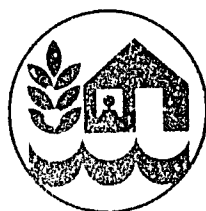




# **IRRIGATION PROJECTS DOCUMENT REVIEW**



## **APPENDIX D: CENTRAL AND SOUTH AMERICA**

**WATER MANAGEMENT SYNTHESIS PROJECT  
WMS REPORT 1**

IRRIGATION PROJECTS DOCUMENT REVIEW

APPENDIX D:

CENTRAL AND SOUTH AMERICA

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## INTRODUCTION

Members of the staff of the USAID-sponsored Water Management Synthesis Project have written this project document review to serve as a resource paper indicating general directions of irrigation project investments in developing countries.

The bulk of the documents obtained were written preliminary to project execution and therefore did not attempt to evaluate either an ongoing or a completed project. It is thus clear that these papers do not purport to represent the projects' actual attainments and shortcomings. For this reason, the reviewers have not attempted to critically assess the merits of executed projects on the basis of this documentation, but rather, have summarized information contained in these documents to arrive at descriptions of individual projects as perceived during the planning stage.

Taking collectively, these summaries afford an overview of methods and strategies used by USAID and IBRD (World Bank) in facing the problems of irrigation development.

## METHODOLOGY

Each of the following summaries is divided loosely into three sections. The first section is an outline giving the project's location, approximate area, expected cost and brief entries on the goals of the project and how these goals are to be achieved. Following this outline are more detailed descriptions of selected aspects of the projects. These descriptions come under the headings "Technical," "Environmental," "Social," "Institutional" and "Economic," headings which generally correspond with those used to organize World Bank appraisal reports.

USAID project papers are less standardized in format with the result that individual project papers may not specifically address certain topics, while having extensive coverage of others. Also, aspects which may sensibly be viewed as one type of factor by the authors of some project papers may legitimately be classified under another heading by other authors. These judgments are reflected in the summaries.

Environmental aspects are not consistently addressed in either USAID or IBRD papers, although in general, the later the document, the more attention is paid to environmental questions. The institutional emphasis in the documents of both organizations pertains mainly to the official channels designated for the construction and operation of projects without casting much light on how water is to be managed by the farmers themselves or on the level of rapport anticipated between irrigators and project personnel.

The third section of the summaries is composed of tables usually including an implementation schedule, a cost breakdown and estimates of present and future productivity within the project area. USAID project summaries also include a copy of the project logical framework, whenever this was available.

## ACKNOWLEDGMENTS

The permission of FAO and the World Bank (IBRD) to perform this project and their assistance in bringing it to completion are gratefully acknowledged.

Recognition of this cooperation, however, in no way implies the support or endorsement of these bodies for this study.

## EXPLANATION OF SYMBOLS

The documents included in this review are organized first by country, then grouped within each country by donor organization, and finally assigned a number within each group. Thus, for example, BO-F-1 stands for Bolivia-FAO-1.

The full project title may be found in the index of projects. The number in parenthesis after the key word is an indication of the frequency of use of the word or words.

### Donor Code

A	USAID
F	FAO
W	World Bank

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CENTRAL AND SOUTH AMERICA

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**TITLE:** Development of Irrigated Agriculture

**PROJECT NO.:** FAO BOL/78/005 - Supercedes BOL/73/008, which was completed August 1977

**COUNTRY:** Bolivia

**KEYWORDS:** Well-pump (tubewell) irrigation (5); surface irrigation (5).

**SUMMARY:** The main activity of the project, which is of interest to the WMS Project, involves working with the 30 or so farmers concerned with a well-pump in each of the villages and helping them develop a complete irrigated farming system approach. This is being done on a pilot program basis and includes finance, exterior, seeds, land leveling and the construction of a pipe distribution system. At present, there are 20 well-pump schemes in the Cochabamba Valley, of which five are equipped with pipe distribution systems. One of these has an improved pipe distribution system (not leaky and full of failures) and most of the land (30 ha) is leveled. Border irrigation is the predominant form of irrigation - few furrows are used.

**LOCATION:** Cochabamba and Tarija Valleys, near Cochabamba.

**CLIMATE:** Typical for 2,500m elevation.

**CROPS:** Maize, potatoes alfalfa, forage crops. The project is encouraging market vegetable production.

**SOILS:** Medium-textured.

**TARGET GROUP:** Farmers of small farms (one hectare on well-pump schemes.)

**BEGIN:** July 1978                      **END:** December 1979      **AREA;** 7,500 ha

**NUMBER OF FARMS:** ?

**CONTRIBUTION:** 7,270 Bolivian pesos (in kind)  
US\$343K - PNUD contribution.

**GOALS:** To transform a predominantly subsistence-type of small farms dependent on the production of rainfed crops, into market-oriented farming enterprises based on intensive year round land use under irrigation.

**PURPOSE:** Irrigated farming systems technology transfer of the farm level, determine and demonstrate optimum irrigated farming systems.



**TYPE OF PROJECT:** Demonstration plot; technical and financial package approach; assistance to farmers; and research to determine optimum irrigated farming systems.

**TECHNOLOGY USED:** Proven common agricultural and irrigation knowledge and experience to apply appropriate farming and surface irrigation practices.

**DOCUMENTS REVIEWED:** Project Plan of Work (12 pages); various progress reports; Initial Project Proposal (20 pages).

**BENEFICIARY INVOLVEMENT:** Farmers in each water users' association which is connected with a well-pump do the earthwork for the distribution pipe as a communal project.

**LOGICAL FRAMEWORK:** Using existing farms, facilities and well-known practices.

**CONTINUATION OF SUMMARY:** A new project extension is being contemplated. This extension will deal with a study of rehabilitation needs for the surface irrigation systems (5,000 ha) in the Cochabamba Valley.

## GENERAL PROJECT DESCRIPTION

The project document calls for activities in two separate geographical regions, the Cochabamba Valley and the Tarija Valley. In each of these regions, two basic objectives are to be fulfilled: the development of small-scale well-pump irrigation schemes (average pump discharge per scheme, 15 liters per second, average scheme size 30 ha, average number of farmers per scheme - 30), and the improvement of three existing surface-water-dependent irrigation schemes totaling 8,400 ha. By applying the concept of self-integrated approach in dealing with these tasks, project activities can be separated into four major categories: institutional and organization aspects; irrigation and drainage infrastructure; technology transfer at the farm level; and supporting investigations. The primary activities have dealt with the well-pump schemes. However, it can be noted that there is no formal separation of a strict sequential order of field activities in regard to attaining the two basic project objectives in the two regions. As results produced in well-pump irrigation schemes may likely be applied in the surface-water-dependent irrigation schemes, and vice versa, at least at the farm level where the physical and socioeconomic conditions are comparable. Furthermore, seasonal weather changes may impose a shifting of field activities from one type of work to another.

## TECHNICAL

The project was set up to initiate the transformation of technology without the delay of preliminary time-consuming field trials. The approach taken by the project in introducing in the farmers' field improved crop production techniques and efficient irrigation practices, consists of applying proven common agricultural and irrigation knowledge and experience. This is being subsequently refined and adjusted through systematic experimentation so as to meet local conditions and requirements. This is being accomplished by establishing demonstration plots on a commercial production scale in cooperation with progressive farmers, willing to follow the technical advice offered by the project.

In addition to setting up demonstration plots, the project will disseminate knowledge of advanced farming practices by offering a package arrangement in connection with land leveling, consisting of technical advice, and crop production loans in the form of seed material, fertilizer, pesticides, tractor work and pump irrigation water, payable at the end of the respective crop season. This package approach containing the element of crop financing on the basis of a cooperative revolving fund, is likely to offer sufficient economic incentive to a core of farmers to accept the project's intention, particularly if extended later on to include marketing security, an aspect to be dealt with by a project consultant.

Since these supporting services will also be provided during the rainy season, the related activities will continue over the entire project.

In order to maximize the demonstration effect, the project has selected one well-pump scheme which is being developed into a functionally integrated model utilizing its land and irrigation water resources in a rational manner. It seems questionable, however, whether this rather ambitious goal can be obtained within the short lifetime of the project as its realization depends primarily on the participation of the majority of the farmers in the well-pump scheme which is being developed into a functionally integrated model utilizing its land and irrigation water resources in a rational manner. It seems questionable, however, whether this rather ambitious goal can be obtained within the short lifetime of the project as its realization depends primarily on the participation of the majority of the farmers in the well-pump schemes selected. Common experience shows that out of a random group of farmers, as represented by our Water Users Association, only a minority may sufficiently be motivated to accept drastic changes in farming practices within a short period of time. Because of this realization, it appears that the project will be extended for an additional time frame.

Some working papers which the project work plan specifically proposed are:

1. Pipeline construction for the conveyance of well-pump irrigation water.
2. Land leveling on small plots.
3. Results of fertilizer, irrigation and crop variety trials.
4. Results of agro-meteorological studies.
5. Concept of well-pump irrigation scheme development in the Cochabamba Valley and the Tarija Valley.
6. Irrigation institutions in relation to water resource development in Bolivia.

From the progress reports reviewed, it appears that the technical aspects of the proposed project are progressing relatively well.

## INSTITUTIONAL

The institutional and organizational task includes: the strengthening of already existing Water Users Associations in the various pump irrigation schemes; the organization of carrying out collective work by member farmers in connection with pipeline construction; and the organization of rotational water delivery to individual farms within given well-pump irrigation schemes. The organization of field days is part of these activities. These activities will be extended to new well-pump schemes as the installation of new well-pump units progresses.

## SOCIAL

While pipeline construction is a communal undertaking, involving each and every member of the Water Users Association of a given well-pump scheme, land leveling is carried out on an individual basis, involving farmers who recognize the benefits derived from this type of land improvement. Land leveling equipment will be made available under the provisions of the project as a FAO/UNDP contribution. Farmers will pay for its operating cost.

## FINANCIAL/ECONOMIC

No significant information given.

TITLE: Irrigation and Conservation of the Bio-Bio River Watershed

PROJECT NO.: FAO CHI/71/549

COUNTRY: Chile

REGION: Central coastal

KEYWORDS: Water management (6); soil conservation (5); training (3); surface irrigation

SUMMARY: The project consisted of: delivering suitable management systems for dry and irrigated lands; establishing sound soil management and water conservation practices; recommending institutional needs; guiding irrigation and drainage practices; strengthening the soil and water management activities of the Ministry of Agriculture; and training.

LOCATION: Bio-Bio River Watershed, 74°W 37°S

CLIMATE: Moderate

CROPS: Corn, beans, wheat, potatoes

SOILS: Mixed

TARGET GROUP: Farmers, administration, technicians, professionals.

BEGIN: 1971                      END: 1977

CONTRIBUTION: 300 million Escudos in kind  
\$953,000 US UNDP Contribution

GOALS: Help Chile obtain self-sufficiency in agricultural production through improvement in soil and water management.

PURPOSE: To assist the GOC in initiating an active program for on-farm development and conservation in a selected irrigation area and associated non-irrigated lands in southern Chile.

TYPE OF PROJECT: Technical assistance to

TECHNOLOGY USED: N/A

DOCUMENTS REVIEWED: Plan of Operation (47 pp.); Results and Recommendations (in Spanish) (55 pp.), 1978.

## GENERAL DESCRIPTION

The general objective of the project was to collaborate in the agro-economic development of both irrigated and nonirrigated lands of the Bio-Bio River watershed through the planning, organization and operation of an adequate advisory and technical assistance service in soil-water management and conservation in selected areas of the watershed. In addition, coordination of supporting investigation and research and training of national staff in these activities was undertaken. The project was concerned primarily with reducing the loss of land by erosion and other deterioration, and increasing agricultural production through improvement in soil and water management. In particular, the project consisted of determining the most suitable management systems for dry and irrigated lands on the basis of soil conditions, water supply, drainage requirements and other factors affecting farming in the watershed served by the Bio-Bio Sur Canal and other selected areas of the Bio-Bio River Basin.

The project also endeavored to establish sound soil management and soil water conservation practices for the irrigation and rainfed lands in the area. In addition, an effort was made to study the institutional and operational problems of the water delivery system with a view to recommending the appropriate institutional and operational changes which were needed to implement improved irrigation and conservation practices.

A major aspect of the project was guiding the establishment of improved irrigation and drainage and other on-farm development works, and the preparation of pre-investment projects for irrigation drainage and agricultural development for the area. Planning, organization and administration of a comprehensive soil-water conservation and management program with particular reference to strengthening the activities of the Ministry of Agriculture at the regional level for rendering, in an integrated manner, the advisory and technical assistance services needed in implementing the recommendations above. Another important aspect of the project included training local personnel in the fields covered by project activities so that qualified and trained staff would be available for carrying out similar works in other areas.

## TECHNICAL

The most important technical aspect of the project in relation to irrigation was that of determining the on-farm irrigation and drainage development requirements and the establishment of guidelines for the planning of such developments on individual farms. This activity included:

1. The study and design of water distribution systems;
2. Evaluation of alternative methods of irrigation such as flooding, border dike, basin, contour, furrow, and sprinkle when applied to different soils and crops;
3. The study of water application efficiency at the farm level and its improvement by controlling the timely supply of water according to the nature of soils, crops, slopes and methods of irrigation;
4. The study of drainage requirements at the farm level;
5. Preparation of detailed design for land grading and leveling according to the recommended irrigation method.

In a way, these activities were carried out. However, they did not seem to be done in the depth that the original project has indicated. The irrigation efficiencies were found to be quite low. However, the expense of improving them was on the high side, and required an excessive amount of financial inputs.

Other aspects of the soil water management were finding optimum irrigation and management practices in terms of water requirements and fertility requirements under irrigation. Some tests were run and recommendations made as to fertility and water needs. By going to improved irrigation methods, it would be possible to increase the land area under irrigation substantially. Improvements of about 50 percent seemed in order.

#### INSTITUTIONAL

The institutional activities were mainly in the area of working with the existing agricultural staffs and training programs as mentioned earlier. In addition, the soils were studied and mapped.

