5270150 (2)

UNCLASSIFIED

128p.

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

PROJECT PAPER

PERU

USE OF TREATED SEWAGE FOR IRRIGATION

Project Number: 527-15-120-150

LA/DR-TQ 8

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: C (A = Add, C = Change, D = Delete) — Amendment Number: Two

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: PERU

3. PROJECT NUMBER: 527-0150

4. BUREAU/OFFICE: LA — 05

5. PROJECT TITLE (maximum 40 characters): Use of Treated Sewage for Irrigation

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 03 DD 31 YY 81

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)
A. Initial FY 77 B. Quarter C. Final FY 80

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 77 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total		200	200	12	208	220
(Grant)	( )	(200)	(200)	(12)	(208)	(220)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country		68	68		124	124 1/
Other Donor(s)						
TOTALS		268	268	12	332	344

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) FN	142	064		200		20		220	
(2)									
(3)									
(4)									
TOTALS				200		20		220	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 021, 070

11. SECONDARY PURPOSE CODE: 122

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

A. Code	BF	RGEN				
B. Amount						

13. PROJECT PURPOSE (maximum 480 characters)

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

14. SCHEDULED EVALUATIONS
Interim MM YY MM YY Final MM 3 YY 81

15. SOURCE/ORIGIN OF GOODS AND SERVICES
[x] 000 [ ] 941 [x] Local [ ] Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a 2 page PP Amendment.)

Change in the AID life of project budget total due to the need of additional research activities required under the project.

1/ At S/.265.00 per US$

17. APPROVED BY
Signature: Leonard Yaeger
Title: Mission Director
Date Signed: MM DD YY

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
MM DD YY

AID 1330-4 (8-79)

USE OF TREATED SEWAGE FOR IRRIGATION PP AMENDMENT

The Use of Treated Sewage for Irrigation Grant Project, Number 527-15-120-150, approved in AID/W on March 14, 1977 established a total life of project contribution of $200,000 for the U.S. Government. These funds were to be used to assist the Government of Peru to establish a pilot site at Tacna to demonstrate the economic and technical feasibility of producing significant quantities of foodstuff and feeds by irrigating desert lands with treated sewage effluent and to test the range of high value crops that may be safely irrigated with treated sewage. Actual estimates for research activities are higher than the amount budgeted. Since one of the main objectives of the project is to test replicability throughout other areas of Peru, Mission considers it imperative to conclude the [illegible]ing thorough research to fully determine the treatment adeq[illegible] the effects on soils and crops and primarily the health eff[illegible] derived from human consumption of foods grown with treated sewage. This intensive research will require physical, chemical, biological and epidemiology controls for a minimum of one year after the various crops cultivated in the project site are harvested and utilized.

For the reasons stated above we request approval of an amendment to the PP in order to increase the total U.S. Government life of project contribution to this project by $20,000 bringing the total cost of the project as amended to $220,000.

Clearances:

PROG:LFSmucker
RLA:SWhitman (in draft)
OARD:JO'Donnell
ENGRI:EAlarcón
CONT:JDavison

AUTHORIZATION AMENDMENT

Name of Country: Peru

Name of Project: Use of Treated Sewage for Irrigation

No. of Project: 527-0150

1. Pursuant to Part I, Chapter 1, Section 103 of the Foreign Assistance Act of 1961, as amended, the Use of Treated Sewage project for Peru was authorized on March 14, 1977. That authorization is hereby amended as follows:

a. The approved life of project budget total is changed from $200,000 to $220,000.

b. Up to Twenty Thousand United States Dollars ($20,000) may be used to finance foreign exchange costs for the project.

c. Section A of the authorization is amended to read:

"All goods and services financed by AID under the Project shall have their source and origin in the United States or in Peru."

d. The following new covenant is added to Section B of the Authorization:

"Prior to any disbursement, or the issuance of any commitment documents under the amended Project Agreement (the Limited Scope Grant Agreement), the Grantee shall furnish a Detailed Plan of the additional Research Activities to be carried out under the project."

2. The authorization dated March 14, 1977 cited above, remains in force except as expressly hereby amended.

Leonard Yaeger
Mission Director

5/5/80
Date

Clearances:
PROG:LFSmucker
RLA:SWhitman (in draft)
OARD:JO'Donnell
ENGRI:EAlarcón
CONT:JDavison

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE ("X" appropriate box)
[X] Original [ ] Change [ ] Add [ ] Delete

PP

DOCUMENT CODE 3

2. COUNTRY/ENTITY
PERU

3. DOCUMENT REVISION NUMBER

4. PROJECT NUMBER
527-15-120-150

5. BUREAU
a. Symbol: LA
b. Code: 05

6. ESTIMATED FY OF PROJECT COMPLETION
FY 80

7. PROJECT TITLE - SHORT (stay within brackets)
USE OF TREATED SEWAGE FOR IRRIGATION

8. ESTIMATED FY OF AUTHORIZATION/OBLIGATION
a. INITIAL mo. 7 yr. 76 b. FINAL FY 78

9. ESTIMATED TOTAL COST ($000 or equivalent, $1 =)

a. FUNDING SOURCE	FIRST YEAR FY TQ			ALL YEARS		
	b. FX	c. L/C	d. Total	e. FX	f. L/C	g. Total
AID APPROPRIATED TOTAL						
(Grant)	( )	(125)	(125)	( )	(200)	(200)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
HOST GOVERNMENT					217.4	217.4
OTHER DONOR(S)						
TOTALS		125	125		417.4	417.4

10. ESTIMATED COSTS/AID APPROPRIATED FUNDS ($000)

a. Appropriation (Alpha Code)	b. Primary Purpose Code	c. Primary Tech. Code	FY TQ d. Grant	FY TQ e. Loan	FY 77 f. Grant	FY 77 g. Loan	FY 78 h. Grant	FY 78 i. Loan	ALL YEARS j. Grant	ALL YEARS k. Loan
FN	142	064	125				75		200	
		TOTALS	125				75		200	
11. ESTIMATED EXPENDITURES			0		93		95			

12. PROJECT PURPOSE(S) (stay within brackets) [ ] Check if different from PID/PRP

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

13. WERE CHANGES MADE IN BLOCKS 12, 13, 14, or 15 OF THE PID FACESHEET? IF YES, ATTACH CHANGED PID FACESHEET.

[ ] Yes [X] No

14. ORIGINATING OFFICE CLEARANCE

Signature: Donald Finberg

Title: Director

Date Signed: mo. 6 day 14 yr. 76

15. Date Received in AID/W, or For AID/W Documents, Date of Distribution
mo. day yr.

AID 1330-4 (7-75)

Department of State TELEGRAM

UNCLASSIFIED 2615

PAGE 01 STATE 241136

BEST AVAILABLE COPY

7 Oct

01

ORIGIN AID-20

A

INFO OCT-01 SSO-00 IGA-02 L-03 EB-07 /033 R

DRAFTED BY LA/DR:KKELLY:TJW
APPROVED BY AA/LA:DMLION
LA/DR:CBWEINBERG LA/DR:RCSIMPSON
LA/DR:MDBROWN GC/LA:TGEIGER(DRAFT)
LA/DR:FWTATE (DRAFT)
LA/DR:JASANBRAILO
LA/DR:HAHASAN (DRAFT)
LA/SA:RCOHEN (DRAFT)
GC/LA:JKESSLER
PPC/DPRE:EHOGAN LA/DR:LSEVILLE(INFO

