartoum, please address all communications concerning the subject project as follows, pursuant to Section 8.01(a) of the Loan Agreement:

Mail Address: Director
REDSO/EA
c/o A.I.D. Affairs Officer
Khartoum, Sudan

Cable Address: Amembassy Nairobi
for REDSO
Nairobi, Kenya

In normal circumstances, it will not be necessary to cable this office directly, since any urgent messages can be cabled to us by the U. S. Embassy in Khartoum, based on communications directed to the resident A.I.D. Affairs Officer.

Sincerely yours,

John R Westley

John R. Westley
Acting Director

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : TA/H, Dr. Lee Howard

DATE: January 11, 1973

FROM : AFR/DS, R.H. Bell

SUBJECT: The Rahad Irrigation Project in Sudan

Attached are pertinent sections of the World Bank's study of the Rahad Irrigation Project in the Sudan. AID is planning to assist in the financing with a $10.0 million loan. As the section on public health indicates, this activity will have a serious impact on the incidence of malaria and schistosomiasis in the region. We would greatly appreciate your office's comments in this connection, particularly with regard to the control measures discussed in the Bank's paper. If you have any questions, please call me at 28164.

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

1.038 Feddans = 1 Ac.

APPRAISAL OF THE RAHAD IRRIGATION PROJECT

SUDAN

2.48
328000
197
494
741

SUMMARY AND CONCLUSIONS

810,000 Acres

i. The Government of Sudan has asked the Bank Group to assist in financing the Rahad Irrigation Project, the first stage of the proposed development of an area of 820,000 feddans (fed) (328,000 ha) by irrigation from the Roseires Dam on the Blue Nile. The Bank Group has been involved in the development of irrigation in Sudan since the 1959 Nile Water Agreement provided the legal framework for further irrigation development.

ii. Agriculture is the mainstay of the economy of Sudan, accounting for 40% of GDP and almost all export earnings. It provides employment for 90% of the population of 15.7 million and, while there is seasonal under-employment, labor is scarce at peak seasons. Of the 16 million fed cropped, about 4 million fed are irrigated. The Ministry of Irrigation (MOI) has constructed many projects, and irrigated area has been expanding at about 5% per year, from 2,790,000 fed but there are no more small projects left to develop. Cropping intensities have risen in the past decade, mostly by the introduction of wheat and/or groundnuts into the rotation.

iii. The Rahad project was proposed by consultants engaged under the Bank Group's Loan (234-SU) and Credit (2-SU) for the Roseires Dam project. It was appraised in 1968, 1970 and 1972. Between appraisals, Bank Group staff have worked closely with Sudanese officials to devise a project which is technically sound and which would in resource use and implementation capacity be appropriate to the economy of the Sudan. The present project alternative is smaller than the two previously appraised, has a shorter supply canal fed by pumping rather than gravity, and would produce benefits sooner. It would increase utilization of the Roseires water and employ the MOI's existing resources of staff and machinery.

iv. The project would develop a net area of 300,000 fed that is now a sparsely-populated semi-desert. Water would be pumped from the Blue Nile downstream of Roseires, into an 84 km canal leading to the Rahad river, using hydro-electric power from the dam. Construction, which would take five years, would include: the pumping station and a 100 m free supply canal, 84 km long; the irrigation distribution and drainage system; staff housing and offices; water supplies for sixty new villages; crop transport, processing and storage facilities; and land clearing and preparation at a rate of 100,000 fed per year. The project would be managed by the Rahad Corporation, a new agency which would be modeled on the lines of the successful Sudan Gezira Board. The Corporation would purchase equipment and vehicles and would provide mechanized cultivation, pest control and all other services and inputs needed as well as granting seasonal credit to its 13,700 tenants. Tenancies, mostly of 24 fed, would not be mortgageable and tenants would be obliged to follow a six-course rotation of cotton and groundnuts and to sell their produce to the Corporation.

what is the [illegible]

BEST AVAILABLE

v. The cost of the project without duties is estimated at ESd 29.1 million (US$83.6 million) with a foreign exchange component of 66% (US$55.6 million). Duties, import surcharges and foreign exchange taxes would total ESd 9.2 million (US$26.3 million).