#### SOCIAL

None given.

#### FINANCIAL/ECONOMIC

None given.

TITLE: On-Farm Irrigation

PROJECT NO.: 513-0297

COUNTRY: Chile

REGION: LA

KEYWORDS: Credit (5); canal rehabilitation (3); water management training (3).

SUMMARY: The project will make available \$13.2M for medium term credit to farmers for on-farm improvements such as land leveling, fruit plantations, purchases of machinery and dairy cattle, and improved on-farm water delivery systems. Four complementary components are: (1) expansion of research in on-farm water management; (2) expansion of the local extension service; (3) technical assistance for improvement of the water allocation model for the basin; and (4) rehabilitation of the main canals.

LOCATION: Limari River Basin (Ovalle)

CLIMATE: Cs

CROPS: Corn, potatoes, vegetables, fruits

SOILS:

TARGET GROUPS: The region is the poorest in Chile. Credit will be available only to the small farmer (less than 20 ha).

BEGIN: FY 77                      END: FY 81                      AREA: 16K ha

NUMBER OF FARMERS: 4K

CONTRIBUTION:	U.S.	\$ 7.000M	Loan
			water management specialist
	GOC	\$ 10.446M	
	TOTAL	<u>\$ 17.446M</u>	

GOALS: To increase income, rural employment and productivity of Limari River Basin small farm families.

PURPOSE: To increase the economic return from irrigation water use.

TYPE OF PROJECT: Large-scale, credit to small farmers.

TECHNOLOGY USED: Heavy equipment when necessary.



DOCUMENTS REVIEWED: Project Paper (170 pp)

PROJECT ORIGIN AND BASE LINE DATA: Similar projects are being carried out by IBRD and the Inter-American Development Bank.

BENEFICIARY INVOLVEMENT: Credit will be available to small farmers and to water user associations, and they will determine the type of work to be done.

LOGICAL FRAMEWORK: Consists of 4 pages attached to reviewed documents.

PERT CHART: Attached to reviewed documents.

## GENERAL DESCRIPTION

The Limari River Basin is an area of traditional irrigation, and a large infrastructure is in place, including three large storage reservoirs. However, much of the system is old and in disrepair. Since much land is available but water is limited, this project will provide credit to farmers to improve water efficiency, ultimately to increase the irrigated land area by 32%.

## TECHNICAL

A. Examples of small projects to which credit might be applied are:

1. Construction of farm ponds to prevent night water wastage and provide a form of demand system to farmers;
2. Land leveling using soil scrapers and planes;
3. Changes in field design;
4. More on-farm irrigation structures including siphon tubes and gated pipe; and
5. Improvement of lateral canals by farmer associations.

B. At the beginning of each season, farmers will be advised on how much water will be available to them, based on a computer model of snowmelt, expected precipitation, and storage capacity. Snow pillows and a satellite relay will provide data on mountain snowfall that is not presently available.

C. The project will provide \$35K per year for a four-man research group to work at the project, to investigate applied technologies such as irrigation scheduling, use of sprinklers, etc.

D. GOC funds (\$30M) will be used to rehabilitate parts of the main canal system. At present, losses are believed to be as high as 70% in an area with 3,000 km of canal. Those with the highest losses will be chosen for rehabilitation.

E. A water management specialist will be hired and assigned to the Commission for Irrigation and Agriculture in the Limari Valley (CORVAL) to assist in improvements in the present water allocation system, to develop a system of water rights and a better water use rate structure.

## INSTITUTIONAL

There are three types of indigenous water user associations in the project area. These are: (1) informal associations of from three to 180 members; (2) legal corporate associations; and (3) distribution and regulatory entities (juntas de vigilancia) which coordinate among the above associations. It is expected that this administrative system will be continued and encouraged.

Project execution and coordination will be by the National Irrigation Commission (CNR). Credit will be distributed by the Central Bank to public and private lending institutions.

The loan will finance the placement of 11 new extension agents in the project area.

## SOCIAL

While not all farmers will ask for or be eligible to receive credit, anyone can benefit from the research and improved crop technology, and from the canal improvements. These changes should have a widespread effect.

It is estimated that 20% of small landowners are women, who will thus benefit directly from the available credit.

## FINANCIAL/ECONOMIC

The annual budget summary is given on page 73 (attached).

For the IRR analysis, an interest rate of 20% was considered to be the minimum for established farm efforts (medium-sized) and 40% was minimum for marginal and part-time small farmers. A 20-year period was used. For 10 sample projects analyzed, eight had an IRR greater than 50%, and all were above 15%, the present cost of capital. This reflects the fact that the irrigation infrastructure is already in place, and the IRR is based on efficient use of present resources.

The major economic benefits will be:

1. Increased land availability, by increasing the value and use of presently under-used land;
2. Increased productivity;
3. Changes in cropping toward fruit, nuts and livestock; and

(4) Increased employment, especially of contract labor during seasonal peak demands.

The credit will be given to local lending institutions at 4-1/2% interest, and they in turn will lend to farmers at 8%. The actual interest rates will be adjusted for the annual inflation (about 300%) which is characteristic of the economy. Credit will only be available for 40% of full potential need in the area. The remainder will need to be allocated later or made up by rollover of credit funds. Credit will be given to farmers with less than 20 ha, to beneficiaries of the agrarian reform, and to agricultural cooperatives where 80% of members own less than 20 ha.

The small farm budget was analyzed using the Small Farm Budget computer program at AID/W. Family income will increase between 322% and 8,270%, depending on farm size. The highest increase is for the 4.8 ha smallest farm size.

Cash Flow Projection and Estimated Lending Levels (000 US\$)

Year	1	2	3	4	5	6	7	8	9	10
<b>I. A. Beginning Balance</b>										
<b>B. Receipts</b>										
1. AID Loan	940	1,765	2,355	1,940	-	-	-	-	-	-
a) Medium Term credit	(700)	(1,600)	(2,300)	(1,900)	-	-	-	-	-	-
b) Technical Assistance	(240)	(165)	(55)	(40)	-	-	-	-	-	-
2. Counterpart Funds	1,419	3,009	3,725	2,293	-	-	-	-	-	-
a) Medium Term credit	(700)	(1,600)	(2,300)	(2,100)	-	-	-	-	-	-
b) Technical Assistance	(219)	(159)	(175)	(193)	-	-	-	-	-	-
c) Civil Works	(500)	(1,250)	(1,250)	(7--)	-	-	-	-	-	-
3. Collection from Subloans										
a) Principal	-	-	-	155.6	511.2	1,022.4	1,484.2	1,002.3	1,115.9	1,280.8
--AID	-	-	-	(77.8)	(255.6)	(511.2)	(731.0)	(493.7)	(549.6)	(630.8)
--GOC	-	-	-	(77.8)	(255.6)	(511.2)	(753.2)	(508.6)	(566.3)	(650.0)
b) Interest (8%)	-	112	368	736.0	1,056.0	1,056.0	1,056.0	1,056.0	1,056.0	1,056.0
c) Payment of principal	-	-	-	-	-	-	-	538.5	538.5	538.5
<b>TOTAL RECEIPTS</b>	<b>2,359</b>	<b>4,886</b>	<b>6,448</b>	<b>5,124.6</b>	<b>1,567.2</b>	<b>2,078.4</b>	<b>2,540.2</b>	<b>2,596.8</b>	<b>2,710.4</b>	<b>2,875.3</b>
<b>II. C. Disbursements</b>										
1. Subloans made	1,400	3,200	4,600	4,155.6	511.2	1,022.4	1,484.2	1,002.3	1,115.9	1,280.8
2. Technical Assistance (AID and GOC), Civil Works	959	1,574	1,480	233.0	-	-	-	-	-	-
3. Payment of Principal	-	-	-	-	-	-	-	538.5	538.5	538.5
4. Return to financial intermediary										
a) Central Bank - 4.5%	-	63.0	207	414	594	594	594	594	594	594
b) Commercial Banks 3.5%	-	49.0	161	322	462	462	462	462	462	462
<b>TOTAL DISBURSEMENTS</b>	<b>2,359</b>	<b>4,886</b>	<b>6,448</b>	<b>5,124.6</b>	<b>1,567.2</b>	<b>2,078.4</b>	<b>2,540.2</b>	<b>2,596.8</b>	<b>2,710.4</b>	<b>2,875.3</b>

**Assumptions**

1. Total Resources - \$17,446 million
2. Term of the loan - 7 year grace period, 13 years amortization principal
3. Interest - 2% grace period; 3% thereafter
4. Terms average subloans - 12 years total, 3 years grace period
5. Rollovers used for relending
6. All funds available are lent on the first day of the year.
7. Counterpart funds provided in full at beginning of each year.
8. Spread-Central Bank-Commercial Banks (4.5%). Commercial Banks - Final Borrower (3.5%).
9. Central Bank interest spread does not accrue to the fund.

TITLE: Small Farm Irrigation Systems

PROJECT NO.: 519-0184

COUNTRY: El Salvador

REGION: LA

KEYWORDS: Gravity fed sprinkler (3); diversion dams (3); surface irrigation (3).

SUMMARY: The project will organize rural communities to construct their own irrigation systems using very simple existing technology. It will be a cooperative enterprise of the Office of Community Development and the Office of Irrigation and will be aimed at the more remote areas of irrigable small farmer lands.

LOCATION: Throughout the country.

CLIMATE: Ar-Aw

CROPS: Vegetables, fruit.

SOILS:

TARGET GROUP: Owners and operators of small farms (average 1 ha)

BEGIN: 1978                      END: 1983                      AREA: 5,000 ha

NUMBER OF FARMS: 6,100

CONTRIBUTION:	USAID	\$ 2.3 M loan
	Community	1.2 M
	GOES	2.0 M
	TOTAL	<u>\$ 5.5 M</u>

GOALS: To increase the food production, productivity, and income of the small farmers.

PURPOSE: To expand the capacity of the GOES to assist low income farmers, or to obtain and utilize needed water resources through the development and construction of appropriate technology irrigation systems.

TYPE OF PROJECT: Large-scale community organizing, construction of small irrigation systems.

TECHNOLOGY USED: Diversion dams, gravity-fed irrigation, pickup trucks, surveying equipment.

DOCUMENTS REVIEWED: Project Paper (180 pp).

PROJECT ORIGIN AND BASE LINE DATA: DIDECO and DGRD have collaborated on six small-scale irrigation projects in the past.

BENEFICIARY INVOLVEMENT: Farmers will be organized into irrigation associations prior to consideration for aid, and will provide labor and local material for construction.

ACTUAL STARTING DATE: N/A            COMPLETION DATE: N/A

LOGICAL FRAMEWORK: Consists of 3 pages attached to the reviewed documents.

PERT CHART: attached to the reviewed documents.

## GENERAL DESCRIPTION

The project will include the following:

1. Establishment of a project office (to be named the Office of Small Scale Irrigation Systems - OSSIS) for implementation control;
2. Construction of approximately 5,000 ha of small scale irrigation systems;
3. Training of approximately 100 extension agents in water and land use management;
4. Short-term training in irrigation science of approximately four engineer-agronomists attached to the OSSIS;
5. Approximately 48 person-months of technical assistance in the form of a long-term project advisor from the U.S. to assist in the supervision and coordination of all implementation activities;
6. Approximately 12 person-months of short-term technical assistance to assist the project advisor in implementation and evaluation of the project;
7. Construction materials and equipment;
8. Community labor and materials; and
9. GOES salaries and operating expenses applied to the project in the activities of community organization and development, engineering and design work, and construction supervision.

## TECHNICAL

The project will use technologies that are easily within the experience and skill of the small farmer. In most cases, the system will consist of a diversion dam, a short (1-2 kilometer) conveyance canal lined with brick or rock, and farm channels. In some cases, if technically feasible, gravity-fed sprinklers will be investigated. The improved availability of water will provide drought insurance during the wet season and the possibility of double-cropping in the dry season. It is expected that there will be a shift to more profitable fruit and vegetable crops on many farms. On the average, the system will require two dry seasons to complete construction.



Detailed criteria have been prepared for subproject selection. They include:

1. Average farm size in each subproject from one to five hectares (but always less than 10 hectares);
2. Demonstration of community organizing and farming ability;
3. Availability of water in the dry season;
4. Irrigation potential of farms; and
5. General agronomic potential of the farmers.

A detailed subproject selection process is given on pages 64 and 65 of the project paper. This includes limits on farm size, target population, and a requirement that the 25-year discounted income flows must exceed project cost.

#### INSTITUTIONAL

The project will require the coordinated efforts of two separate agencies of the GOES: the DIDECO (Community Development Division) of the Ministry of Interior and the DGRD (Division of Irrigation and Flood Control) of the Ministry of Agriculture. These two offices have already produced a fruitful collaboration on a pilot scheme with six projects and are willing to further coordinate by setting up a joint office, the OSSIS (Office of Small Scale Irrigation Systems) which will be given funding and staff by both DIDECO and DGRD.

In practice, the DIDECO will enter a potentially irrigable area and begin community organization. If this is successful, the DGRD will begin technical analysis and design of the project. The farmers will be organized into irrigator associations, probably centering on a water master who will allocate water and provide adjudication. The water user associations will eventually take over O&M of the canals from DGRD.

One hundred extension agents of CENTA (the National Center for Agricultural Research) will be assigned to project areas. They will be given training on water efficiency, fertilizers, pesticides, and the initiation of new projects.

There will be an ongoing evaluation of the project to provide redirection when necessary as well as a final review evaluation.

## SOCIAL

Farmers are independent, but willing to organize to achieve community goals. There are no inherent problems in organizing farmers.

Projects will only be carried out in areas where the average holding is less than 10 hectares. In general, the DGRD has not been concerned with the size of the landholding.

## FINANCIAL/ECONOMIC

The cost of project inputs/outputs is given on page 33 (attached).

A sample cost breakdown for a 100 hectare project is given on page 158 (attached).

Analysis of the six pilot projects has shown an average net increase in income of 30%. The effects are better for the smaller farms (a 53% increase in the one-half to one hectare range). Most of this improvement is due to changes in crop mix permitted by introducing irrigation.