---------- 038178

R 282130Z SEP 76
FM SECSTATE WASHDC
TO AMEMBASSY LIMA IMMEDIATE

UNCLAS STATE 241136

AIDAC

E.O. 11652: N/A

TAGS:

SUBJECT: USE OF TREATED SEWAGE FOR IRRIGATION GRANT PP

1. SUBJECT PROJECT IS HEREBY APPROVED, AT A LIFE OF PRO JECT LEVEL OF 200,000 DOLS, WITH 125,000 DOLS IN THE TO. USAID IS AUTHORIZED TO NEGOTIATE A PROJECT AGREEMENT CON SISTENT WITH THIS APPROVAL. ADVICE OF ALLOTMENT FOLLOWS IMMEDIATE CABLE.

2. AS MISSION IS AWARE, AID/W HAS CAREFULLY ANALYZED TH PROJECT, AND SOME CONCERN REMAINS AS TO ITS REP ABILITY, COST, AND EMPHASIS BEING PLACED ON THE RESEARCH EFFORT. THE FOLLOWING GUIDANCE IS PROVIDED IN ORDER TO MAXIMIZE THE BENEFITS TO BE DERIVED FROM THE PROJECT:

LA/DR Chron

UNCLASSIFIED

45

(A) PROJECT REPLICABILITY: THE HIGHER COSTS OF REPLICATING PROJECT AT THE LIMA SITE (DUE TO PUMPING AND CIVIL WORKS COSTS) RAISE CONCERNS OVER ECONOMIC FEASIBILITY OF SUCH A PROJECT. ANY PLANS FOR DEVELOPING LIMA PROJECT ARE CONTINGENT UPON (1) SUCCESSFUL COMPLETION OF TACNA PROJECT AND (2) EXTENSIVE AGRICULTURAL AND ENGINEERING STUDIES OF PROPOSED LIMA SITE (INCLUDING STUDY OF CANAL FROM TREATMENT PLANT TO IRRIGATION SITE AND HOW RELATED COSTS SHOULD BE TREATED AS PART OF TOTAL PROJECT COSTS).

(B) PROJECT COSTS: THE PROJECT REQUIRES PROPER LABORATORY FACILITIES AND TECHNICAL PERSONNEL FOR CONTINUOUS ANALYSIS OF EFFLUENT. WHEN CONSIDERED AS PART OF TOTAL PROJECT COSTS, THE COSTS FOR SUCH FACILITIES AND PERSONNEL RAISE SOME QUESTION AS TO WHETHER PROJECT FUNDS ARE SUFFICIENT TO PERMIT THE EFFECTIVELY CONTROLLED RESEARCH REQUIRED BY THE PROJECT. THE MISSION SHOULD EXAMINE THIS CONCERN AS PROJECT IMPLEMENTATION MOVES FORWARD AND BE PREPARED TO MAKE NECESSARY CHANGES IN OTHER ASPECTS OF THE PROJECT (I.E., REDUCE NUMBER OF HECTARES) IN ORDER TO ASSURE RESEARCH CONTINUES AS REQUIRED.

(C) RESEARCH: SUCCESS OF RESEARCH ON FIVE-HECTARE DEMONSTRATION PLOT IS PRINCIPAL ASSUMPTION IN THE FEASIBILITY OF THE LIMA PROJECT. THIS SERVES TO EMPHASIZE THE IMPORTANCE OF THE RESEARCH ASPECT OF THE PROJECT, AND THE NEED TO CLOSELY MONITOR THE RESEARCH PERFORMED FOR ITS POTENTIAL IMPACT ON PROJECT REPLICABILITY. ROBINSON

USE OF TREATED SEWAGE FOR IRRIGATION

TABLE OF CONTENTS

		Page
Part I.	Summary and Recommendations	
	A. Face Sheet	1
	B. List of abbreviations for Peruvian Agencies	4
	C. Location map	5
	D. Recommendations	6
	E. Description of the Project	6
	F. Summary Findings	7
Part II.	Background and Detailed Description	
	A. Background	12
	1. Agricultural Economic Background	12
	2. Project Background	14
	B. Detailed Description of Project	15
Part III.	Project Analysis	
	A. Technical Analysis	18
	B. Financial Plan	19
	C. Economic Analysis	20
	D. Financial Analysis	25
	E. Social Analysis	30
Part IV.	Implementation Planning	
	A. Administrative Arrangements	37
	B. Implementation Plan	47
	C. Evaluation Plan	49
	D. Conditions and Covenants	51

ANNEXES

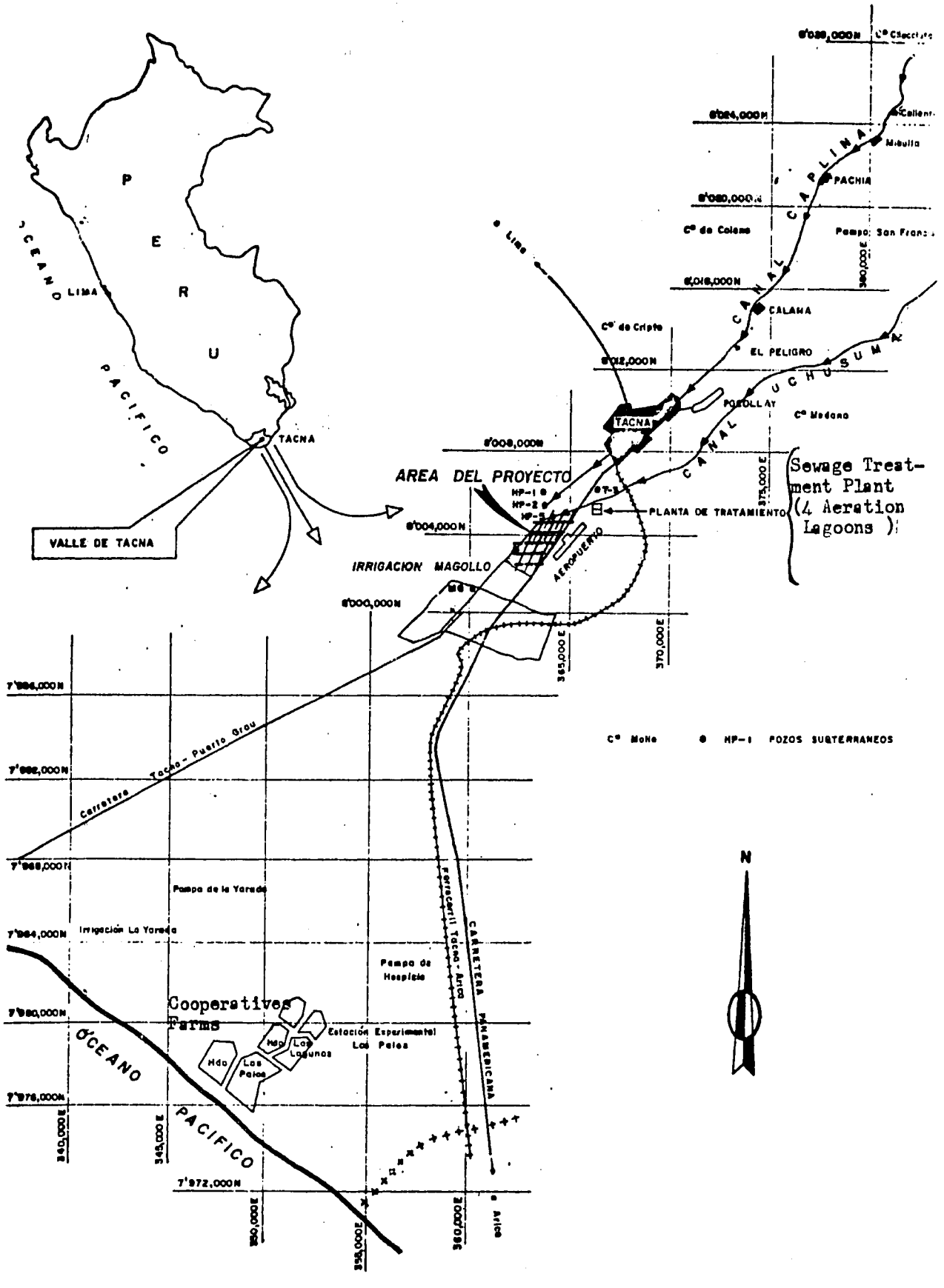
A.	Draft of Project Description for ProAg	52
B.	Project Technical Details	
	1. Construction Schedule	55
	2. Estimated Tonnage Yield per Year	56