vi. Engineering consultants (US$3 million) would have full responsibility for major works, advise on location and design of large canals and certify work executed by the MOI. Studies would be made for a second stage project, including a review of the optimum utilization of Roseires water.

vii. Agricultural and construction equipment, vehicles, locomotives and rolling stock for the light railway and all other materials and equipment (US$18 million) would be procured by international competitive bidding (ICB). Contracts for major irrigation structures, ginneries and most buildings (US$23 million) would be awarded after ICB but Government would carry out the irrigation distribution system (US$23 million) by force account in order to provide employment for the MOI's permanent labor force and equipment. Miscellaneous buildings, small construction contracts, erection of warehouses, light railway construction and other such works (US$4 million) would be included in ICB but, because of their scattered nature, would probably be won by local contractors.

viii. The cost of inputs and services supplied by the Corporation would be charged to tenants' individual accounts. Assurances would be obtained that a "land and water charge" - required by the Rahad Corporation Act - would be levied on an increasing scale reaching ESd 170, or 41% of gross income, at full development. This would maintain tenant's net incomes at ESd 200-240 (US$575-690) as gross incomes improve. The tenant's net income would be about the national average family income and comparable with those on other irrigation schemes: however, it would be two to three times present family incomes in the project area and provide adequate incentive. At this level of land and water charge the present value of subsidy discounted at 10% over 45 years would be ESd 10.6 million and the recovery index 55%. However, tenants would pay ESd 185 per year in incremental import and export duties which, if considered as a contribution to recovery, would raise the index to 114%.

ix. The project would produce Acala cotton lint, cotton seed and groundnuts for export and vegetables and other crops for domestic use. Annual foreign exchange earnings would be US$42 million gross (US$27 million net). The economic rate of return (ERR) would be between 10% and 18%. If projected 1980 world crop prices are realized and the project is constructed on schedule, the ERR would be 15%. The project would include staff and farmer training and would introduce higher levels of agricultural technology than are now found on irrigated schemes in Sudan.

x. Irrigation of a large tract of semi-desert would entail many ecological changes. In particular, irrigation would encourage spread of the vectors of the very serious endemic diseases, malaria and bilharzia. The project would include a rural hospital, health centers and materials

BEST AVAILABLE

for controlling the vectors and the program for controlling and treating the diseases would be agreed with the Association.

xi. The project would be suitable for credits totalling about US$55 million, or 65% of the total cost. Subject to appropriate assurances, it would be suitable for an IDA credit on usual terms of US$25 million, or 30% of the total cost provided that the remaining US$30 million had been committed by other lenders. IDA should assist Government in finding other lenders.

consumer cooperatives; literacy campaigns; cleanliness and sanitary campaigns; and scholarships. The plans of the Committee would be executed by the staff of the Corporation's Social Development Section (Fig. 3) and financed by a small levy on crops, which would be matched by funds from the Corporation's profits.

6. In the final analysis, the most pronounced influence on the success of settlement may prove to be the demonstration effect of the highly successful settlement of the Gezira Scheme, a few kilometers away across the Blue Nile.

B. Public Health

7. Many diseases are endemic in the region but malaria and schistosomiasis (bilharzia) probably cause the most human misery and economic loss. Both these diseases are associated directly with water and irrigation of the project area would cause a great increase in their incidence. The project would include control measures against the mosquitoes and snails which are the vectors and alternate hosts of the causative parasites. The Ministry of Health, which would be represented on the Social Development Committee, would be responsible for execution of control measures as well as for the staffing and operation of the project hospital and clinics.

Malaria

8. Control measures against the mosquito vector are well understood and widely practiced in the Sudan. Aerial spraying of crops has been general practice in the Gezira and pump schemes for ten years. Mosquitoes have developed very high resistance to common insecticides as a result of long exposure to low dosages from drifting residues. Control measures therefore center on identification of potential breeding grounds and treatment with larvicidal oils applied with simple sprayers. The project would include purchase of larvicides during the four-year construction period.