For the worse case with low benefits and high costs, the E/C ratio is 1.06 based on a 15% discount rate used in El Salvador. Using the same data provides an IRR of 16.2%.

The farmers will provide 60% of instruction costs in the form of labor and local materials. It is not the policy of GOES to require amortization of irrigation projects by the farmers.

It is estimated that these systems will cost about \$250/hectare for materials.

The GOES is prepared to assume full funding of the project at the end of five years.

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7. COSTING OF PROJECT OUTPUTS/INPUTS  
(in \$000 or Equivalent)

PROJECT PAPER

Project #519-0184

Title: Small Farm Irrigation Systems

Project Inputs	Project Outputs			Total
	#1	#2	#3	
AID Appropriated				
Construction Materials & Equip.	1,250			1,250
Vehicles	275			275
Technical Assistance	250	70		320
Participant Training			70	70
Inflation Factor	240			240
Contingency	145			145
Total	2,160	70	70	2,300
Host Country: Government				
Administration	1,322			1,322
Fuel, Lubricants & Maintenance				
Vehicles	245			245
Overhead	165			165
Inflation Factor	268			268
Subtotal	2,000			2,000
Host Country: Private				
Local Labor by Community	980			980
Inflation Factor	220			220
Subtotal	1,200	-	-	1,200
TOTAL HOST COUNTRY	3,200	-	-	3,200
GRAND TOTAL	5,360	70	70	5,500

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Illustrative Subproject Cost Breakdown  
"San Lorenzo"  
 100 Hectares

<u>Amount</u>	<u>Unit</u>	<u>Materials</u>	<u>\$</u> <u>Unit Price</u>	<u>\$</u> <u>Subtotal</u>
17,000	ea	Clay tile brick 0.30 x 0.30*	0.10	17,000.-
115,000	ea	" " " 0.25 x 0.25	0.10	115,000.-
7,000	ea	" " " 0.20 x 0.20	0.10	700.-
7,000	ea	Regular Construction Brick	0.09	630.-
1,500	bgs	Cement	3.00	4,500.-
212	m <sup>3</sup>	Sand	3.20	678.40
35	m <sup>3</sup>	Crushed Rock	9.00	315.-
176	m <sup>3</sup>	Rock	6.00	1,056.-
15	ea	Pre-cast Concrete Channels 4 meters long	20.00	300.-
27	ea	Concrete Pipe Ø15"	5.20	140.-
2	ea	" " Ø24"	10.00	20.-
12	ea	" " Ø30"	40.00	480.-
40	ea	" " Ø8"	2.00	80.-
13	qq	Reinforcing Steel Ø1/4"	23.20	301.60
25	qq	" " Ø3/8"	20.00	500.-
1	qq	" " Ø1/2"	19.20	19.20
5	qq	" " Ø5/8"	19.20	96.-
16	ea	Wood Planks 1"x11"x15 ft	6.00	96.-
5	doc	" Studs 2"x4"x15 ft	4.20	21.-
12	doc	" Planks 1"x14"x15 ft	58.00	696.-
5	doc	" Planks 1"x4"x15 ft	28.00	140.-
120	lbs	Tie Wire	0.32	38.40
9	lbs	Nails 3"	0.32	2.88
7	lbs	" 4"	0.32	2.23
60	lbs	" 2.1/2"	0.32	19.20
5	ea	Diversion Gates	80.00	400.-

TITLE: Small Farmer Development

PROJECT NO.: 520-0233

COUNTRY: Guatemala

REGION: LA

KEYWORDS: Resettlement (5); rural roads (3); contour ditch and furrow irrigation (3); institution building (1).

SUMMARY: The project provides for four activities in different areas of the country: (1) Five thousand families will be resettled to a relatively unpopulated area. An agricultural infrastructure, roads, and financial credit will be provided to them. (2) A labor-intensive road project will provide construction of 280 km of farm-to-market roads. (3) A pilot program will establish 5,000 ha of small-scale irrigation and 5,000 ha of contour ditch and furrow irrigation, using labor-intensive methods. (4) The sector coordination and planning unit in the Ministry of Agriculture will be strengthened, and programs established for service training of field technicians, and for scholarship training of technical and managerial personnel.

LOCATION: Throughout Guatemala.

CLIMATE: Aw

CROPS: Corn, wheat, beans, spices.

SOILS: N/A

BEGIN: 1976                      END: 1981                      AREA: 20K ha

NUMBER OF FARMS: 2,000

CONTRIBUTION:	USAID	\$ 1.875 M grant
		13.000 M loan
	Other	2.5 M farmers
	GOG	10.649 M
		<hr/>
	TOTAL	\$28.024 M

TARGET GROUP: Rural poor

GOALS: To improve the quality of life and increase the incomes of rural Guatemalans.

**PURPOSE:** To increase the agricultural productivity and create alternative employment opportunities in rural areas by increasing the productive capacity of small farmer land resources, opening new lands for settlement, expanding the farm-to-market transportation infrastructure, and strengthening the capacity of public agricultural sector organizations.

**TYPE OF PROJECT:** Resettlement and land conservation pilot projects.

**TECHNOLOGY USED:** D6 tractors, trucks and scrapers for road-building. Much unskilled hand labor will be employed, and final irrigation systems will use simple technology.

**DOCUMENTS REVIEWED:** Project paper (160 pages).

**PROJECT ORIGIN AND BASE LINE DATA:** A similar project to resettle 2,000 families has been successful in four years under the guidance of the Maryknoll Fathers. Their experience will be used further. Nine months of preparation went into the final project outline.

**BENEFICIARY INVOLVEMENT:** The farmers are responsible for preparing and maintaining their own land. Local people will be hired for the road projects.

**ACTUAL STARTING DATE:** N/A .      **COMPLETION DATE:** N/A

**LOGICAL FRAMEWORK:** Not available.

**PERT CHART:** Attached to Reviewed Documents.

## TECHNICAL

### A. New Lands

It is felt that the best approach is to allow the greatest possible latitude to farmers for the direction and rate of development. The government will not be a caretaker, but will provide technical assistance when necessary.

The land in the Northern Transversal Strip (NTS) is presently owned by the government's land transformation agency (INTA). Agreements will be reached with the Cooperative Federation or with individual cooperatives to accept responsibility for land development. The sponsoring cooperative will then screen farmers, provide them with a limited training concerning objectives and legal obligations, and transport them to the site. Farmers will be organized in "blocks" of 850, each block being a future community. The sponsoring cooperative will provide the most basic infrastructure (access roads and farm diversions), but the farmers will clear the land themselves. When the time is right, each block will form its own cooperative, which will be responsible for self-governance, technical assistance, credit, agricultural inputs, marketing, disease control, infrastructure, and channels of external assistance.

This subproject will begin with settlement of 2,000 families on 10K ha of land already surveyed and prepared. Design studies will be continued on 30K more hectares, which will be available for 3,000 more families. Finally, with the "pilot" experience developed here, a potential 540K ha will be studied for settlement.

Technical assistance in the amount of \$435K will provide for a cooperative management specialist and a settlement planning specialist (three years each), and for nine months of short-term specialized assistance.

### B. Access Roads Improvement

To complement a project of the IDB (construction of 300 km of secondary rural roads), this project will undertake the construction of 280 km of tertiary and feeder roads. Objectives are (a) to provide access to concentrations of small farmers, and (b) to employ locally available excess labor to the greatest possible extent. Roads will be constructed in the Highland, Oriente, and Northern Lowlands regions.

The project includes building of new, minimum-standard all-weather roads, upgrading of existing service tracks, and the elimination of particular bottlenecks in existing service tracks.

### C. Land Resources Improvement

The farmers suffer from inadequate rainfall and from a high rate of erosion when the rains do fall. Two pilot projects aimed at small areas (50 ha), will develop methods for attacking these problems:

1. Small-scale irrigation (5,000 ha). Simple labor-intensive systems will be built, involving stream diversions to one farm or group of farms. When required, this will involve more complex systems such as gravity-fed sprinkler lines or even pump life systems.

2. Soil conservation (5,000 ha). This activity may be carried out in conjunction with irrigation systems. Contour furrows and ditches, built by hand, as well as contour farming, at a cost of \$45/ha, will be introduced to the farmers.

The DIGESA (Directorate General of Agricultural Services) will organize two teams to provide technical assistance for implementation of subprojects, including feasibility studies, organization of farmers, selection, design and building of structures, and advising on farm technology. The resulting plans will be submitted to BANDESA (National Agricultural Development Bank) for financing at 8% for 10 years.

Technical assistance will consist of an irrigation engineer and a soil conservation specialist (36 man-months each).

### D. Human Resources Development

Operations in the Ministry of Agriculture have been hampered by the low level of training among personnel (less than 5% with training beyond secondary level), lack of planning, poor data base, and poor coordination among agencies. This element of the loan will provide support for:

1. Assistance to establish an expanded Sector Planning and Coordination Office within the Ministry of Agriculture. Included here will be 144 man-months of long-term technical assistance in the fields of agricultural economics, regional planning and analysis, programming and budgeting. Sixty man-months of short-term technical assistance will provide for sector planning strategy and development of evaluation methodologies.

2. Establishment of an integrated, sector-wide pre- and in-service training program. Primary recipients will be field technicians and their supervisors (1,000 of 6,500 total employees). Pre-service training will be provided for new



employees at six-month intervals. Thirty-six man-months of long-term technical assistance will be provided.

3. Advanced training in the U.S. and third countries for selected personnel. GOG funds will finance 400 man-years of study at San Carlos University. AID and GOG funds will finance 56 man-years of study abroad at the technician, M.S., and Ph.D. levels, of which 42 man-years will be in the U.S.

#### E. Technical Assistance

Two full-time advisors will provide technical assistance for the design and implementation of the improved Food Marketing Systems and Market Towns Development Loans.

#### SOCIAL

The project, by providing employment for Indian peasants in their own areas, will reduce the amount of seasonal out-migration. The farmers are aware of the benefits of rural roads and irrigation, and are ready to participate in any regional development.

#### FINANCIAL

A schedule of project expenditures is given on pages 108-109 (attached).

The IRR for the New Lands subproject is 31% and for the Access Roads Improvement is 30%.

**TABLE II**  
**Schedule of Project Expenditures**  
 (US \$000)

	Y E A R					TOTAL
	1976	1977	1978	1979	1980	
<b>I. LAND SETTLEMENT ACTIVITY</b>						
Cooperative Infrastructure & Services	\$ --	\$ 190.8	4 349.8	\$ 508.8	\$ 540.6	\$1,590.0
Production & Medium-Term Credit	--	100.0	120.0	460.0	1,320.0	2,000.0
Secondary Roads and Social Infrastructure	--	199.8	331.8	431.0	309.4	1,272.0
Technical Assistance	91.5	265.2	356.2	355.7	326.4	1,395.0
Cadastre and Land Use Studies	--	826.5	825.5	--	--	1,652.0
Subtotal	<u>91.5</u>	<u>1,582.3</u>	<u>1,983.3</u>	<u>1,755.5</u>	<u>2,496.4</u>	<u>7,903.0</u>
<b>II. ACCESS ROADS</b>						
A. Construction	--	100.0	25.0	15.0	10.0	150.0
1. Engineering	--	45.0	72.0	108.0	105.0	330.0
2. Supervision	--	35.0	77.0	87.0	61.0	260.0
3. Administration	--	1,047.0	1,552.0	1,858.0	1,793.0	6,250.0
4. Construction	--	11.0	60.5	132.0	214.5	418.0
B. Maintenance	--	--	--	--	--	--
Subtotal	<u>--</u>	<u>1,238.0</u>	<u>1,786.5</u>	<u>2,200.0</u>	<u>2,183.5</u>	<u>7,408.0</u>
<b>III. LAND RESOURCES IMPROVEMENT</b>						
Personnel Costs	--	72.0	72.0	72.0	72.0	288.0
Operating Expenses	--	28.0	28.0	28.0	28.0	112.0
Vehicles	--	48.0	--	--	--	48.0
Equipment and Supplies	--	10.0	6.0	5.0	5.0	26.0
Credit Fund	--	50.0	100.0	150.0	200.0	500.0
Social Payment Fund	--	25.0	50.0	75.0	100.0	250.0
Contingency (8.7%)	--	20.2	22.4	28.7	35.7	107.0
Technical Assistance	75.0	110.0	110.0	35.0	--	330.0
Subtotal	<u>75.0</u>	<u>363.2</u>	<u>388.4</u>	<u>393.7</u>	<u>440.7</u>	<u>1,661.0</u>

	Y E A R					TOTAL
	1976	1977	1978	1979	1980	
<b>IV. HUMAN RESOURCES</b>						
<b>A. Sector Planning and Coordinating Office</b>						
1. Personnel Cost	\$ --	\$ 338.2	\$ 338.0	\$ 347.8	\$ 337.8	\$1,361.8
2. Technical Assistance	178.7	275.0	275.0	96.3	--	825.0
3. Operating Cost	--	100.0	100.0	100.0	100.0	400.0
4. Equipment & Supplies	--	100.0	--	--	--	100.0
5. Contract Services	--	80.0	100.0	100.0	100.0	380.0
<b>B. Pre- and In-Service Training</b>						
1. Personnel Cost	52.8	52.8	52.8	52.8	52.8	264.0
2. Operating Expenses	50.0	50.0	50.0	50.0	50.0	250.0
3. Vehicles	94.0	--	--	--	--	94.0
4. Equipment & Supplies	105.0	23.0	23.0	23.0	23.0	197.0
5. Contract Instructional Serv.	20.0	20.0	20.0	20.0	20.0	100.0
6. Training Costs	31.0	35.0	35.0	35.0	35.0	171.0
7. Repair of Atitlan	15.0	--	--	--	--	15.0
8. Institution Salaries	57.6	57.6	57.6	57.6	57.6	288.0
9. Amatitlan Operational Costs	70.0	70.0	70.0	70.0	70.0	350.0
<b>C. Scholarship Program</b>	--	211.5	384.0	129.5	--	725.0
Subtotal	<u>674.1</u>	<u>1,413.1</u>	<u>1,505.4</u>	<u>1,082.0</u>	<u>846.2</u>	<u>5,520.8</u>
<b>V. TECHNICAL ASSISTANCE FOP:</b>						
Marketing Services	85.0	110.0	--	--	--	195.0
Market Town Services	<u>40.0</u>	<u>50.0</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>90.0</u>
Subtotal	<u>125.0</u>	<u>160.0</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>285.0</u>
<b>GRAND TOTAL</b>	<u>\$ 965.6</u>	<u>\$4,756.6</u>	<u>\$5,663.6</u>	<u>\$5,431.2</u>	<u>\$5,966.8</u>	<u>\$22,783.8</u>

TITLE: Small Farm Development/Black Bush

PROJECT NO.: 5040075

COUNTRY: Guyana

REGION: LA

KEYWORDS: Crop technology (5); land leveling (3); surface irrigation (3).