		Page
C.	Environmental Assessment	57
D.	Logical Framework Matrix	60
E.	Project Performance Tracking Network Chart	61
F.	Statutory Checklist	63
G.	Grantee's Application for Assistance	82
H.	Mission Director's Certification	83
I.	Draft Authorizing Document	84
J.	Contractor's Report	85
K.	State 179480	91
L.	PP Addendum	95

B. LIST OF ABBREVIATIONS FOR PERUVIAN AGENCIES

GOP	Government of Peru
MOA	Ministry of Agriculture
DGA	Directorate General of Waters
DIPRECO	Directorate of Preservation and Conservation
A. Z. VII	Agrarian Zone No. 7
A. B.	Agrarian Bank
MOF	Ministry of Food
MOH	Ministry of Health
AREA No. 4	Tacna Office of the Ministry of Health.

C. LOCATION MAP



USE OF TREATED SEWAGE FOR IRRIGATION
PROJECT PAPER

PART I. SUMMARY AND RECOMMENDATIONS

A. Face Sheet

B. List of abbreviations for Peruvian Agencies

C. Location map

D. Recommendations

USAID/Peru recommends that AID/W authorize a Grant of $200,000 ($125,000 in the Transition Quarter and $75,000 in FY 1978) to assist the Government of Peru, through the Directorate General of Waters of the Ministry of Agriculture, to demonstrate the economic and technical feasibility of producing significant quantities of food and forage on Peru's vast coastal desert by irrigating with treated sewage effluent. The demonstration will be executed at a site near the city of Tacna in southern Peru.

E. Description of the Project

Based on an existing sewerage treatment facility, this project provides for the construction of an irrigation system to utilize available treated sewerage effluent for crop production on the coastal desert lands near Tacna. The system to be constructed will service an initial 120 hectares by 1978 and will be designed for extension to an additional 80 hectares which will be developed by the GOP at a later date. 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 sewerage meet sanitary regulations for foods for human consumption.

The construction of the project irrigation system will be completed by early 1978, thus permitting the planting of 120 hectares of crops at that time. This area is sufficient for the harvesting of approximately 6,708,000 pounds of agricultural products per year based on a land utilization ratio of 1.65 which will be obtained through double cropping. Initial production, in accordance with existing GOP sanitary regulations, will include corn, potatoes, lima beans, squash and alfalfa.

An important aspect of the project however, will be a five hectare research plot to be administered and monitored collaboratively by the agriculture and health authorities. The research plot will provide for continuous analysis of soils, water quality, etc., but will also be devoted to the testing of the sanitary properties of labor intensive, high value crops such as tomatoes, melons and lettuce which are at present precluded from production with the use of sewerage effluent under the GOP sanitary code. The purpose of this research is to demonstrate that treated sewerage effluent is safe for the production of such food crops.

The Directorate General of Waters (DGA), a principal division of the Ministry of Agriculture (MOA), will be the responsible GOP Agency for this project acting in close coordination with the Agrarian Zone VII (MOA Tacna Office) and other local institutions such as the Tacna Office of the Agrarian Bank, the Ministry of Health's Tacna Office, and the local office of the Ministry of Food (MOF). Beneficiaries of the project will be landless former farmers who will be organized into a cooperative by the Agrarian Zone VII (A.Z. VII) concurrently with the execution of infrastructure works.

The most important structure of the system already exists and is operating; this is the sewage treatment plant. The project will finance primary and smaller secondary canals, low cost feeder roads, water control gates and research and supervision. GOP counterpart contributions to this project will be basically in-kind and credit, providing services, some of the skilled and support personnel at all stages of the project and some of the materials. AID grant funds will be utilized for renting certain pieces of equipment, for contracting specialized professional personnel, and for labor and some materials.

F. Summary Findings

1. Priority

USAID/Peru and the Ministry of Agriculture's Directorate General of Waters (DGA) staff have worked closely to develop this project and have readily secured the interest of other GOP agencies, e.g., the Ministry of Health and the Agrarian Bank, in collaborating. The project fits well within the GOP's economic development priorities which stress increased food production through such means as the expansion of Peru's limited arable lands through irrigation projects. It is the Mission's

judgement that the AID assistance proposed under this project can lead to significant economic benefits to Peru in terms of maximizing scarce coastal water resources to increase the domestic food supply.

2. Administrative and Technical Feasibility

The planning, design and cost calculations for construction, which the DGA has done for this project, have essentially followed irrigation planning practices which have been used and refined in Peru over the past years and which are accepted as standard for small irrigation projects. DGA's engineers approached the project planning with professional competence in each of several engineering disciplines. Their field investigations have been in sufficient depth to assure that adequate data is available for developing and laying out all elements of irrigation and drainage. USAID/ENG has reviewed the DGA standard designs and has found them to be technically satisfactory. In the final engineering study the standard designs will be tailored to actual field conditions and, at that time, will again be reviewed by USAID/ENG to assure their adequacy.

GOP funding for the project is contained in their 1976 budget and in the 1977/78 biennial budget request of the DGA. The additional resources required of the DGA as a result of this project does not impose an excessive burden on its current or future funds. The USAID is confident that sufficient technical management capacity exists in the DGA to execute the project effectively and efficiently as they have demonstrated in various projects in several parts of Peru.