Bilharzia

9. Schistosomiasis is a parasitic disease. It is caused by worms that lodge in the blood vessels in the intestine and around the urinary bladder and lay millions of eggs, some of which are excreted in the urine and feces of the infected person. If the eggs reach fresh water, they hatch into larvae (miracidia) that infect snails living there. The miracidia multiply inside the snail, and develop into a different kind of larva, called a cercaria, which is shed by the snail by the thousands and can swim. If the cercaria reaches a person in contact with the water, it can dissolve its way through the skin and migrate through the circulatory system to its permanent resting and breeding places.

10. Although WHO has estimated that 150 million people world-wide suffer from schistosomiasis, the feeling among most experts is that in

areas where schistosomiasis is endemic, an equilibrium is set up between the infected person, the schistosome worms inside the body, and the many other debilitating conditions affecting that person, including malnutrition and other parasites. Under these conditions, it becomes difficult to separate out the effects of schistosomiasis in such a way as to prove its economic effects.

11. The most critical problem comes when a new population is infected with schistosomiasis, for example, as a result of a new irrigation project. This can come about in two ways. Either previously infected snails spread into new habitats created by the project, or else new (human) migrants, encouraged by the project, move in and infect previously uninfected snails, thus infecting the adult population previously resident in the area. Thus introduced into a new population, schistosomiasis becomes a severely debilitating disease.

12. Bilharzia (primarily S. Haematobium) has been present in the Sudan since ancient times but it's history prior to 1925 is not well documented. The disease attracted attention when it reached endemic proportions with the start of irrigation from Sennar Dam in 1925. Construction of dams at Jebel Aulia on the White Nile; Roseries, Blue Nile; and Khashm el Girba, Atbara River; and the extension of the irrigated area have increased the hazard while the annual migrations of cotton harvesters, other laborers and nomads have spread bilharzia to every part of the Sudan.

13. Ministry of Health statistics show that in 1970 there were 92,115 cases and 2,989 deaths from bilharzia in the Sudan. Several authorities consider that these official statistics reveal only the "tip of the icebergs" and that bilharzia is second only to malaria as a cause of morbidity. As noted above, bilharzia is associated with irrigation, which provides the ideal habitat for the snail vectors. Floating snails are spread by water movement in canals. The human population is exposed to infection while in the fields and while carrying out domestic chores, such as laundry, or bathing in canals. Children are often infected while playing or swimming: in one survey the marked difference in prevalence between 7-10 year old urban boys (30%) and girls (almost nil) was attributed to social customs which do not allow girls to bathe in the public canals.

14. There have been no "before and after" studies in the Sudan but two surveys give an indication of the influence of irrigation:

- in 1964, 10,000 people were examined in the then undeveloped riverine area which is now submerged by the reservoir of Roseires dam. The prevalence of bilharzia was men, 7%; women, 5% and children, 9%.

- recent surveys in southern Gezira, which has been irrigated for 40 years, showed that the prevalence of bilharzia ranged between 62% and 100% in some villages.

Experience at Khashm el Girba has followed the same pattern. Before the dam and irrigation scheme were constructed, the Atbara River was free of snails and there was little or no bilharzia. Now, after six crop seasons, snails are very common and bilharzia has been brought in by settlers from Wadi Halfa.

15. Control of Snails. The main method of controlling the disease is by reducing or eliminating the population of snails, which are the alternate host of the causative organism. Since snails are most abundant in the presence of aquatic weeds, good canal maintenance is a prerequisite for control but is not enough by itself. The two main control methods are trapping floating snails and use of chemicals (molluscicides). Both methods have been used since about 1940 in the Gezira, although it was not until 1955 that a major snail control program, with annual budgets which reached LSd 250,000, was launched. Snail traps are still used but there is controversy over their effectiveness. One official claims that it costs £10,000 to trap 5,000 snails. The wire mesh of the traps is comparatively fragile and maintenance costs are high.

16. Copper sulfate is the only molluscicide now in routine use in the Sudan: cloth bags containing crystals are suspended in the water at each canal regulator for one day twice per year. The aim is to obtain a concentration of 20-30 parts per million (ppm) throughout the canal but copper sulphate is absorbed by mud and does not travel far.