SUMMARY: The Black Bush Project is to be financed from several sources, including IDA, IFAD, and AID. The AID component will provide for improved production techniques, purchase of and improved maintenance for field machinery, rice drying and storage facilities, and new headquarters and personnel for the area extension service.

LOCATION: Black Bush Region

CLIMATE: Ar

CROPS: Rice, vegetables.

SOILS: Marine silt and clay.

TARGET GROUP: The small farmer, who will rent or own a landholding in the project.

BEGIN: FY 1978                      END: FY 1984                      AREA: 46,600 ac

NUMBER OF FARMS: 5,713.

CONTRIBUTION:	U.S.	\$ 7.5 M loan (\$1.4 M grant)
	IFAD	10.0 M
	IDA	10.0 M
	Other	8.5 M
	(unspec.)	
	GOG	6.8 M
	TOTAL	<u>\$42.8 M</u>

SECTOR GOAL: To improve the standard of living in rural areas of Guyana.

SUBGOAL: To increase small farmer income and productivity.

OVERALL PROJECT PURPOSE: To increase the production of rice and other food crops by 6,000 small farmers in the Black Bush region.

**PURPOSE OF AID-FINANCED COMPONENT:** To provide a package of services, complementary to other donor-financed civil works which includes A&E services for the designing and construction phase of the overall project and services which will maximize production potential and benefits.

**TYPE OF PROJECT:** Support services for large-scale land reclamation and irrigation projects.

**TECHNOLOGY USED:** Tractors, combines, disk harrows, ditcher, border disk and land levelers.

**DOCUMENTS REVIEWED:** Project Paper (230 pp).

**PROJECT ORIGIN AND BASE LINE DATA:** An initial feasibility study was made by Harza Engineering, and was further supplemented by World Bank studies. This AID project also funds some feasibility studies for future project components.

**BENEFICIARY INVOLVEMENT:** Farmers will crop the land supplied to them.

**LOG FRAME:** Consists of one page attached to reviewed documents.

**PERT CHART:** Attached to reviewed documents.

## GENERAL DESCRIPTION

This project is broken down into two components:

1. Civil works, including a 1,000 cfs pumping plant, rehabilitation of the irrigation supply and drainage system, and installation of water control devices; and
2. Complementary services, including seed production, research, extension, water management, marketing and training.

The civil works will be financed by IDA, IFAD, and another, unspecified donor; AID will finance the complementary services, as described below.

## TECHNICAL

### A. Production

Rice will occupy 92% of project land, but other crops (vegetables) will supply 34% of incremental income. Therefore, the project will stress both finding integrated production packages for each crop, and providing the individual farmer with a mix of crops that best fits his situation.

1. Tractors and equipment will be bought and provided on a rental basis to farmers for land-leveling and seedbed preparation. Heavy equipment will include tractors, land levelers, disk harrows, border disks, ditchers and combines.
2. Data will be collected on present water management practices, and these will be studied, revised, and improved methods will be introduced.
3. The machine pool will be upgraded by providing all necessary tools and spare parts, introducing better record-keeping and a program of continuous maintenance, proper scheduling of machine use, and training for 105 operators and mechanics. They will service 42 combines, 66 tractors, and related equipment.
4. A seed processing and testing facility will be established to ensure high quality seed. Twenty-four hundred acres of certified seed crop will provide for the needs of most of the region.
5. An extension specialist and an adaptive research specialist will be provided to train extension agents in research and education of farmers. Eighteen new agents will be recruited, making a total of 21 in the area.

6. Fifty-one man-months of in-country and overseas training in various of the above subjects will be provided to Ministry of Agriculture personnel.

#### B. Marketing

Facilities will be provided for storage and drying of 200K bags of rice. Two buildings with the necessary grain augers and elevators will be used. This will provide for about one-half of future project requirements.

#### C. Project Management

1. In addition to 196 man-months of technical assistance in the production areas described above, 470 man-months of engineering services will be needed for project management, and for testing the feasibility of related future projects.

2. Operation and maintenance will be undertaken by the Hydraulics Division of the Ministry of Agriculture. A new headquarters (6,000 square feet) will be built, and additional financing will be found for upgrading salaries and administration.

3. The sum of \$505K will be provided for a feasibility study for expanding production in a 10K ac area south of the present project.

#### INSTITUTIONAL

Implementation of the AID-financed project component will be by the Guyana Rice Board (GRB), a semi-autonomous organization within the Ministry of Agriculture. The Hydraulics Division will be responsible for engineering components, including O&M of facilities. The Extension Division of the Ministry of Agriculture will be concerned with all crops other than rice. New agents will be recruited for the project area.

#### SOCIAL

No significant information given.

#### ECONOMIC

Annual disbursements are shown on page 106 (attached).

Sample farm operation costs are shown on page 143 (attached).

The IRR is 13.3%, which is higher than the local cost of capital.

Change in income due to the project will be from \$232 to \$416 on three and one-half acre farms, and from \$1,130 to \$1,730 on 15 ac farms. Total additional net family income will be \$1.5 M annually.

Annual O&M will be \$17/ac. It is anticipated that farmers will be charged for O&M and about 35% of capital costs. The charge will be progressive, increasing with the size of holding.



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TABLE 5  
PROJECTED AID DISBURSEMENT SCHEDULE BY FISCAL YEAR (LC AND DOLLAR COSTS)  
(Figures in U.S. \$000)

	FY 79			FY 80			FY 81			FY 82			FY 83			FY 84			TOTALS		
	LC	US	TOT	LC	US	TOT	LC	US	TOT	LC	US	TOT	LC	US	TOT	LC	US	TOT	LC	US	TOT
<b>Consultants</b>	81		207			240			278			164			60			1030			
	203		400			480			520			172			90			1865			
		284	607			720			798			336			150			2895			
<b>Technical Assistance</b>	-	30		25			25			-			-		70						
	-		370			588			518			251			20			1747			
	-		400			613			533			251			20			1817			
<b>Agri. Equipment</b>	-	135		136			-			-			-		271						
	289		1940			405			-			350			-			2984			
		289	2075			541			-			350			-			3255			
<b>Construction</b>	60		190			170			10			-			430						
	222		17			16			5			89			44			393			
		282	207			186			15			89			44			823			
<b>Training</b>	-	10		10			9			-			-		29						
	-		24			32			25			-			-			81			
	-		34			42			34			-			-			110			
<b>Local Curr.</b>	141		572			582			312			164			60			1830			
<b>U.S. \$</b>	714		2751			1521			1068			862			154			7070			
<b>Grand Total</b>	855		3323			2102			1380			1026			214			8900			

TABLE 8

FARM BUDGET - BLACK BUSH POLDER IRRIGATION PROJECT: PRODUCTION COSTS

	<u>Cost per Acre for Farm Size of:</u>			
	<u>3.5 ac</u>	<u>8.0 ac</u>	<u>15.0 ac</u>	<u>28.0 ac</u>
Land preparation	\$44.00	\$44.00	\$44.00	\$33.00
Seed Padi	14.94	14.94	14.94	14.94
Transportation	.75	.75	.75	.75
Fertilizers - Urea \$15.72/cwt	15.72	17.95	19.19	19.19
T.S.P. \$17.52/cwt	8.76	8.76	8.76	8.76
Transportation	1.00	1.20	1.20	1.20
Weed Control	9.20	9.20	9.20	9.20
Pest & Disease Control				
Seed Treatment	.44	.44	.44)	
Rice Caterpillar	2.60	2.60	2.60)	8.41
Stem Borer	3.09	3.09	3.09)	
Padi Bug (2 Treatments)	5.78	5.78	5.78)	
Harvesting \$2.50/bag	50.00	52.50	55.00	55.00
Transportation of padi from field to mill \$1.00/bag				
Empty bags 70¢ each	<u>14.00</u>	<u>14.70</u>	<u>15.40</u>	<u>15.40</u>
<u>Total:</u>	<u>190.40</u>	<u>196.91</u>	<u>201.12</u>	<u>187.85</u>

Source: IBRD and Agricultural Co-Operative Development Bank

\*Figures are in 1977 prices.

TITLE: Black Bush Irrigation Project

REPORT NO.:

COUNTRY: Guyana

KEYWORDS: Crop technology (5); land leveling (3); system rehabilitation (3).

SUMMARY: The proposed project would be part of a comprehensive plan being undertaken by Government to rehabilitate existing irrigation and drainage systems, including roads and on-farm development, and improve agricultural supporting services for about 450,000 ac of lands suitable for rice and sugarcane production in the coastal areas of the country. The main objectives of this program are to provide flood protection, a dependable water supply for double-cropping, adequate drainage, all-weather roads, on-farm development (land leveling) and improved agricultural supporting services, all of which would increase rice production and improve the quality for export markets.

LOCATION: East Berbice

CLIMATE: Ar

CROPS: Rice, sugarcane, blackeyed peas, coconuts

SOILS: Dark-colored, fine-textured, and slightly to moderately acid in the surface layers, and fine-textured, light-colored but mottled and somewhat alkaline in subsoil. High clay content, suitable for rice.

TARGET GROUP: The irrigating farmer.

BEGIN: 1978                      END: 1984                      AREA: 75,000 ac.

NUMBER OF FARMS: 6,000

CONTRIBUTION: The total cost of the project is estimated at US\$42.8 million with a foreign exchange component of US\$270 million, or 63% of the total cost. The foreign exchange component for civil works alone is 56% and the higher percentage for the project is due to the large number of pumping plants (eight) which would be constructed under the project, together with other equipment to be imported and the cost of consultant services. The estimated total project costs include US\$4.1 million for physical contingencies and US\$11.2 million to cover expected price increases. Financing in the equivalent amount of US\$36.0 million would be provided by a proposed IDA credit of US\$10.0 million, a loan of US\$10.0 million from the

International Fund for Agricultural Development (IFAD), a loan of US\$10.0 million from the OPEC Special Fund (OPEC), and a loan of US\$6.0 million from the United States Agency for International Development (USAID).

**GOALS:** It is estimated that more than 6,000 families would benefit directly from the project. For the three-and-one-half acre farms, the annual per capita family net income without the project would be G\$592, which represents a per capita income of about G\$100 or US\$40 per annum. To supplement their farm incomes, farmers in the project area are employed part-time as hired laborers and engage in fishing. With the project, the annual net farm income of the three-and-one-half acre target group would increase to G\$1,063 per family after allowing for family labor and project charges consisting only of operation and maintenance costs. Notwithstanding the additional labor requirements with the project, the small farm holders would continue to augment their annual income by off-farm activities. Furthermore, farmers in this category would be exempted from project charges for recovery of investment which represents a form of subsidy. For the largest farm size, annual per capita family net income would reach G\$4,635 net of project charges and allowance for family labor.

**PURPOSE:** To increase the crop production of small farmers.

**TYPE OF PROJECT:** Large scale irrigation rehabilitation and improvement.

**TECHNOLOGY USED:** Lined canals, pumping plants.

**DOCUMENTS REVIEWED:** Staff Appraisal Report (84 pages).

**PROJECT ORIGIN AND BASE LINE DATA:** An initial feasibility study was made by Harza Engineering.

**BENEFICIARY INVOLVEMENT:** Farms in all categories from small to large would have a net income with the project sufficient to pay project charges to cover O&M costs and a proportion of the capital costs. Assurance would be sought during negotiations that Government would impose a progressive system of project charges, as project facilities are completed and lands come into full production, sufficient to cover actual annual operation and maintenance costs and recover a proportion of the capital investment in project works over a period of 40 years. The system of charges would be reviewed with the IDA at least once every two years to evaluate the effect of the changes in prices on the value of the investment and to make adjustments as required in these charges.

## GENERAL DESCRIPTION

The project would include works to improve and increase the water supply, rehabilitation and improvement of irrigation and drainage systems, on-farm development and improvement of agricultural supporting services and other facilities for the main purpose of increasing rice production in the Frontlands (29,600 ac), Block III (19,400 ac) and the Polder (26,500 ac). The rehabilitation of irrigation and drainage systems would be carried out on the Frontlands area and on about 4,000 ac in the Polder as the general systems serving the remaining 22,500 ac in the Polder are in relatively good condition and do not require extensive rehabilitation. Existing systems in Block III would not be rehabilitated under the project as Government plans to include this work in a later phase. This increase in production would be partially achieved by providing a full water supply to the three areas sufficient for double-cropping of rice on about 59,500 ac and for about 5,000 ac in sugarcane and food crops. The 4,600 ac in coconuts in the Frontlands and Block III would not be provided with on-farm development or irrigation until use of this land is converted to food crops or oilseeds, or replanted to higher yielding coconut varieties. About 6,500 ac of reef lands which are too high in elevation or salt affected would remain idle and not be irrigated. The increased water supply would be obtained by pumping from the Berbice River to supplement the present gravity diversions through the Torani Canal to the Canje River, from which the supply to the three areas would be obtained by pumping. The entire cultivated area in the Polder would benefit from the increased water supply, since the new pumping plant to be constructed for the Frontlands would discharge into the existing main canal serving the Polder and the capacity of the plant would provide an increased supply of the Polder.