3. Financial and Economic Feasibility

The feasibility study prepared by the DGA on the proposed project contains a detailed economic and financial analysis which demonstrates clearly the feasibility of the program. 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 and the benefit-cost ratio to be 1.13 for the first phase of the project (120 Ha.). For the second phase of the project (200 Ha.) the projected internal rate of return is 24.10% and the benefit cost ratio is 1.16.

4. Replicability and Output Potential

Peru's coastal desert is ideal for treated sewage irrigation projects. The ultra-violet ray factor is extremely high on the desert, even during seasons when large areas have cloud cover. These rays speed the oxidation digestion of sewage in the treatment process by speeding algae growth in the lagoons. It is estimated that about 14,000 hectares of land near Peru's 8 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 (14,000 has. X land use intensity factor of 1.65).

The following illustrates the potential outputs which may reasonably be projected for the above mentioned replicable area based on analyses undertaken for the project demonstration site.

a. Production of Agricultural Commodities

For the Tacna pilot project, the projected gross value of agricultural production averages S/.40,400 (US$898) per hectare. Applying this average to 23,100 has. results in a total value of potential production of US$20,744,000. This total is equivalent to 5% of Peru's total 1975 food imports ($395 million). While there is not a complete overlap between current food imports and the types of crops which could be grown with treated sewage irrigation, such production would result in direct savings in the case of corn, potatoes and meat (alfalfa).

Actual commodities produced would vary from area to area, depending upon temperatures, soil conditions, and whether or not the GOP changes its current policy on the types of crops which can be cultivated using treated sewage. In general, however, one hectare of intensively cultivated arable coastal land in Peru is capable of supporting ten people per year in terms of agricultural crops. An expanded system of treated sewage irrigation should then eventually be able to support 230,000 people in terms of its production.

b. Employment

i) Family

Assuming an average of one family per 4.5 has. of actual land, approximately 3,110 farm families (18,660

people) could 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.

ii) Contracted Labor

Assuming labor needs average 100 man days per cropable hectare, total manpower requirements would be 2,310,000 person days. Family labor available is calculated at 2.2 family members available for 220 days per year. Total family labor (3,110 x 2.2 x 220) is 1,505,240 man days. Contracted hired labor would be required to complete the remaining needs: 804,760 days or 3,658 jobs representing a value of S/.132,636,640 (US$2,947,480) at current wage levels.

iii) Cost Per Job Created

The Tacna pilot project will require an average investment of $1,421 per hectare. This cost does not include approximately $79 per hectare which would be required for pumping in other areas, thus bringing the total average investment per replicable hectare to $1,500. Since a total of 10,500 new jobs would be created (family labor plus contracted labor) the average cost per job created would be $2,000 (14,000 has. times $1,500 divided by 10,500). This figure compares very favorably with this Mission's experience in "little man" type projects under earthquake reconstruction assistance. The average cost per job under Loan 053 was $3,159 in the Coast and $2,906 in the Sierra.

It should be noted that replication would also require new GOP investmnet in sewage treatment facilities such as that which already exists in Tacna. Such facilities would have an average cost of $2,000 per hectare. This cost was not included in the above calculations since it represents an investment primarily in the sanitation/environment/health sector and should not be charged to agriculture. Nevertheless, inclusion of this major cost would still result in a return on investment of 8.53%, not taking into account the benefits of an improved health environment.

c. Prospects for Replicability

The GOP is showing increasing interest in building sewage treatment facilities based primarily on health considerations. In addition to Tacna, for example, sewage treatment lagoon facilities already exist at Ica, Sullana and Piura. Heightened

interest in sewerage treatment facilities for their potential for reclamation of valuable water for agricultural purposes may reasonably be predicted as a result of the execution of the proposed demonstration project.

Moreover, sewage treatment facilities are essential for reversing the serious contamination of several streams and adjacent coastal areas nearby Peru's larger coastal cities a subject of increasing GOP and private concern. As an example, the immediate ocean and swimming beaches fronting Lima have a pollution contamination factor 6 times higher than the permissible maximum. As one result of awaking concerns relative to such contamination, a pre-feasibility study has recently been made for recovering and treating some 6 cubic meters per second, i.e., 60% of the city's present discharge of raw sewage.

Thus, based on health, agricultural, and environmental interests and the financial and technical advantages of sewage lagoon treatment facilities along Peru's coastal desert, project replicability is both desirable and likely.

PART II. Background and Detailed Description

A. Background

1. Agricultural Sector Background

One of the major problems impeding Peru's economic growth is the continuing low growth rate of the agricultural sector which in recent years has given rise to shortages of foodstuffs, vastly increased imports of basic foods, and inflationary pressures. 1/ An estimated 47% of Peru's population is dependent upon the agricultural sector, which is characterized by poor farming practices, a low level of technology and correspondingly low income levels.

An estimated 45% of Peru's population is concentrated on the Pacific coast desert. This sloping plain extends nearly the full length of Peru, over 1600 miles, but, squeezed between the ocean and the abruptly rising Andes, it averages less than 12 miles in potentially useable width. Fifty-three short fast flowing streams cut this desert. Only thirteen of these have continuous flow, although they all provide for some irrigation within the immediate confines of their valleys. As a result they are the oasis around which population centers and immediate agricultural support areas have developed. Between the river valleys there is only desert, which has little economic potential in its present condition.

The limited productive land base of Peru is a major constraint to achieving agricultural goals. It is estimated that there are approximately 400 persons per square kilometer of arable land in the country, a very poor ratio when one considers the number of inhabitants which depend on agriculture for a livelihood, and the high (3.1%) rate of population growth.

While the agricultural sector employs an estimated 47% of the total work force, its relative contribution to GDP has been steadily dropping over the last decade. In 1965 agriculture contributed

---

1/ Peru's food imports amounted to $166 million in 1972; in 1973 these jumped to $238 million and soared to $395 million in 1975. This contributed to Peru's international reserves decline of $543 million during 1975.

18.3% of GDP; this dropped to 14.9% in 1972 and is estimated at 13% in 1974/75. Agricultural growth rates since 1970 have ranged from "poor" to "unacceptable" in economic terms. The following table gives the latest Ministry of Economy and Finance figures on percentage growth rates for overall GNP and key sectors of the economy, clearly indicating the relatively poor performance of the Agricultural Sector.

	1974	1975
GNP	6.6	4.0
Agriculture	2.3	1.0
Fishing	40.0	-18.1 2/
Mining	2.5	-10.4 2/
Industry	8.0	6.0
Construction	19.0	15.0
Others	5.9	5.1

In 1969 the Peruvian government initiated a high priority comprehensive Agrarian Reform Program, designed to bring about a radical change in the structure of the traditional land tenure system. The target of the Agrarian Reform, perhaps the most ambitious undertaken in South America, is to redistribute approximately 10.5 million hectares of land to an estimated 342,000 farm families by the end of 1976. To date over 7.2 million hectares have been expropriated and 6 million hectares have been transferred to almost 250,000 families which have, for the most part, been consolidated into Agrarian Production cooperatives. 3/

2/ Fishing and Mining both dropped drastically due to lower world prices for copper and fishmeal during 1975; the situation was worsened by increased strike and work stoppage activities in both sectors. The Mining sector was further weakened by the nationalization of the Marcona Corporation and Peru's inability to find markets for its iron ore.