17. Two new synthetic organic molluscicides, Bayluside (Bayer) and Frescon (Shell), are effective in killing snails in the laboratory and, under some conditions, in the field. It is possible under laboratory conditions to kill snails with concentrations of molluscicides that do not harm fish and other wildlife. Under field conditions, fish will be killed at least near the dispensers. There is no evidence that these synthetic molluscicide formulations affect humans, even when canals are used as sources of drinking water. However, the Association would require the Ministry of Health to review toxicological tests of any formulation and its decomposition products before authorizing its use in the project's control program.

18. Trials with Frescon are being carried out in the Northern Group of the Gezira scheme. Frescon, an emulsifiable concentrate containing 16-1/2% of the active ingredient (n-trityl morpholine), is fed into a canal with a simple constant-flow dispenser to obtain a concentration of 0.075 ppm. The active ingredient is almost insoluble in water and travels in the form of minute crystals. Under certain conditions (ph 6) it hydrolyses rapidly to an inactive chemical (triphenyl carbinol) and it is also precipitated out on silt particles. In the Gezira experiment, the half-life has been estimated at 30-40 hours.

19. In the Gezira trials, Frescon has been found to travel 40 km under favorable flow conditions, i.e. when the irrigation demand is high. Over 100,000 fed have been treated from a dispenser on the main canal with boosters at appropriate points. The optimum regime has not yet been established but results to date suggest that effective control may be attainable with three applications per year at a cost, for chemical alone, of LSd 0.350 per fed.

20. Public Health Measures. Control of snails must be complemented by sanitary engineering measures including:

(a) Siting of villages and, particularly, latrines so as to reduce the danger of contamination of canals and drains;

(b) Arrangements which minimize the need for people to come in contact with water in canals, fields and drains. Most important of these are suitable water supplies which make it unnecesary to draw water directly from canals; and

(c) provision of carefully sited bathing and laundering places.

21. The Corporation would exercise due care in selecting sites for new villages and the project includes provision of water supplies for both existing and new villages in the project area. Provision of other facilities, and also for providing health education, would be the responsibility of the Social Development Committee and the Corporation's Social Development office.

Rural Health Service

22. The Ministry of Health would provide treatment for bilharzia at a 60-bed rural hospital, situated at Project Headquarters; Health Centers at each of three Group Headquarters; and at 15 dispensaries situated in major villages. Existing government designs of appropriate standard would be used. The buildings and equipment would be provided by the project but the staff and operating costs would be financed from the Ministry's annual budget.

C. Ecology

23. The public health aspects of modifying the ecology of the area have been discussed above. Other changes in the flora and fauna of the area may occur but are unlikely to be of major significance. Three aspects of the project, however, are noteworthy; its effect on the Dinder Game Park, the use of aerial spraying, and the possibility of development of alflatoxin on groundnuts.

The Dinder Game Park

24. The Dinder Game Park, about 120 km south of the southern end of the project (Map 1) was established in 1935 and covers 2,470 sq km. While it is the nearest Park to Europe, it is not very accessible and can be reached only by a rather arduous drive or by light aircraft. The resident species (bucks, kudu, warthog, buffalo, lion, hyaena and buffalo) normally stay within the boundaries of the park and would not be affected by the project. However, concern was expressed in 1965 that the gravity proposal then being considered by the MOI would interfere with the migration of four species; tiang (Damaliscus korrigum); roan antelope (Hippotragus equinus); giraffe; and ostrich. Two further immigrant species, Sommering Gazelle and Singa Gazelle, were not thought to be threatened since they migrate north-eastwards to Butana area.