In addition to the project works and on-farm development, the project would include an agricultural development program to improve supporting services and other facilities to improve the processing of rice.

The Black Bush Polder is a new land settlement scheme (26,500 ac), completed in 1963, and presently farmed by about 1,500 families on state lease land with homestead plots of two-and-one-half acres and rice plots of seven-and-one-half acres or 15.0 ac. The scheme is located inland from the cultivated areas along the coast and was constructed in an area which was mostly occupied by a swamp. The irrigation supply for this area is obtained by pumping from the Canje River. This scheme was constructed as a model rural development project with four central villages including housing, water supply, electric power, schools, health services, paved roads and four rice mills with drying and storage facilities. The scheme has been successful and is presently producing about 500,000 bags

(31,250 tons) of paddy annually. From the standpoint of rehabilitation and improvement of existing developed areas, the Polder is not specifically a part of the project, since this is not a critical problem with the existing systems in the Polder. However, it must necessarily be considered in the planning and implementation of the overall project since the main canal and distributaries would be enlarged to convey water to the Frontlands area, supplied from a new pumping plant which would be constructed adjacent to the existing Black Bush pumping plant. This would make it possible to increase the water supply to all lands in the Polder, which is operating with less than the optimum capacity in the system, however, no benefit would be claimed for this.

The Black Bush Frontlands (29,600 ac) are located between the Polder and the sea, along the public road extending from Bloomfield Estate No. 8, about 13 miles east of New Amsterdam, to Estate No. 51. This is one of the older developed areas along the coast and was formerly farmed partially under irrigation by water supplied from the Black Bush swamp. However, with construction of the Polder, this supply was cut off and presently the area is generally limited to the autumn rice crop under rainfed conditions. The lower-lying clay soils (20,200 ac) are suitable for rice growing and a full water supply would permit double-cropping and more than double production. This area has the highest priority for future development and entitlement to water with the increase in supply under the project. The area also has 1,000 ac in sugarcane, 500 ac in food crops, and 3,800 ac in coconuts on the reef lands which are also suitable for vegetables, soybeans, maize and other crops which require light-textured and well-drained soils. The existing coconut groves consist of trees 30 to 40 years old with low productivity. For the small benefit to be gained, investment to irrigate these trees could not be justified and very little could be done to develop these lands for other crops under irrigation until these trees are removed. This probably would not occur as long as there is some production. Due to this situation, the project does not include on-farm development of these lands at present, however, the pumping plants and main canal would provide sufficient capacity to irrigate these lands in the future, when it is almost certain they would be utilized for other crops. There are about 4,100 ac in the area which are not suitable for cultivation due to salinity.

The Block III area (19,400 ac) is contiguous with the Frontlands and extends along the coast from Estate No. 52 to Estate No. 74, which is adjacent to the Skeldon sugar estate and the village of Corriverton. The depth of these frontland areas from the sea-coast to the backdams or distributary canals is roughly four miles. The Block III area was developed as an irrigation and drainage district during the 1940's, mainly by and for private landowners, and the efficiency of land and water use and the level of production are better than in most irrigated areas in the country, including

the Polder. However, after 30 years of operation, the main pumping plant needs to be replaced and the project works require rehabilitation. About 12,000 ac are cropped to rice under irrigation at present, with more than 5,000 ac which cannot be served due to insufficient water supply or low levels in the canals which are below the level of these lands. The initiative of the farmers in this area is reflected in better cultivation practices and higher production than in other areas, the high percentage of ownership of tractors and combines, and the large number of privately owned rice mills.

The project would also include the existing Torani Canal, which connects the Berbice and Canje Rivers, as the transfer of additional water for the project by pumping from the Berbice River would utilize this canal. Some improvement to the banks of the Canje River to carry the increased flow from the outlet of the canal to the Manaribisi (Block III) pumping station would also be included in the project. Government has expressed an interest in developing an area of about 10,000 acres for irrigation and drainage between the back of the Manarabisi Cattle Pasture and the Canje River where a number of livestock cooperatives have been established. This area would be included in the project for the purpose of carrying out a feasibility study for a later stage of the project.

The area between the public road and the sea, comprising about 10,500 ac adjacent to the Frontlands and Block III, would not be included in the project area since a large part is subject to inundation by seawater. The lower land areas are heavily salinized and reclamation of the soils would be very costly, as it would require construction of a sea defense, an extensive drainage system including pumping plants, and a large supply of fresh water for leaching. The productive potential of these lands would not justify this heavy investment, particularly when better lands, such as the Manarabisi Cattle Pasture, are available for development. Such extension would depend, however, on new works to increase the water supply.

#### ORGANIZATION AND MANAGEMENT

The Ministry of Agriculture (MAG) would be the executing agency for the project and have responsibility for all the principal activities to be undertaken on the project. This responsibility would be administered through the several departments, divisions or boards with the Ministry which have specific competence for irrigation and drainage and agricultural development throughout the country as well as in the project area. The project components for which these divisions or boards would be responsible are as follows:

1. Drainage and Irrigation Board (D&I Board). The D&I Board was designated as the legal entity under the Drainage and Irrigation Ordinance of 1953 for policy formulation, administration and management of irrigation and drainage development. The ordinance empowered the D&I Board to have sole control for planning, implementation and management of irrigation and drainage works, but in reality the board functions under the direction of the Minister of Agriculture as a policy advisory group and fulfills certain legal requirements, as established in the ordinance, such as declaring developed areas to be Declared Irrigation and Drainage Areas. In these areas, the D&I Board has authority to operate and maintain the works, schedule and control water deliveries and collect project charges. The Polder, Block III and a part of the Frontlands are Declared Areas at present and the balance of the Frontlands would become so with implementation of the project. The ownership of all works and lands occupied by works is vested in the Board.

2. Hydraulics Division. The Hydraulics Division would have direct responsibility for engineering planning, construction of project works, and operation and maintenance of works, tasks which this division is presently fulfilling on other projects in the country as well as on existing works in the project area. The Hydraulics Division would be assisted on implementation of the project by a team of consultants in the same manner the Tapakuma project is presently being executed. The division would appoint a Project Engineer as their official representative on the project and provide the necessary support staff to work with the consultants on investigations and surveys, planning and design, and supervision of construction. The Chief Hydraulic Officer would represent the Ministry for management of the engineering and construction phases of the project and serve as "Contract Engineer" for the administration of construction contracts.

3. Extension Division. This division of the Agricultural Department in the Ministry would have responsibility for the extension and training programs on the project and for the agricultural research program. Both these programs would be undertaken with the participation of the Guyana Rice Board (GRB), which would also provide technical assistance on rice production and which has the major responsibility for research on rice in the country. The Extension Division of MAG is basically concerned with research and technical assistance and distribution of seeds and fertilizers for crops other than rice and with training programs for farmers. At present, the division has a senior Agricultural Officer serving the East Berbice Region and an Agricultural Office with three assistants working in the Polder. The extension and research



programs on the project would be patterned after similar programs now underway on the Tapakuma project which are proving to be effective. Since Guyana does not have a national extension service at present, the main task of the Extension Division would be to train extension workers and create a permanent extension unit to serve the area. This unit would become a part of the national service when it is established, but there is a need to provide this assistance to farmers during the course of the project (1978-83) if the objectives and goals are to be met. This training program would be coordinated with the rural training center to be established in the Polder under the Bank-financed Second Education Project and the National Agricultural Extension In-Service Training and Communications Center to be established under the Ministry of Agriculture.

4. Land Development Division (LDD). The Land Development Division would continue to be responsible for administration of settlement schemes in the project area, of which the Polder is the main one. These schemes comprise groups of settlers farming land leased from the Government and the LDD assists with selection and settlement of the farmers, provides technical assistance on crop production and farm management, performs on-farm development, helps farmers to obtain credit and inputs and cooperates with the Hydraulics Division on water management and collection of project charges. The chief of the LDD in the Polder is presently serving as Project Manager for the Polder. This arrangement would be continued with the project.

5. Lands Department. The Lands Department administers registration of titles on freehold land, the leasing of government land and the collection of rents and land taxes.

6. The Guyana Rice Board. The GRB is a semi-autonomous organization which exercises considerable influence in its budgetary and physical operations, but which is part of MAG and comes under the supervision of the Minister of Agriculture. The activities of the GRB under the project would include: an agricultural credit program to supply fertilizers, chemicals, and other inputs to rice farmers; machiner services for land preparation and harvesting from their machinery pool; drying, storage and milling of rice; a research program for varietal improvement; production of foundation seed and multiplication for supply of pure line seed to farmers; technical assistance for pest and disease control, introduction of improved varieties and production practices; the cleaning, grading, blending and packaging of rice for both export and local consumption; and the marketing of all milled rice, except that retained by the farmers for their own rice. Assurances would

be obtained during negotiations that Government would cause GRB to carry out these functions as required to achieve the objectives of the project.

The MAG would appoint a Project Manager who would have authority to supervise and manage field activities and operations and, specifically, to coordinate the participation of the departments, divisions, and boards in the project. The Project Manager would be under the authority of the Minister of Agriculture and his appointment would provide administrative authority for operation and management of the project at the project level. His authority would extend to the three project units (Frontlands, Polder, Block III) and the present Project Manager in the Polder would continue in that post, but under the supervision of the new Project Manager. This would include all activities carried out by the Ministry of Agriculture with the exception of those which are the direct responsibility of GRB and under the supervision of the GRB Regional Manager, whose office is in Corriverton. The Project Manager would, however, have authority to consult with the GRB Regional Manager in order to obtain better coordination of land preparation and harvesting with irrigation schedules, to increase the use of improved varieties, to facilitate the availability of credit, seed and inputs for the Farmers and to generally improve the standards of GRB's operations. The Project Manager would work closely with the consultants during the project implementation period but the position would be permanent.

The Minister of Agriculture, through the Hydraulics Division, would appoint a Project Engineer who would work with the consultants and represent the division on technical matters during the implementation period and, following completion of construction, would supervise operation and maintenance (O&M) for the three project units, particularly for scheduling the operation of pumping plants and delivery of water as required to the project areas. The Project Engineer, who would be under the administration supervision of the Project Manager, would also supervise overall maintenance activities and the two District Engineers now located at Whim and Benab, who are responsible for O&M in the Polder and Block III, respectively. The station at Whim also performs a limited amount of work in the Frontlands. These two engineers, with their staffs and equipment, would continue to operate as at present, however, the O&M facilities would be expanded and improved under the project. Assurances would be obtained from Government during negotiations that the Project Manager and Project Engineer would be appointed within six months following the date of loan effectiveness.

#### TECHNICAL

The project works would consist of the following:

1. A new 1,000 cusec pumping plant on the Berbice River at the intake of the existing Torani Canal for transfer of water to the Canje River.
2. Rehabilitation of the Torani Canal to restore it to the original capacity of 1,000 cusec and bank improvements on the Canje River between the outlet of the Torani Canal to the Manarabisi pumping plant, to contain a maximum discharge of about 1,800 cusec.
3. A new 300 cusec pumping plant on the Canje River to replace the existing 30-year-old plant which supplies Block III.
4. Rehabilitation of the main supply canal (10 miles to Block III and the Seaford distributary (eight miles), including construction of 15 new main regulators, to increase the water delivery rate into the watercourses.
5. A new pumping plant adjacent to the Black Bush Polder pumping plant on the Canje River with a capacity of 500 cusec to serve the Frontlands and supply additional water to the Polder.
6. Upgrading the capacity of the Black Bush main canal (seven miles), the north and south branch canals (seven miles), and the distributaries (22 miles) to convey the additional supply to the Polder and the Frontlands.
7. Improvement of existing facilities in the Polder to provide water to 2,500 ac which cannot be irrigated at present and to correct certain localized problems on drainage in the Lesboholden and Mibikuri homestead areas.
8. Rehabilitation and improvement of irrigation and drainage systems and roads and on-farm development in the Frontlands area comprising 29,600 ac.
9. Provision of five sluice structures on the new main drains to be constructed in the Frontlands area, together with about 1,000 cusec of drainage pumping to supplement discharge through the sluices.

The project would include construction of drying and storage facilities in the Frontlands and Block III areas for paddy rice with a capacity of about 400,000 bags (140 lb) per month. This would include additional yard drying space as well as mechanical dryers and flat storage in covered structures. This would be an important factor in reducing losses and in producing risk for the export market.

## ECONOMIC

The benefits from the project would accrue directly to over 6,000 families. The project would also satisfy efficiency criteria in terms of allocation of scarce resources and equity considerations since the benefits would largely accrue to small farm holders of less than 10 ac. In addition, secondary benefits in terms of employment creation and expansion of commercial services related to processing of agricultural produce in the East Berbice region would be forthcoming. These incremental benefits are attributed to higher yields, cropping intensity rising from the current level of 110% without the project to 154% with the project and the development of 6,500 ac of unutilized land. The principal crop, rice, would occupy 92% of the total irrigable land, excluding the coconut groves, followed by food crops 5%, and sugarcane 3%. Although the water supply would suffice to irrigate the 4,600 ac of coconuts, this area would not be irrigated and no incremental output is expected. Total incremental benefits would gradually increase starting in year three (1980) and full development is anticipated to peak in year eight (1985). The incremental foreign exchange earnings from rice exports would amount to US\$8.2 million annually at full development. Food crop production from the project area would be destined for the domestic markets and would contribute to the attainment of food self-sufficiency.

The estimated cost of the project, not including price contingencies and farm machinery, is US\$30.4 million in mid-1977 prices. The annual operation and maintenance cost at full development would be US\$643,000 or US\$17 per acre. Farmers' contribution toward project costs during project implementation for on-farm development is not anticipated. Government's share of the total project cost is 28% to be financed by annual budgetary appropriations spread over six years. In addition, Government would take full responsibility for the operation and maintenance of the project.

For the purpose of the economic evaluation, the following assumptions were made and some cost items were excluded to reflect the real resource cost to the economy at large.