3/ The bulk of Agrarian Reform beneficiaries have been organized into production and service cooperatives, agrarian societies of social interest, campesino communities and integrated land parcel cooperatives. In some cases, individuals hold title to small parcels of land, but the majority of land is held by the cooperative itself.

Redistribution of land has helped to solve some of the social inequities in the rural sector but the Agrarian Reform has not been able to effect a solution to the pressing economic problems of the agricultural sector occasioned by low productivity and a lack of arable land. As a result of the dearth of land available for agricultural purposes, the GOP has fostered an aggressive policy of land reclamation through the use of traditional irrigation methods -- the enormous Chira-Piura, Tinajones and Majes projects indicate the government's commitment to expand the country's agricultural base. At the same time, there is an increasing emphasis on small to medium sized irrigation projects. The DGA's 1975-76 action plan calls for basic studies of irrigation improvement projects involving 800 km. of canals which would affect the irrigation of over 300,000 hectares.

Recently the GOP has taken steps to prohibit urban expansion on agricultural lands. At the same time it has shown initial awareness of the importance of conserving the scarce supply of water available on the coast. Conservative figures indicate that coastal population centers presently discharge some 1.2 million metric tons (317 million gallons) of untreated sewage into nearby streams and the Pacific ocean every day. This not only wastes water rich in organic fertilizers but thoroughly contaminates the streams and ocean and disrupts the aquatic environment. This sewage effluent offers great potential for making selected desert areas highly productive. If collected before final discharge and treated the present volume of water being discharged could irrigate an estimated 14,000 hectares, thus converting selected areas of barren desert into needed food producing areas and at the same time provide a living for currently landless farmers.

The reclamation, development and management of selected desert lands is consistent with the GOP priorities of expanding the agricultural base and exploiting more intensively its scarce resources.

2. Project Background

The USAID and DGA have been working together in the development of small irrigation projects for the past two

years. The use of treated sewage effluent for irrigation is seen as an extension to traditional approaches, incorporating a new concept for irrigating with water otherwise being wasted, producing food crops in Peru and helping to solve serious environmental problems.

In March 1975 a potential project was identified adjacent to a city of Lima Pueblo Joven, named "Villa El Salvador". A PID was prepared based on that project site. Due to delays in getting local agencies started on definite plans for building the oxidation lagoons in Villa El Salvador the DGA and USAID jointly decided that another site was necessary in order to have a functioning project within the coming two years for demonstration purposes. For this reason, Tacna was identified as an alternative site. In October 1975, DGA officially requested a change to Tacna where there is a new aeration lagoon sewage treatment plant in operation. In December 1975 a Memorandum of Agreement was signed between DGA and USAID by which $8,000 in Grant funds were made available to DGA to develop a feasibility study. This study, "Use of Treated Sewage for Irrigation-Tacna, Perú", has been recently completed and serves as the basis for this proposal.

B. Detailed Description of Project

The Logical Framework for this project appears in Annex D. Despite the fact that the Tacna project in and of itself is relatively small in nature, if it proves a successful demonstration and is replicated in other coastal areas it will be making a significant contribution to the solution of a major problem in Peru -- insufficient production of domestically produced food.

Most of Peru's major cities are located on the dry desert area along the Pacific coast. From these cities a large volume of sewage is currently dumped, untreated, into streams and the ocean, creating serious environmental hazards as well as the loss of a potentially rich resource, the organic-rich irrigation waters which could flow to neighboring desert areas. The secondary goal of the project is to create an awareness of the dual benefits which treated sewage for irrigation would bring: an improved environmental and increased agricultural land.

Since the Tacna project is designed to serve as a demonstration, the Project purpose if to show clearly the economic and technical feasibility of the process so that it will in fact be replicated in other areas.

To achieve both purpose and goals, inputs will be required from USAID (in the form of grant financial assistance and engineering guidance and monitoring), and four GOP entities, the Ministries of Agriculture, Health and Food, and the Agrarian Bank. Timely coordinated inputs from the above entities will result in the following outputs: (1) construction of basic infrastructure at the Tacna site; (2) 120 hectares brought into economic production by the end of the second year; (3) yields for selected crops; (4) a functioning demonstration site; and (5) the establishment of the a grarian production cooperative which will work the newly-irrigated land.

The Ministry of Agriculture's Directorate General of Waters (DGA) has completed the feasibility study for the Tacna pilot project site with funds made available from A.I.D. Under the proposed project, A.I.D. funds will assist in financing the design and construction of the irrigation infrastructure at the project site. Although the demonstration facility initially will encompass 120 hectares, the basic infrastructure will be built to specifications that will permit expansion of the site to 200 hectares at an estimated additional cost of $31,000.

Final selection of crops to be grown will be made during the development of the final engineering design/study to be undertaken by the DGA. Crops selected will be from among the type presently permitted by Peruvian law to be grown with treated sewage effluent. However, a part of this demonstration project will be to experiment with other food crops, outside the "permissable list," e.g. tomatoes, lettuce and other garden crops. This will be done to demonstrate that high value foods of the raw edible type grown with treated sewage effluent are sanitary and safe for human consumption, with an end towards convincing the GOP to modify its policy and expand the number of crops that can be grown with treated

sewage effluent. A control plot of approximately 5 hectares will be set aside for this particular experimental purpose.

The DGA will be the primary agency responsible for implementing the project and will provide, inter alia, 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 No. VII in Tacna (A. Z. VII) 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's Tacna Office 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 mentioned above. A portion of the A.I.D. project contribution will assist in setting up simple, but adequate, research facilities at the project site. Collaboration and coordination among all of the above mentioned parties has been very good during the development of the feasibility study; there are ample indications that this will continue in the future.

The immediate participants/beneficiaries of the project will be approximately 150 members of poor families who have migrated from the Sierra to the "pueblos jóvenes" of Tacna. These 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. The land is currently public domain, without economic utility. It will be passed to the Agrarian Reform, which in turn will adjudicate it to the newly-formed cooperative. Since the land has been in the public domain there are no former owners to compensate so the cooperative will not be charged for the land.

PART III. PROJECT ANALYSIS

A. Technical Analysis

The most important structure in the system exists and is operating; this is the Tacna sewage treatment plant. This modern facility is comprised of four aeration lagoons and was designed by a USA engineering consultant firm. It has been operating satisfactorily since October 1975. This project will complete the infrastructure necessary to irrigate coastal desert lands using the treated sewage effluent from this plant.

The treated effluent will flow from the plant to the areas to be irrigated in a concrete lined canal 5 Km. long. The capacity of this canal will be 230 ft/sec.; thus it will adequately handle the maximum designed discharge of the treatment plant when this will be attained by 1985. Present effluent flows vary between 100 and 130 ft/sec., depending upon the hour of the day. This main canal will cross under the Pan-American highway just north of the Tacna airport. Here, as in most of its length, the road is six meters wide.