RAHAD IRRIGATION PROJECT

Cost Estimate

	Foreign	Local	Total w/o Duties	Surcharge and Foreign Exchange Tax	[illegible]	Total with Duties	FE, % of Total w/o Duties
	.....	.....	.....	$ 50 '000	.....	.....	%
Preliminaries							
Surveys, Camps, Temporary Water	10	130	140	5	5	150	7
Irrigation Works							
(a) [illegible]							
- Pumps	800	80	880	160	280	1,320 1/	90
- Pumphouse	360	155	515	60	60	635 1/	70
- Nahal Barrage and Regulator	360	200	560	60	70	690 1/	65
- Supply Canal: Structures	900	400	1,300	160	160	1,620 2/	70
: Excavation	350	370	720	60	150	930 2/	35
Subtotal	2,770	1,205	3,975	500	720	5,195	
(b) Distribution, Drainage and Roads							
- Canal Excavation	850	920	1,770	150	370	2,290 2/	35
- Structures: (Irrigation and Drainage)	970	1,380	2,350	170	280	2,800	35
- Drainage Excavation	85	95	180	20	40	240 2/	35
- Roads and Culverts	15	15	30	5	5	40	45
Subtotal	1,920	2,410	4,330	345	695	5,370	
(c) Materials - for Structures in (b) above	140	10	150	30	60	240	95
(d) Ministry of Irrigation Equipment	1,230	50	1,230	250	530	2,060 3/	-
(e) New Equipment, Vehicles and Spare Parts							
- Construction Equipment	610	100	710	120	160	990	85
- Vehicles	280	60	340	60	230	630	80
Subtotal	890	160	1,050	180	390	1,620	
Buildings							
RH Offices, Workshops and Houses	470	460	930	80	190	1,200 4/	50
Sewage and Subdivisions	400	440	840	70	160	1,070 4/	50
Blocks and Sections, incl. Pumphouse Colony	420	450	870	70	170	1,110 4/	50
Subtotal	1,290	1,350	2,640	220	520	3,330	
Services and Utilities							
Electrical Distribution to Group Level	10	10	20	5	5	30	50
Water Supply	35	15	50	5	15	70	70
Road and Bridge to HQ	600	470	1,070	100	100	1,270	55
Communications	120	30	150	20	30	200	80
Subtotal	765	525	1,290	130	150	1,570	
Transmission Lines (C.E.W.C.)							
Substation and Transmission - Pumps	300	115	415	50	120	585	70
Substation and Transmission - HQ and Glas	85	35	120	15	35	170	70
Subtotal	385	150	535	65	155	755	
Agricultural Equipment, Vehicles and Spare Parts							
Farm Equipment (incl. Levelling)	2,400	300	2,700	450	110	3,290	90
Vehicles	180	50	230	40	255	525	80
Subtotal	2,580	350	2,930	490	375	3,825	
Processing and Storage							
[illegible]	800	350	1,150	160	290	1,650	70
Decorticators	170	30	200	30	40	270	85
Warehouses: Materials	320	20	340	60	130	530	95
: Construction	30	20	50	5	5	60	25
Subtotal	1,320	440	1,760	255	305	2,510	
Light Railway							
Materials and Equipment	1,170	50	1,220	200	400	1,840	95
Construction	70	300	370	30	80	400	20
Subtotal	1,240	350	1,590	230	480	2,240	
Public Health							
Village Water Supplies: Materials	230	20	250	45	90	385	95
: Construction	10	90	100	5	10	115	20
Hospital and Clinics	80	60	140	10	30	180	60
Vehicles	50	15	65	10	90	165	80
Inventory of Chemicals	210	5	215	30	-	245	95
Subtotal	580	190	770	100	220	1,090	
Seed Production and Research Farm	70	50	120	10	20	150	60
Settlement							
Bush Clearance	60	80	140	10	20	170	40
Land Levelling	240	150	390	50	50	490	60
Siphons	20	10	30	5	5	40	60
Farmer Payments	-	270	270	-	-	270	-
Subtotal	320	510	830	65	75	1,070	
Administration and Pilot Unit							
Management	350	400	500	-	-	500	20
Agriculture	50	50	100	-	-	100	20
Subtotal	400	450	600	-	-	600	
Consultants to Commission	630	70	700	-	-	700	90
Contingency [illegible]	270	30	300	-	-	300	90
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Contingency							
Physical	1,510	210	2,720	345	610	3,235	70
Price Escalation	1,000	500	1,500	200	300	2,000	70
Subtotal	2,710	1,210	3,920	545	1,010	5,475	
GRAND TOTAL	19,340	9,790	29,130	3,410	5,700	38,230	66

1/ Assumes foreign contractor. If local contractor is awarded contract, the foreign exchange is reduced by 50%.

2/ Includes depreciation of equipment.

3/ Depreciated value at 1970.

4/ Assumes foreign contractor.

June 6, 1973

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