1. Price contingencies which amount to 26% of the total project cost are deducted since the analysis is in constant 1977 prices. It is further assumed that relative prices would not change.
2. The cost of farm machinery has not been included since this is part of annual production costs. The cost of O&M equipment is also excluded as this would be covered by annual depreciation as a part of the total O&M cost. The cost of the studies for a Stage II project is not included.

3. The total project cost is also net of taxes since they represent financial costs rather than real resource consumption.

4. In an attempt to estimate shadow wage rate for unskilled labor, both the national and project area unemployment situations were examined. The recent unemployment figure for Guyana indicates a 15% overall unemployment rate and 27% for the East Berbice region. In the absence of any regional parameters for a shadow wage rate for labor, it is assumed that the opportunity cost of labor is 75% of the going wage rate.

5. The life of the project will be 50 years and construction is scheduled for completion in year six (1983). Accordingly, project benefits would gradually reach their peak in year eight (1985).

6. Commodity prices used in the economic analysis are based on world market projections provided by the Bank's Commodities and Export Projection Division.

7. A shadow exchange rate of G\$3.00 to US\$1.00 was adopted, against the official rate of G\$2.55.

Based on the above assumptions and values, the economic rate of return is 13.3%, which is higher than the opportunity cost of capital for Guyana. Hence, the project as proposed is viable in both economic and financial terms.

GUYANA  
BLACK BUSH IRRIGATION PROJECT  
28.0 Acre Farm Budget  
(in G\$)

Crop	Land Area (ac)	Cropped Area (ac)	Yield (T/Ac)	Price (\$/ton)	GVP <sup>1/</sup> (per ac. per crop)	Inputs <sup>2/</sup> (per ac. per crop)	<u>Gross Benefits</u>	
							(per ac.)	Total
Rice	28	50.4	1.3 <sup>3/</sup>	296	384.80	187.85	196.95	9,926
Food Crops	--	--						
Total	28	50.4						
Cropping Intensity: 180								
<u>Gross Farm Benefits</u>								
Less Hired Labor						1,412.20		
Family labor						296.00		
Interest <sup>4/</sup>						952.46		<u>2,660</u>
								7,266
<u>Net Farm Benefits</u>								
Project Charges								1,232
Operation and Maintenance								<u>1,400</u>
Investment Recovery								4,634
<u>Net Farm Income</u>								
<u>Estimated Net Income Without Project</u>								3,857
<u>Incremental Net Income</u>								777

<sup>1/</sup> Gross value of production.

<sup>2/</sup> Production costs less labor.

<sup>3/</sup> 22 140 lb. bags.

<sup>4/</sup> 9% on working capital.

GUYANA  
BLACK BUSH IRRIGATION PROJECT

8.0 Acre Farm Budget  
(in G\$)

Crop	Land Area (ac)	Cropped Area (ac)	Yield (T/ac)	Price (\$/Ton)	GVP <sup>1/</sup> (per ac. per crop)	Inputs <sup>2/</sup> (per ac. per crop)	<u>Gross Benefits</u>	
							(per ac.)	Total
Rice	7.8	12.5	1.3 <sup>3/</sup>	296	389.80	196.31	187.89	2,349
Food Crops	0.2	0.75	3.9	694	2706.6	460.00	2246.60	562
<b>Total</b>	<b>8.0</b>	<b>12.75</b>						<b>2,911</b>

Cropping Intensity: 160%

Gross Farm Benefit

Less: Hired Labor	49.00	
Family Labor	414.40	
Interest <sup>4/</sup>	236.34	
		<u>699</u>
		2,212

Net Farm Benefits

Project Charges		
Operation and maintenance		352
Investment recovery		<u>120</u>

Net Farm Income 1,740

Estimated Net Income Without Project 1,152

Incremental Net Income 588

<sup>1/</sup> Gross value of production.

<sup>2/</sup> Production costs less labor.

<sup>3/</sup> 21 140 lb bags.

<sup>4/</sup> 9% on working capital.

GUYANA  
BLACK BUSH IRRIGATION PROJECT  
15.0 Acre Farm Budget  
(In G\$)

Crop	Land Area (Ac.)	Cropped Area (Ac.)	Yield (T/Ac.)	Price (\$/Ton)	GVP <sup>1/</sup> (per ac. per crop)	Inputs <sup>2/</sup> (per ac. per crop)	<u>Gross Benefits</u>		
							(per ac.)	Total	
Rice	13.3	23.5	1.3 <sup>3/</sup>	296	384.80	201.12	183.68	4,316	
Food Crops	1.2	1.5	3.9	694	2,706.60	483.00	2,224.00	3,336	
<b>Total</b>	<b>15.0</b>	<b>25.0</b>						<b>7,652</b>	
Cropping Intensity: 167%									
<u>Gross Farm Benefits</u>									
Less: Hired labor						818.40			
Family labor						768.00			
Interest <sup>4/</sup>						525.74		<u>2,112</u>	
								<u>2,540</u>	
<u>Net Farm Benefits</u>									
Project Charges									
Operation and maintenance							660		
Investment recovery							<u>525</u>		
<u>Net Farm Income</u>								4,355	
<u>Estimated Net Income Without Project</u>								2,884	
<u>Incremental Net Income</u>								1,471	

<sup>1/</sup> Gross value of production

<sup>2/</sup> Production costs less labor.

<sup>3/</sup> 22 140 lb bags.

<sup>4/</sup> 9% on working capital.



GUYANA  
BLACK BUSH IRRIGATION PROJECT  
Civil Works Cost Estimates

<u>Item</u>	<u>Local</u>	<u>Foreign</u>	<u>Total</u>	<u>Local</u>	<u>Foreign</u>	<u>Total</u>
	-----	(G\$ '000)	-----	-----	(US\$ '000)	-----
1. Berbice Pumping Station (a) Civil Works	1,017	1,352	2,369	399	530	929
2. Torani Canal	264	360	624	104	141	245
3. Canje River Bank Improvement	315	435	750	123	171	294
4. Manarabiai Pumping Station	296	428	724	116	168	284
5. Manarabiai and Seaford Canal Improvements	393	831	1,224	154	326	480
6. Black Bush Pumping Station	625	823	1,448	245	323	568
7. Black Bush Polder Scheme						
(a) Main Irrigation System	1,015	2,253	3,268	398	884	1,282
(b) Main Drainage System	410	860	1,270	161	337	498
Subtotal	1,425	3,113	4,538	559	1,221	1,780
8. Frontlands Scheme						
(a) Irrigation System	4,770	5,530	10,300	1,870	2,169	4,039
(b) Drainage System	5,612	6,497	12,109	2,201	2,548	4,749
(c) Land Development	1,470	1,125	2,595	576	441	1,017
(d) All-weather Roads	1,117	1,984	3,101	438	778	1,216
Subtotal	12,969	15,136	28,105	5,085	5,936	11,021
Total	17,304	22,478	39,782	6,785	8,816	15,601

Rate of Exchange: G\$ 2.55 = US\$1.00.

GUYANA  
BLACK BUSH IRRIGATION PROJECT  
SUMMARY OF ESTIMATED COSTS

<u>Item</u>	<u>Local Currency</u>	<u>Foreign Exchange</u>	<u>Total</u>
	(US\$ million)		
Civil works	6.785	8.816	15.601
Buildings	0.559	0.241	0.800
Equipment, including irrigation pumps <sup>1/</sup>	0.361	6.000	6.361
Engineering and supervision	0.667	--	0.667
Consultant services	0.297	2.715	3.012
Extension, research and seed production	0.382	--	0.382
Project preparation facility	--	0.280	0.280
Feasibility study for Stage II	<u>0.100</u>	<u>0.300</u>	<u>0.400</u>
Base Cost Estimate	9.151	18.352	27.503
Physical Contingencies	1.374	2.753	4.127
Price Contingencies	<u>5.234</u>	<u>5.970</u>	<u>11.204</u>
Estimated Total Cost	<u>15.759</u>	<u>27.075</u>	<u>42.834</u>
Percentage	37	63	100

<sup>1/</sup> Drainage pumps with an estimated value of US\$1.0 million would be provided by Government.

GUYANA

BLACK BUSH IRRIGATION PROJECT  
Cost and Rent Recovery Indices<sup>a/</sup>  
(GS)

<u>Representative size farms</u>	<u>3.5 ac</u>	<u>8 ac</u>	<u>15 ac</u>	<u>28 ac</u>	<u>Total Project (GS '000)</u>
1. Gross value of production	1158	2313	6149	9138	
2. Less: Production (cash) Costs	473	1252	3668	6274	
3. Equals: Net cash income (1-2)	685	1061	2481	2864	
4. Less: Depreciation	--	--	--	--	
5. Imputed value of family labor	141	182	170	98	
6. Imputed value of management services,	35	53	124	143	
7. Imputed return on own capital	--	--	--	--	
8. Allowance for risk/uncertainty	68	106	248	286	
9. General taxes	--	--	--	--	
10. Equals rent/surplus	441	717	1939	2331	27060
11. Rent as a percentage of net cash income	64	67	78	82	
12. O&M charges	73	168	315	588	
13. Capital charges	--	120	525	1400	
14. Total direct charges	73	288	840	1988	9754
15. Rent recovery index (14 ÷ 10)	16	40	43	85	36%
16. Public sector outlays (capital + O&M)					59726
17. Cost recovery index (14 ÷ 16)					16%

Representative size farms	3.5 ac	8 ac	15 ac	28 ac	Total Project (C\$ '000)
18. Farmers income PC, in project year 8 at full development	249	438	1051	1261	
19. Estimated critical consumption level (CCL same project year)	N.A.				
20. Estimated national PCI - 1985	N.A.				

<sup>a/</sup> All items are incremental. Total project charges rents and outlays have been discounted at 10%.

TITLE: Integrated Agricultural Development

PROJECT NO.: 521-0078

COUNTRY: Haiti

REGION: LA

KEYWORDS: Irrigation rehabilitation (3); soil conservation (5);  
credit (3).

SUMMARY: The project has technical and institutional goals. The intent is to upgrade the institutional resources of the Haitian Department of Agriculture so that it can better design, construct and operate irrigation and soil conservation projects. To this end, \$2.14M will be used to improve the administrative and management capability of the Department of Agriculture, \$1.1M will be applied to crop research, \$1.0M will be used to improve the extension system, \$1.4M will be used for agricultural credit, and \$1.9M will be given to the Faculty of Agronomy and Veterinary Medicine to develop teaching programs in irrigation and soil conservation. Also, in the course of the project, 15 irrigation systems on 9,000 ha will be repaired (\$3.8M), and erosion control techniques will be applied to 20K ha of uplands (\$0.8).

LOCATION: Throughout Haiti

CLIMATE: Ar

CROPS: Corn, beans, manioc, yams.

SOILS: Marl

TARGET GROUP: Small farmers (one to one and three-tenths hectares).

BEGIN: September 1976                      END: FY 1979                      AREA: 9,000 ha  
Irr.

NUMBER OF FARMS:

CONTRIBUTION:	US	\$ 4.100M grant
		8.000M loan
	GOH	10.501M
	TOTAL	<u>\$22.601M</u>

GOALS: To increase the production, productivity and income of the small farm sector in Haiti.

PURPOSE: To develop the institutional capacity of the Department of Agriculture, Natural Resources and Rural Development (DARNDR) and community organizations to deliver productive resources to small farmers.

TYPE OF PROJECT: Institution-building, research, training, irrigation rehabilitation.

TECHNOLOGY USED: Mostly hand labor.

DOCUMENTS REVIEWED: Project paper (150 pages).

PROJECT ORIGIN AND BASE LINE DATA: Parts of the present project have been tested in AID's Agricultural Development Support Project (521-0069). Also, J.G. White Engineering Corp. has carried out prefeasibility studies of repairs of 24 irrigation systems.

BENEFICIARY INVOLVEMENT: Farmer associations will be paid to repair the irrigation structures.

LOGICAL FRAMEWORK: Consists of 6 pages attached to reviewed documents.

PERT CHART: Attached to reviewed documents.

## GENERAL DESCRIPTION

At present, the Department of Agriculture, Natural Resources and Rural Development (DARNDR) is characterized by a complex administrative structure, very small budget and low salaries, poor record-keeping, overly centralized decision-making, and low morale. This is especially critical at present, since large numbers of donor organizations are trying to channel funds through the DARNDR. The principal purpose of this project is to improve the administrative abilities of DARNDR and its subsidiary agencies.

## TECHNICAL

The project will work to rehabilitate irrigation systems in the Les Caves, Jacmel, Cul de Sac, and Northwest Regions totaling 9,000 ha. This mostly involves cleaning and repair of canals, and replacement of masonry structures. Most of the work will be done manually using paid labor from the community groupements of farmers.

New soil conservation techniques will be applied to 20K ha in the unirrigated uplands. Methods will include: (1) use of new crops (contour planting of fruit trees); (2) provision of low-level inputs (seeds, trees); (3) improvement of present cropping practices (weeding, mulching, new planting patterns); and (4) land treatment, such as terracing and diking. Farmers will be paid for land treatment work.

A research program will collect potential plant materials from around the world and test them in Haiti. Those that are promising will be expanded to the village nursery level and finally distributed to farmers.

## INSTITUTIONAL

A Management Implementation Team (237 man-months) will work with and through the DARNDR to improve organization, distribute decision-making, and finally to give DARNDR the capability to carry out irrigation and soil conservation projects on its own.

The Bureau of Agricultural Credit (BCA) gives loans only to small farmers on the basis of: (1) capacity to repay; (2) marketability of the crop; and (3) collateral. Loans are generally for less than \$2,000 at a rate of 8% (12% subloans are permitted to Agricultural Credit Societies). Interest income represents only 13% of total BCA revenues and the repayment rate is poor.

The BCA will be improved by adding 28 field agents and 27 new supervisory personnel to distribute \$1M of credit. Four man-years of technical assistance will be provided to BCA.

The DARNDR extension service will be strengthened with 82 new agents, more training for agents already in the field, and pickup trucks, motorbikes and bicycles for agents.

The Soil Conservation Service will gain 15 new employees and 24 man-years of technical assistance. Five hundred farmers will be trained in terracing and tree planting.