Eleven (11) Km. of smaller secondary canals will complete the distribution network for distributing water to all parts of the first 120 Has. to be developed. Provisions will be made for extending these canals, as necessary, to provide water to the increased hectarage (to a total of 200 Ha.) as more effluent becomes available from the treatment plant. The natural slope of the terrain of the site is 2%, thus 45 drops (small cascades) will be required in the secondary canals to dissipate the naturally developed hydraulic energy.

Nine kilometers of three meter wide, low-cost feeder roads will provide access to the project site. Ten culverts will be required at locations where secondary canals cross under these feeder roads. At 12 locations iron gates will be installed to provide control of the water to each area selected for irrigation at the time required. The entire system is to be built as simply as practicable, and will utilize labor-intensive methods with a minimum of equipment.

All preliminary work performed by DGA appears to be quite acceptable, including a 1/2,000 topographic map with one meter contour lines and a detailed soils study. These are in the feasibility study. Before construction starts final design will be made by the DGA. The soil quality is not uniform in the project area, varying from Class I to Class IV, i.e., good to poor.

Nevertheless, experience elsewhere with treated sewage irrigation has shown that the organic components quickly improve the quality of the soil.

The employment generation of the project corresponds favorably to other Peruvian irrigation projects. At the start 65 or more persons will work the land steadily and additional farm labor will be needed seasonally every year; later other workers will be added as the treatment plant effluent increases and as more land is incorporated into the system. The host government has the capability of adequately controlling operation and maintenance. The sewage treatment plant is presently under the control of Tacna Ministry of Health and Ministry of Housing offices. The irrigation system and lands will be controlled by the Agrarian Zone VII. Not too far distant in this same valley the Magoyo and La Yarada irrigation systems are good examples of managerial efficiency being demonstrated by the Agrarian Zone VII.

From an overall view, the development of this project should also achieve a significant environmental benefit. This is discussed in the environmental assessment, Annex C.

B. Financial Plan

Present cost estimates are as follows:

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

It is expected that the Agrarian Bank will provide all needed production credit to the area beneficiaries; this will amount to $120,000 for the first crop. The current rate of interest for production credit is 6% per annum.

1/ See Implementation Plan.

One item not included in the cost estimates is the cost of land. At the present time the land is unused and has no economic value. Estimates of its potential value with irrigation are varied and go as high as S/.7,000 ($155) per hectare. Since the land will be given without charge to the project beneficiaries, the implicit value of the GOP contribution will rise by the total value of the land -- $31,000, considering an eventual project size of 200 hectares valued at $155 a hectare.

The research and operational control of the project will be closely coordinated with the Ministry of Health. A detailed program will be designed to provide scientific and technical information in sanitation, control of effluent quality, crop yields and soils control.

A 15% contingency is considered to be adequate considering the level of cost estimates made in the Feasibility Study. In the same manner a 20% inflation factor is realistic for Peru, given the fact that the construction period will be less than one year. Since these cost data are consistent with USAID/ENG experience with unit costs in comparable construction activities, the total cost of the project is considered to be reasonable. Adequate planning has taken place to produce a technically sound project; consequently Section 611(a) (1) of the Foreign Assistance Act has been fully complied with by the Feasibility Study made by DGA.

C. Economic Analysis

Economic justification of the project is derived from two major benefits: (1) increased food supply to the Tacna areas; and (2) income which will be generated to the target population.

1. Phase One - 120 Hectares (1978)

The 120 hectares which will be irrigated under the project are currently unused, due to the lack of water. The type of agriculture which is anticipated is one of "medium technology," under which crops traditional to the area will be cultivated. Double cropping will be possible, and crop rotation will be practiced to insure optimum land use. 115 hectares of the project area were originally studied by the DGA, and the following land use was calculated:

Alfalfa	40 has.	21.1%
Lima Beans	25 has.	13.2%
Potatoes	50 has.	26.3%
Corn	55 has.	28.9%
Squash	20 has.	10.5%
	190 has.	100.0%

Of these crops, alfalfa will be permanent for four years; squash and potatoes will be cultivated during the winter; corn and squash during the summer. This basic rotation will be repeated during the four-year period until the original alfalfa crop is discontinued. Total cultivated area will thus be 190 hectares, which, using 115 has. as the physical extension of the project, results in a land use intensity of 1.65. Table I shows anticipated costs and values of production, based on figures developed by the Agrarian Bank.

Based on the estimated net value of production of S/.2,682,920 or US$59,620, projected family incomes in the project area come to $2,384 per year, or $397 per capita considering an average family size of six persons. These figures are average annual income; they actually will vary on a four-year cycle, due to the fact that every fourth year alfalfa must be replanted.

Production of the five crops is estimated as follows:

Alfalfa	:	2,185 metric tons/year
Lima Beans	:	30 metric tons/year
Corn	:	165 metric tons/year
Potatoes	:	600 metric tons/year
Squash	:	160 metric tons/year

2. Phase Two - 200 Hectares (1985)

By 1985, when the sewage treatment plant is operating at full capacity, the project will be able to effectively irrigate 200 hectares. Assuming increments in the production of the original five crops, 1985 land use -- again with double cropping-- would be approximately the following:

Alfalfa	75 has.	23.1%
Lima Beans	40 has.	12.3%
Potatoes	85 has.	26.2%
Corn	90 has.	27.7%
Squash	35 has.	10.7%
	325 has.	100.0%

Table 2 shows anticipated costs and values of production.

Table 1

COSTS OF PRODUCTION AND VALUE OF PRODUCTION

(Figures in Peruvian soles, calculated at rate of S/.45.- = US$1)

	GROSS VALUE OF PRODUCTION				COSTS OF PRODUCTION (S/.) 1/ 2/			NET VALUE OF PRODUCTIO (S/.)	
CROP	No.Has.	Yield Kg/Ha.	Price S/.Kg.	Total S/.	Agro-Inputs	Labor	Total	Total	Per Ha.
Alfalfa 3/	40	54,625	0.6	1,311,000	--	--	767,720	543,280	13,582
Corn	55	3,000	9.0	1,485,000	536,470	491,040	1,027,510	457,490	8,318
Squash	20	8,000	5.0	800,000	160,140	209,260	369,400	430,600	21,530
Potatoes	50	12,000	6.0	3,600,000	1,756,000	725,400	2,481,400	1,118,600	22,372
Lima Beans	25	1,200	16.0	480,000	172,675	174,375	347,050	132,950	5,318
	190			7,676,000 ($ 170,578)			4,993,080 ($ 110,957)	2,682,920 ($ 59,620)	

1/ Agro-inputs include: fertilizer, seed, pesticides, machinery and water.

2/ Labor includes the cost of manual labor plus social benefits.

3/ Yields, cost of production and net value of production are the annual average of four years alfalfa production. Yields consider an average of 5% spoilage.

TABLE 2

COSTS OF PRODUCTION AND VALUE OF PRODUCTION (PHASE TWO = 200 Has.)

(Figures in Peruvian soles, calculated at rate of S/.45 = US $1)

CROP	No. Has	GROSS VALUE OF PRODUCTION Yield Kg/Ha.	Price S/./Kg.	Total S/.	COSTS OF PRODUCTION ($) Agro-Inputs 1/	Labor 2/	Total	NET VALUE OF PRODUCTION (S/.) Total	Per Ha.
Alfalfa 3/	75	54,625	0.6	2,458,125	--	--	1,439,475	1,018,650	13,582
Corn	90	3,000	9.0	2,430,000	877,860	803,520	1,681,380	748,620	8,318
Squash	35	8,000	5.0	1,400,000	280,245	366,205	646,450	753,550	21,530
Potatoes	85	12,000	6.0	6,120,000	2,985,200	1,233,180	4,218,380	1,901,620	22,372
Lima Beans	40	1,200	16.0	768,000	276,280	279,000	555,280	212,720	5,318
	325			13,176,125 ($ 292,802)			8,540,965 ($189,799)	4,635,160 ($103,003)	

1/ Agro-inputs include: fertilizer, seed, pesticides, machinery and water.

2/ Labor includes the cost of manual labor plus social benefits.

3/ Yields, cost of production and net value of production are the annual average of four years alfalfa production. Yields consider an average of 5% spoilage.

Assuming that the expanded land utilization will be able to support a total of 45 families (assuming approximately 4.5 has. per family), projected family incomes will be substantially the same as in the First Phase. These estimates are, however, based on the assumption of a constant level of technology and constant yields. Since such a situation is highly improbable, we can assume significantly higher incomes over time.

Production of the five crops in 1985 is estimated as follows:

Alfalfa	:	4,075 metric tons/year
Lima Beans	:	48 metric tons/year
Corn	:	270 metric tons/year
Potatoes	:	1,020 metric tons/year
Squash	:	280 metric tons/year

3. Employment Generation

The following table gives Agrarian Bank estimates on man days per year for one hectare of selected crop production in the Tacna Valley:

Alfalfa	:	75 days
Corn	:	64 days
Squash	:	75 days
Potatoes	:	104 days
Lima Beans	:	50 days
Garlic	:	140 days
Ají	:	120 days
Lettuce	:	126 days
Cabbage	:	130 days
Onions	:	160 days
Melons	:	115 days
Tomatoes	:	130 days

At the present time the majority of the above listed garden crops which have a high labor content (over 100 days per hectare) cannot, by law, be cultivated in areas served by treated sewage. Since an integral part of the Project will be research on cultivation of truck crops, it is hoped that GOP policy will be changed to allow for production of more labor-intensive crops, which would expand the employment base of areas where future treated sewage projects are initiated.

4. Marketing of New Production

No difficulties are anticipated in marketing this production. In fact, it is reasonable to anticipate that for many years to come, the Toquepala and Cuajone mines will be eager to buy any excess food production which might be available from the Tacna Valley in the need to feed their large mining work forces.

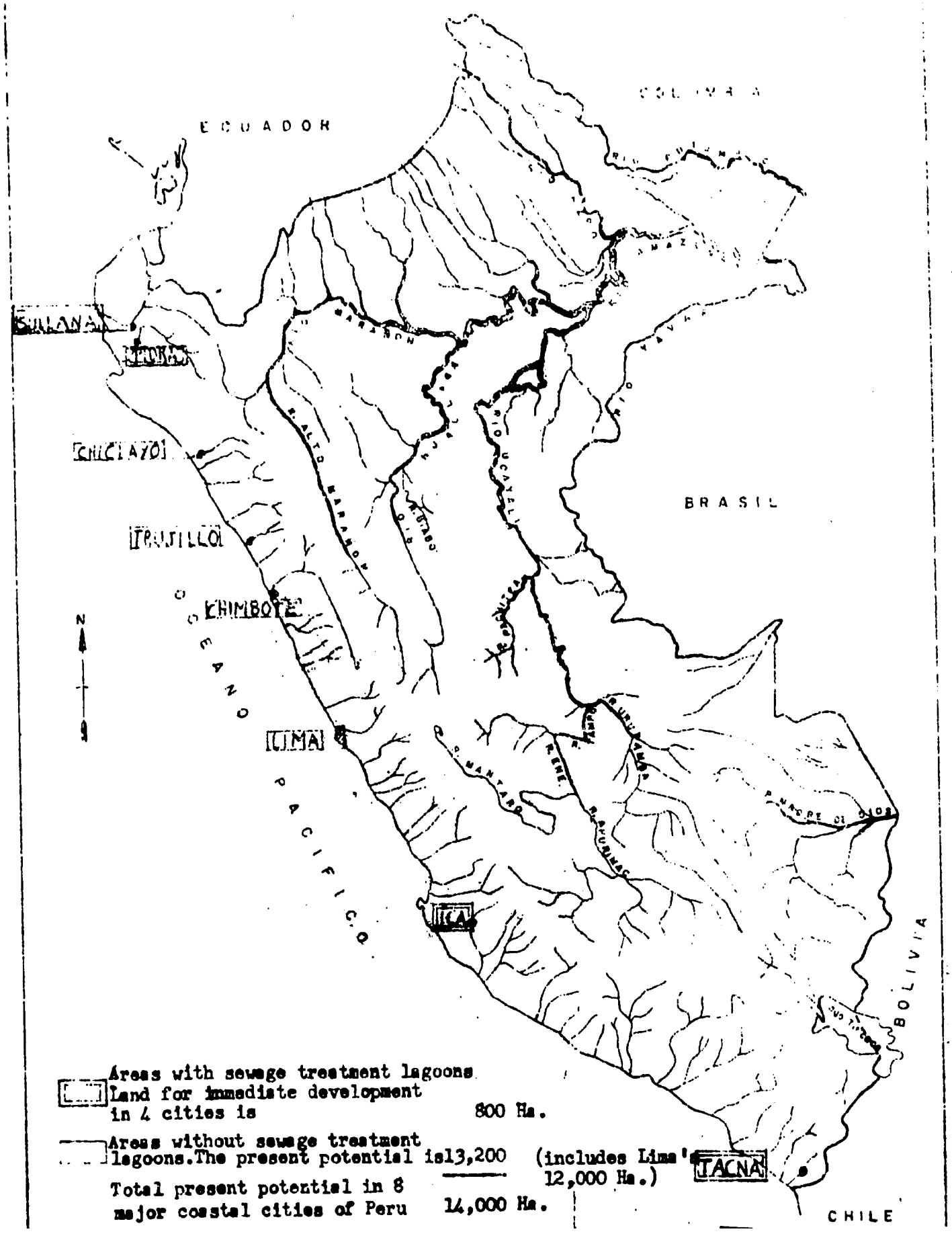
The city of Tacna and its surrounding area is currently a net importer of foodstuffs. Given the limited agricultural possibilities due to lack of water for irrigating land, it seems that this condition will continue. Any irrigated lands that can be brought into production will, in some measure, help to alleviate the need to import food. The same can be said for all cities in the Peruvian coastal desert. Considering 8 of the major cities, there is presently sufficient sewage being wasted which, once treated, would irrigate some 14,000 has. Irrigable lands near these cities have been or can be readily identified. By 1995 the sewage output will double. Clearly, the potential is great for having this type of project copied in many cities along Peru's coastal desert. (See Map, Page 26)

D. Financial Analysis

1. First Phase - 120 Hectares

Execution of the project works is programmed for completion in the first year. The total first phase investment is S/.13,494,975 (US$299,888). Certain other costs will be incurred each year over the anticipated 25-year life of the project. These are summarized in Table 3. These yearly costs, along with production costs, and anticipated income derived from agricultural production are discounted using discount rates of 20% and 25%, to arrive at an internal rate of return of 23.94%. (See Table 4) The benefit-cost ratio of 1.13 is calculated in Table 5.