The Faculty of Agronomy and Veterinary Medicine (FAMV) consists of 36 professors and 140 students. It currently experiences a lack of trained faculty members (most are part-time), library facilities, and teaching materials, and an oversupply of students (for political reasons). The AID project will provide for 10 full-time professors, retraining of present DARNDR agronomes, training of 20-50 new technicians per year, a restructuring of present study programs, and 8,000 square feet of new classroom space. A one-year non-degree post-graduate program in irrigation and soil conservation will be instituted.

#### SOCIAL

Operation and management at the village level will be by groupements, community associations of 20-30 farmers, often organized by the Church. The groupements, consisting of the rural poor, usually have the desire but not the expertise to carry out change. In the past, groupements have often disintegrated due to lack of interest or resources. The project will provide training in O&M and administration of irrigation systems, although it is not clear who will provide this training. Also, farmers will regain control over the water masters, who apparently have become political appointees functioning independently of system requirements.

#### ECONOMIC

A schedule of summary costs and disbursements is given on pp. 82-85 (attached). The IRR is 12% for the irrigation rehabilitation, assuming that farmers amortize the full cost of system repairs. In the highland areas, the IRR is 27% for soil conservation.

Irrigation rehabilitation costs are tentatively estimated at \$1,000/ha, although this may decrease as the scope of work broadens.

It is current policy for donor organizations to pay a salary supplement to any government counterparts assigned to them. Up to 90% of counterpart supplements in this case will be paid by PL-480 food sales.



Farmers in the groupements will be paid for their labor, with 60% of time paid directly to the farmer, 20% paid to the groupement collectively, and 20% donated by the farmer. They will be paid the minimum wage (\$1.30/day) although this is considerably more than prevailing wages.

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TABLE I

Summary Cost Estimates and Financial Plan

	AID Grant <sup>1/</sup>	AID Loan <sup>1/</sup>	GOB <sup>2/</sup>	Community Contribution (Labor)	Total
<b>I. <u>Project Administration</u></b>					
Technical Assistance (192 PM Long Term)	1,615,000				1,615,000
Technical Assistance (45 PM Short Term)	385,000				385,000
Equipment and Materials		101,600			101,600
Vehicles		29,000			29,000
DARNDR Personnel			231,300		231,300
Operations and Maintenance			150,900		150,900
Contingency and Inflation		6,900			6,900
Subtotal	1,000,000	137,500	382,200	—	2,519,000
<b>II. <u>Irrigation</u></b>					
Technical Assistance (264 PM Long Term)		1,282,000			1,282,000
Equipment and Materials		2,265,600			2,265,600
Vehicles		31,000			31,000
DARNDR Personnel			312,000		312,000
Local Labor			2,003,000	500,800	2,503,800
Contingency and Inflation		182,900			182,900
Subtotal		3,761,500	2,315,000	500,800	6,577,000

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	AID Grant <sup>1/</sup>	AID Loan <sup>1/</sup>	GOH <sup>2/</sup>	Community Contribut. (Labor)	Total
<b>III. <u>Extension/Information</u></b>					
Technical Assistance (160 PM Long Term)	330,000				330,000
Training: Off-shore ( persons)		173,000			173,000
Training: In-Country			110,000		110,000
Equipment and Materials		331,000			331,000
Vehicles		71,700			71,700
DARNDR Personnel			674,000		674,000
Operations and Maintenance			187,000		187,000
Contingency and Inflation		71,100			71,100
Subtotal	330,000	646,800	971,000		1,947,800
<b>IV. <u>Soil Conservation</u></b>					
Technical Assistance (130 PM Long Term)		330,000			330,000
Training: Off-shore (4 persons)		173,000			173,000
Training: In-country			85,000		85,000
Equipment and Materials		120,000			120,000
Vehicles		83,000			83,000
DARNDR Personnel			204,000		204,000
Local Labor			4,800,000	1,200,000	6,000,000
Operation & Maintenance			270,000		270,000
Contingency & Inflation		63,000			63,000
Subtotal		769,000	5,359,000	1,200,000	7,328,000

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	AID Grant <sup>1/</sup>	AID Loan <sup>1/</sup>	GOH <sup>2/</sup>	Community Contribut. (Labor)	Total
<b>V. <u>Research and Development</u></b>					
Technical Assistance (60 PM Long Term)	275,000				275,000
Technical Assistance (24 PM Short Term)	95,000				95,000
Training:Off-shore (4 persons)		173,000			173,000
Training:In-Country			60,000		60,000
Equipment & Materials		240,000			240,000
Vehicles		26,000			26,000
Construction		200,000			200,000
DARNDR Personnel			300,000		300,000
Local Labor			80,000	20,000	100,000
Operations & Maintenance			150,000		150,000
Contingency & Inflation		86,500			86,500
Subtotal	370,000	725,500	590,000	20,000	1,705,500
<b>VI. <u>Credit</u></b>					
Technical Assistance (48 PM Long Term)		280,000			280,000
Vehicles		29,400			29,400
Agricultural Credit		1,000,000			1,000,000
BCA Personnel			594,000		594,000
Operations & Maintenance			40,000		40,000
Contingency & Inflation		116,600			116,600
Subtotal		1,426,000	634,000		2,060,000

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	AID Grant <sup>1/</sup>	AID Loan <sup>1/</sup>	GOH <sup>2/</sup>	Community Contribut. (Labor)	Total
<b>VII. FAMV</b>					
Technical Assistance (192 PM Long Term)	1,120,000				1,120,000
Technical Assistance (48 PM Short Term)	280,000				280,000
Training: Off-shore (4)		130,000			130,000
Equipment & Materials		98,000			98,000
Vehicles		25,000			25,000
Construction		122,000			122,000
FAMV Personnel			190,000		190,000
Operations & Maintenance			60,000		60,000
Contingency & Inflation		158,700			158,700
Subtotal	1,400,000	533,700	150,000		2,183,700
GRAND TOTAL	4,100,000 (16.9%)	8,000,000 (32.9%)	10,501,200 (43.2%)	1,720,800 (7.0%)	24,322,000 (100%)

<sup>1/</sup>Entire amount of AID loan and grant are for foreign exchange costs with the exception of approximately \$322,000 of loan financed local construction and \$1,800,000 of loan financed local materials cost.

<sup>2/</sup>Local currency costs.

NOTE: It is proposed that the Mission be authorized to increase or decrease any of the loan-financed elements (I through VII) by a maximum of 15%, provided that the total amount of the loan is not exceeded.

TITLE: Use of Treated Water for Irrigation

PROJECT NO.: 527-0150

COUNTRY: Peru

REGION: Latin America

KEYWORDS: Surface irrigation (1); irrigation with treated sewage (5).

SUMMARY: This project provides for the construction of an irrigation system to utilize available treated sewage effluent for crop production on the coastal desert lands near Tacna. The system to be constructed will service an initial 120 ha by 1978 and will be designed for extension to an additional 80 ha. The project is designed to demonstrate the economic feasibility of producing significant quantities of foodstuffs on now barren desert lands reclaimable in this manner and to demonstrate that foods grown with treated sewage meet sanitary regulations for foods for human consumption.

LOCATION: Tacna

CLIMATE: BWh

CROPS: Alfalfa, corn, potatoes, lima beans, squash.

TARGET GROUP: Landless former farmers who have migrated from the Altiplano to the coast.

BEGIN: July 1976      END: 1980      AREA: 120 ha.

CONTRIBUTION:	USAID	\$200.0K
	GOP	217.4K
	TOTAL	<u>\$417.4K</u>

GOALS: To increase food production through expansion of arable land along Peru's populated coastal desert and to reduce sewage contamination along Peru's coast.

PURPOSE: To successfully demonstrate the economic and technical feasibility of producing significant quantities of needed foodstuffs by irrigating desert lands with treated sewage effluent.

TYPE OF PROJECT: Research and pilot project.

TECHNOLOGY USED: Labor-intensive.

DOCUMENTS REVIEWED: Project Paper (100 pp) and Project Evaluation Summary (five pages).

PROJECT ORIGIN AND BASE LINE DATA: AID and DGA have been working together on small irrigation projects for the last two years. A feasibility study for this project was prepared by DGA in 1975.

BENEFICIARY INVOLVEMENT: Unclear.

LOGICAL FRAMEWORK: Attached to Reviewed Documents.

PERT CHART: Attached to Reviewed Documents.

## TECHNICAL

It is estimated that about 14,000 ha of land near Peru's eight major cities could quite readily be irrigated with treated sewage. As double cropping is feasible along the coastal desert, a cropping equivalent of approximately 23,100 ha of arable land could be achieved through project replicability.

The Tacna sewage treatment plant is now in existence. Treated effluent from the plant will flow to the irrigated areas in a concrete-lined canal five kilometers long and with a capacity of 230 cubic feet per second. Eleven kilometers of smaller secondary canals will distribute waste to all parts of the first 120 ha to be developed. Provisions will be made for extending these canals, as necessary, to provide water to the increased area (up to 200 ha) as more effluent becomes available from the plant. Nine kilometers of three meter wide, low-cost feeder roads will provide access to the project site. The entire system will be built as simply as practicable and will utilize labor-intensive methods with a minimum of equipment.

The project will produce the following outputs:

1. Construction of the basis infrastructure at the Tacna site;
2. One hundred and twenty hectares brought into production by the end of the second year;
3. Yields for selected crops;
4. A functioning demonstration site; and
5. The establishment of an agrarian production cooperative which will work the land.

## INSTITUTIONAL

The Directorate General of Waters (DGA) will be the primary agency responsible for implementing the project and will provide the services of a Chief Engineer as overall project supervisor. DGA will secure the coordination and collaboration of the Ministry of Agriculture's Agrarian Zone Office in Tacna, as well as the Ministry of Food's local office, for production and other technical advice, and the Agrarian Bank and the Ministry of Health Tacna offices. The Tacna Branch of the Agrarian Bank will provide necessary production credit to the farmers participating in the project. The Ministry of Health will provide technical expertise for overall project sanitary control and will assume primary responsibility for experimentation with selected food crops on the separate



five hectare plot for testing crops, such as tomatoes, outside the permissible list of affluence-grown crops. A portion of the AID project contribution will assist in setting up simple, but adequate, research facilities at the project site.

The former landless farmers will be organized into a production cooperative, according to regulations established under Peru's comprehensive Agrarian Reform program. A list of eligible small farmer candidates already exists, and final selection of participants and legal incorporation of the cooperative will be undertaken simultaneously with construction of the irrigation infrastructure, so that the participating farmers will be ready to move into cultivation once the construction is completed.

## SOCIAL

Assuming an average of one family per four-and-one half hectares of actual land, approximately 3,110 farm families would become direct beneficiaries of project replicability. Using a general rule of thumb of 2.2 workers per farm family, 6,842 jobs would be created among the beneficiaries themselves.

## ECONOMIC

A financial plan is given on page 19 (attached).

A study of the costs and incomes generated by the project over the course of a 25-year period, which is calculated to be the useful life of the project, showed the projected internal rate of return to be 23.94 percent and the benefit-cost ratio to be 1.13 for the first phase of the project (120 ha) based on a 15% interest rate. For the second phase of the project (200 ha), the projected IRR is 24.10% and the B-C ratio is 1.16.

Project family incomes in the project area come to \$2,384 per year, or \$397 per capita based on an average family size of six.

It is expected that the Agrarian Bank will provide all needed production credit to the area beneficiaries; this will amount to \$112,000 for the first crop. The current rate of interest for production credit is six percent per annum.

The Tacna Valley has a very good collection record for water tariffs as compared to other water districts, and these will be sufficient to cover maintenance and operating costs. The Water Tariffs Division of the DGA has determined that the tariff for the Tacna pilot project will be one centave per cubic meter, covering O&M of the project irrigation works.

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B. Financial Plan

Present cost estimates are as follows:

	<u>\$</u>	<u>GOP (\$)</u>	<u>AID (\$)</u>
Design Engineering cost	22,222	4,444	17,778
Supervision and field control <sup>1/</sup>	33,333	20,000	13,333
Construction Cost	121,070	20,514	100,556
Research and Production Management	46,666	22,222	24,444
Subtotal	223,291		
Contingency (15%)	33,494	11,272	22,222
Inflation (20%)	44,658	22,991	21,667
Construction & Research Subtotal	301,443		
Agrarian Bank Credit	120,000	120,000	0
Total	421,443	221,443	200,000

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1/ See Implementation Plan

TITLE: Improved Water and Land Use in the Sierra

PROJECT NO.: 526-0156

COUNTRY: Peru

KEYWORDS: Small-scale irrigation (5); soil conservation (3); technical assistance (1); on-farm water use efficiency (3); economic evaluation (3).

SUMMARY: The project will comprise:

1. Construction of irrigation and drainage works for up to 27 subprojects;
2. Implementation of a complementary program of protective afforestation to prevent erosion, conserve water, and to protect irrigation structures in the subproject areas;
3. Strengthening of regional irrigation offices with additional personnel and required machinery and equipment;
4. Establishment of a special fund in the Agrarian Bank for sublending to participating farmers for investments in on-farm land development;
5. One hundred and two man-months of U.S. or third country high-level technical advisory services to the DGA (Direccion General de Aguas) in planning and project analysis, and 72 man-months of locally-procured advisory services to the DGA subproject teams;
6. The sum of \$155,000 for long and short-term training of MOA staff;
7. An informally conducted on-farm demonstration program of technical assistance to farmers in efficiency of water use; and
8. Approximately \$255,000 to finance watershed planning studies.

LOCATION: Cajamarca and Mantaro Regions.

CLIMATE: H

CROPS: Potatoes, root crops, cereals, beans, alfalfa.

BEGIN: October 1975      END: 1979      AREA: 27.9K ha.

CONTRIBUTION: USAID \$11.0M grant  
                  GOP     12.5M  
                  TOTAL    \$23.5M

GOALS: To increase income and employment opportunities of the rural Sierra population and to increase food production in the Sierra.

PURPOSE: Improve land and water use in the project areas through:

1. Increase in productive land area;
2. Increase in crop yields;
3. Expansion of cropping alternatives;
4. Increase in efficiency of water use;
5. Reduction in soil loss from erosion; and
6. Strengthened technical capacity at the regional level.

TYPE OF PROJECT: Large-scale, made up of multiple subprojects.

TECHNOLOGY USED: Simple construction with locally unavailable unskilled labor and materials.

DOCUMENTS REVIEWED: Project Paper (about 200 pp).

PROJECT ORIGIN AND BASE LINE DATA: A USAID-contracted preliminary survey (1975) provided a foundation for feasibility studies by DGA of five subprojects, in preparation for the project paper.

BENEFICIARY INVOLVEMENT: Projects will be located in areas where farmers demonstrate the ability to organize themselves and show an interest in the potential irrigation improvements.

LOGICAL FRAMEWORK: Attached to reviewed documents.

PERT CHART: Not available.

## TECHNICAL

The project will finance the construction of up to 27 small irrigation systems. Five of these have already been analyzed for technical feasibility. They range in size from 500 to 3,300 ha; some consist entirely of new construction and some include about 50% renovation of existing systems. The types of structures to be built are: intakes, canals, culverts, aqueducts, crossings, weirs, distribution boxes, drainage ditches, roads, and small bridges. Construction simplicity will strongly favor the use of locally available unskilled labor and materials. All needed labor will come from the immediate subproject areas. This unskilled labor will be supported by selected skilled laborers, works foremen, and superintendents. Additionally, maximum use will be made of local materials.

Selected areas in subproject watersheds, above the line where cultivation should be or is practiced, will be planted to eucalyptus, pine, or other trees known to grow well in the particular soils of the area. These trees will serve to minimize immediate rainfall runoff and to release groundwaters slowly, thereby augmenting the flow of water to the streams well into the dry season. Other areas, generally within cultivated zones, which now have erosion scars, will also be carefully shaped and planted with trees.

## INSTITUTIONAL

The project will be directed and administered by the Direccion General de Aguas (DGA) in the Ministry of Agriculture (MOA), with primary administrative responsibility vested in the Direccion de Preservacion y Conservacion (DIPRECO). DIPRECO engineers will draw up plans and specifications for the irrigation and drainage works in each subproject, organize the local labor force for the construction of works in the subproject areas, and provide the necessary technical expertise and supervision of construction. DIPRECO will collaborate with the Direccion de Distrito de Riego (DDR) and DDR counterparts in the Agrarian Zonal Offices to set up strengthened regional irrigation offices in the two project areas. The purpose of these regional offices is to assist in supervision of construction, to organize water user associations in subproject areas, to monitor routine operation and maintenance of irrigation systems, and to provide required technical assistance in water use and on-farm improvements.

Additional coordination will come from the General Directorate of Forestry and Wildlife (DGFF) and from the Agrarian Bank, which, as financial agent of the credit fund for on-farm development investments, will play a key roll in the project. Ancillary support

will be furnished by the National Office of Evaluation of Natural Resources, the National System for Social Mobilization Support, and the General Directorate of Irrigation.

Technical assistance will be required at three levels:

1. For advising high-level GOP managers and analysts in techniques of water-related subproject development, analysis, administration and evaluation;
2. For implementation of subprojects; and
3. For improving the level of on-farm technology.

Additional TA funds will finance short and long-term training, training equipment, and watershed planning studies.

There should be no problem in organizing water user associations, as there is a tradition of communal responsibility for routine operation and maintenance of irrigation systems throughout the sierra.

#### SOCIAL

Peruvian sociologists have conducted an analysis of the socio-cultural feasibility of the first five selected subprojects. It was concluded that strong motivation and economic interest existed among the local farming communities in the project areas.

#### ECONOMIC

For the five subprojects, the predicted IRR's are 37.8, 29.2, 50, 26.8, and 18.8 percent. With interest and 15%, the predicted benefit-cost ratios are 3.2, 2.4, 10.8, 2.4, and 1.4.

A sample of subproject costs for the 3,390 ha Chupaca project is given on page 46 (attached).

The Project Paper does not provide a table of annual project expenditures.

Some indication of cost-estimates for the 22 additional subprojects is given in Table IX, page 76 (attached).

Up to four tests were carried out to test the economic and financial viability of each subproject:

1. The economic rate of return indicates whether the project is in the national interest;
2. One financial test measures returns to farmers' labor, management and investment;
3. Another financial test measures returns to his management and investment when labor is valued at the going farm labor rate; and
4. The final test shows the rate of return on the subproject per se (not the incremental benefits).

A fund for investments in on-farm improvements will be established within the Agrarian Bank, composed of up to \$1 million AID funds and up to \$3 million of GOP counterpart funds. Credit from this fund will be eligible on concessional terms for use in integrated medium and long-term investment programs designed to maximize efficiency of water distribution and to finance supplementary on-farm improvements. Such programs will include land leveling, terracing, construction of tertiary canals and laterals, installation of water control and application devices, and similar investments in land development and irrigation network extension.

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For illustrative purposes a cost breakdown is given of the Chupaca project in the Mantaro Zone:

<u>Cost of</u>	<u>S/. (in millions)</u>	<u>\$ (in thousands)</u>
Final Study	0.7	15.3
Construction	34.2	788.5
Land Development	<u>23.3</u>	<u>538.0</u>
TOTAL	S/.58.2	\$1,341.8

The construction costs can be broken down as follows

Labor	S/. 5.7	\$ 130.9
Materials	15.9	366.5
Tools and Equipment	6.8	157.1
Overhead	3.5	79.7
Supervision	0.6	14.9
Contingencies	<u>1.7</u>	<u>39.4</u>
TOTAL	S/.34.2	\$ 788.5

The detailed land development costs are:

Labor	S/. 4.3	\$ 99.6
Materials	6.5	250.6
Tools and Equipment	9.6	221.0
Overhead	1.2	27.7
Supervision	0.5	11.1
Contingencies	<u>1.2</u>	<u>27.7</u>
TOTAL	S/.23.3	\$ 538.0

These cost figures should be representative of the work to be done and are consistent with USAID/ENG's experience with unit costs in comparable construction activities.



TABLE IX

## COST ESTIMATES FOR 22 ADDITIONAL SUBPROJECTS IN CAJAMARCA AND MANTARO

Type of Infrastructure	Number	Unit Cost (in Soles)	TOTAL INVESTMENT	
			(in Soles) 1974 Values	(in US Dollars)
a) Works				
1. Small dams	5	S/.2,500,000	S/.12,500,000	\$ 288,150
2. Intaks	21	1,000,000	21,000,000	484,090
3. 34 special structures (bridges, siphons, etc.)	34	1,000,000	34,000,000	783,770
4. Principal irrigation canals	155 km.	400,000/km.	62,000,000	1,429,230
5. Secondary irrigation canals	245 km.	155,000/km.	36,750,000	847,160
6. Principal drainage canals	30 km.	1,000,000/km.	30,000,000	691,560
7. Secondary drainage canals	60 km.	200,000/km.	12,000,000	276,620
b) On-Farm Improvement				
1. Physical development of new irrigated lands	9,400 has.	15,000/ha.	141,000,000	3,250,340
2. Physical development of irrigated lands	5,300 has.	10,000/ha.	53,000,000	1,221,760
3. Miscellaneous complementary works (roads, etc.)	--	--	43,750,000	1,100,740
		Total	S/.450,000,000	\$ 10,373,420
		Cost of Studies	S/. 11,500,000	\$ 266,000
		GRAND TOTAL	S/.461,500,000	\$ 10,639,420

\* U.S. dollars are calculated at S/.43.38 to \$1.00

TITLE: On-Farm Water Management

PROJECT NO.: 527-0170

COUNTRY: Peru

REGION: Latin America

KEYWORDS: Water management research (5); demonstration farms (5).

SUMMARY: The project will optimize land and water use by setting up three research farms to:

1. Conduct systematic research of soil, water and plant interrelationships for major crops in Peru;
2. Demonstrate the effects of improved water management practices in water use and crop production; and
3. Develop irrigation system designs that optimize water application according to soil type, fertilizer utilization, and crop.

Alternative energy sources will be considered when possible.

LOCATION: La Molina, Canete, Huancayo

CLIMATE: Aw.

CROPS: Potato, corn, sweet potato, lima beans.

SOILS:

TARGET GROUP: Initially, agriculture students and technicians; ultimately, the small farmer.

BEGIN: FY 1978            END: FY 1980            AREA: 25ha

CONTRIBUTION:	US	\$497K grant
		irrigation engineer 36M
		agronomist 24
	GOP	?10K
	TOTAL	<u>\$1.07K</u>

GOALS: To increase the agricultural productivity and incomes of Peru's rural poor.

PURPOSE: To improve on-farm water management practices among small farmers in order to increase production by developing and

demonstrating the validity of alternative, improved on-farm water use management systems.

TYPE OF PROJECT: Research in water management at three research/demonstration farms.

PROJECT ORIGIN AND BASE LINE DATA: This project originated from a two-year contract (ProAg 24) begun in 1975 to provide technical assistance by an irrigation engineer and an agronomist. The present project will continue and expand that work.

DOCUMENTS REVIEWED: Project Paper (75 pp)

LOG FRAME: Attached to reviewed documents.

PLANNED START: January 1, 1978

PERT CHART: Attached to reviewed documents.

## GENERAL DESCRIPTION

This grant is to assist the Ministry of Agriculture to establish three research farms to develop improved on-farm water management. The major expenditures are for technical assistance.

## TECHNICAL

The project will establish three farms, at La Molina, Canete, and Huancayo, with areas of one, eight, and 16 hectares, respectively. These farms, two of which (La Molina and Canete) are adjacent to educational institutions, will be used for research, for training field technicians, and for demonstrating techniques to farmers. The locations were chosen for the educational advantage they provide, for their distribution in Peru's different climatic zones, and for their proximity to major agricultural areas.

Outputs include:

1. At least 18 water-fertilizer production interaction studies on several major crops. These will be the basis for further farmer field trials. Sprinkle, trickle and surface irrigation methods will be used.
2. Previous ET and irrigation water requirement models will be validated or revised. A Technical Manual of Irrigation Water Requirements will be published.
3. Irrigation efficiency will be demonstrated through the use of simple water measuring devices.
4. The results from the above will be applied to 186 small plots to demonstrate optimum cropping techniques.
5. Irrigation management demonstrations will be applied to plots of 54 local farmers or agricultural cooperatives, to show results are practically applicable.
6. Thirty simple extension bulletins will be prepared on all aspects of water management.
7. Alternative energy sources will be explored when possible.
8. It is estimated that 750-1,000 students, technicians and farmers will receive training or concentrated exposure to the research and demonstration.

## INSTITUTIONAL

Direct implementation will be by the Directorate of Conservation (DICO) within the Directorate General of Waters (DGA), a division of the Ministry of Agriculture. The DGA will provide four full-time counterpart technicians, three project farm engineers, three technical agricultural assistants, six or more field workers, land, machinery, vehicles, laboratory facilities, and office space.

AID will provide for technical assistance in the form of an irrigation engineer and an agronomist from Utah State University. Both of these men are already in place, funded by ProAg 24, which is due to expire soon. USU will provide computer services for analysis of field plot and climatic data, and additional technical resources when needed.

## SOCIAL

For this research project, no important social effects are anticipated.

## FINANCIAL/ECONOMIC

A detailed cost breakdown is given on pp. 27-29 (attached).

Since this project is for research and not for direct farm application, it was not possible to make any analysis of project costs and benefits. No B/C ratio or IRR is given.

Project Paper - Pages 27-29

TABLE III

Detailed Breakdown of A.I.D. Project Costs

1. AID Financed Technical Assistance		
<u>Salaries</u>		\$200,399
<u>Field Staff - LT Technicians</u>	(162,899)	
Irrigation Engineer - 36 wm	100,929	
Agronomist - 24 wm	61,970	
<u>Short-Term Technicians</u>	( 15,000)	
Agronomists - 4 wm	10,000	
Irrigation Engineers - 2 wm	5,000	
<u>On-Campus Staff</u>		
9 wm - \$2,500 p. wm	22,500	
<u>Benefits</u>		42,084
21% of total salaries \$200,399	42,084	
<u>Allowances - LT Technicians</u>		78,075
<u>Education Allowance</u>	(19,810)	
Engineer dependents	16,130	
Agronomist dependents	3,680	
<u>Housing Allowance</u>	(36,775)	
Irrigation Engineer - 3 years.	22,485	
Agronomist - 2 years.	14,290	
<u>Post Differential - LT Technicians only</u>		
10% of Salaries \$162,899	16,290	
<u>Rest and Recuperation</u>	(5,200)	
Irrigation Engineer	3,100	
Agronomist	2,100	

Detailed Breakdown of AID Project Costs (Continued)

<u>Travel and Transportation</u>	(15,000)	\$ 55,000
Home Leave and Return Home of Irrigation Engineer	13,500	
Home Leave and Return Home of Agronomist	9,500	
In-country Travel and per diem for LT technicians	17,000	
In-country travel and per diem for ST technicians - 180 days	9,000	
International travel for ST	6,000	
<u>Overhead</u>		66,870
30% Field Staff = \$177,899	53,370	
60% On-Campus Staff - <sup>2</sup> \$22,500	13,500	
<u>Miscellaneous Expenses</u>	(4,275)	4,275
On-Campus Support	4,275	
2. <u>Equipment</u>	(19,000)	19,000
Laboratory equipment, water measuring devices, soil water determination equipment, pipe, hydraulic rams, pumps, windmills sprinklers, soil sampling equip.	11,500	
Four-wheel drive carry-all	7,500	
3. <u>Participants</u>	(18,000)	18,000
6-8 months ST training in crop field plot technique, on-farm water management practices, irrigation extension methods, etc.	18,000	
4. <u>Other Costs</u>	(13,000)	13,000
Publications	8,000	
In-country Training	5,000	
GRAND TOTAL		<u>\$496,703</u>