Considering the fact that this project will be the first time that treated sewerage will be used for irrigation purposes in a controlled and supervised situation it is considered essential that continuing research be programmed over the first two years, to determine the applicability of the process to other areas. Since these costs will result in an output which will have broad applicability they have been excluded from calculations to determine per hectare costs of the project, since to charge them exclusively to this project would be to overstate their significance in this one particular project. Considering an execution cost of



Areas with sewage treatment lagoons
Land for immediate development
in 4 cities is 800 Ha.

Areas without sewage treatment
lagoons. The present potential is 13,200 (includes Lima's 12,000 Ha.)

Total present potential in 8
major coastal cities of Peru 14,000 Ha.

TABLE 3

FLOW OF INVESTMENT, MAINTENANCE AND REPAIR COSTS

DURING USEFUL LIFE OF PROJECT (25 YEARS)

(PHASE ONE: 120 HECTARES)

ITEM / YEAR:	1	2	3	4	5	6	7	8	9	25
Investment	10,659,975									
Maint. & Repair of Works 1/		50,000	50,000	50,000	50,000	50,000	60,000	60,000	60,000	103,680
Permanent Alfalfa		1,075,000	665,280	665,280	665,280	1,076,000	665,280	665,280	665,280	665,280
Rotated Crops		4,225,360	4,225,360	4,225,360	4,225,360	4,225,360	4,225,360	4,225,360	4,225,360	4,225,360
Research 2/		1,417,500	1,417,500							
Total	10,659,975	6,767,860	6,358,140	4,940,640	4,940,640	5,350,360	4,950,640	4,950,640	4,950,640	4,994,320

1/ Maintenance and Repair Costs are increased 20% every five years.

2/ Research Costs do not form a part of the Project. Included are 15% Contingencies and 20% for Inflation.

TABLE 4

INTERNAL RATE OF RETURN CALCULATION

(Phase One: 120 Hectares)

Year	Investment and Maintenance S/.	Production Costs S/.	Total Costs S/.	Income S/.	Net Cash Flow S/.	Discount Rate 20%	Present Value at 20%	Discount Rate 25%	Present Value at 25%
1	10,659,975		10,659,975		-10,659,975	0.8333	-8,879,759	0.800	-8,527,980
2	1,125,000	4,225,360	5,350,360	7,163,000	1,812,640	0.6944	1,258,697	0.6400	1,160,089
3	715,280	4,225,360	4,940,640	7,847,000	2,906,360	0.5787	1,681,911	0.5120	1,488,056
4	715,280	4,225,360	4,940,640	7,847,000	2,906,360	0.4822	1,401,447	0.4096	1,190,445
5	715,280	4,225,360	4,940,640	7,847,000	2,906,360	0.4019	1,168,066	0.3277	952,414
6	1,125,000	4,225,360	5,350,360	7,163,000	1,812,640	0.3349	728,500	0.2621	475,093
7	725,280	4,225,360	4,950,640	7,847,000	2,896,360	0.2791	808,374	0.2097	607,367
8	725,280	4,225,360	4,950,640	7,847,000	2,896,360	0.2326	673,693	0.1578	486,009
9	725,280	4,225,360	4,950,640	7,847,000	2,896,360	0.1933	561,314	0.1342	388,691
10	1,135,000	4,225,360	5,360,360	7,163,000	1,802,640	0.1615	291,126	0.1074	193,603
11	725,280	4,225,360	4,950,640	7,847,000	2,896,360	0.1346	389,850	0.0859	248,797
12	737,280	4,225,360	4,962,640	7,847,000	2,884,360	0.1122	323,625	0.0687	198,156
13	737,280	4,225,360	4,962,640	7,847,000	2,884,360	0.0935	269,688	0.0550	158,640
14	1,147,000	4,225,360	5,372,360	7,163,000	1,790,640	0.0779	139,491	0.0440	78,788
15	737,280	4,225,360	4,962,640	7,847,000	2,884,360	0.0649	187,195	0.0352	101,529
16	737,280	4,225,360	4,962,640	7,847,000	2,884,360	0.0541	156,044	0.0281	81,051
17	751,680	4,225,360	4,977,040	7,847,000	2,869,960	0.0451	129,435	0.0225	64,574
18	1,161,400	4,225,360	5,386,760	7,163,000	1,776,240	0.0376	66,787	0.0180	31,972
19	751,680	4,225,360	4,977,040	7,847,000	2,869,960	0.0813	89,830	0.0144	41,327
20	751,680	4,225,360	4,977,040	7,847,000	2,869,960	0.0261	74,906	0.0115	33,004
21	751,680	4,225,360	4,977,040	7,847,000	2,869,960	0.0217	62,278	0.0092	26,404
22	1,178,680	4,225,360	5,404,040	7,163,000	1,758,960	0.0181	31,837	0.0074	13,016
23	768,960	4,225,360	4,994,320	7,847,000	2,852,680	0.0151	51,633	0.0059	16,831
24	768,960	4,225,360	4,994,320	7,847,000	2,852,680	0.0126	35,944	0.0047	13,408
25	768,960	4,225,360	4,994,320	7,847,000	2,852,680	0.0105	29,953	0.0038	10,840
							1,731,865		-467,876

$$IRR = 20 + 5 \times \frac{1,731,865}{2,199,741} = 20 + 5 \times 0.7873 = 23.94$$

TABLE 5

BENEFIT COST RATIO

(Phase One: 120 Hectares)

Year	Present Worth (Costs) S/. 15%	Present Worth (Income) S/. 15%
1	9,269,914	0
2	4,045,407	5,415,944
3	3,248,471	5,159,403
4	2,825,058	4,486,915
5	2,456,486	3,901,528
6	2,312,961	3,096,565
7	1,860,945	2,949,687
8	1,618,364	2,565,184
9	1,407,467	2,230,902
10	1,325,081	1,770,694
11	1,066,471	1,686,320
12	927,517	1,466,604
13	806,429	1,275,158
14	759,114	1,012,132
15	609,908	964,396
16	530,506	838,844
17	462,367	728,986
18	435,250	578,770
19	349,986	551,644
20	304,097	479,452
21	264,281	416,676
22	249,666	330,931
23	200,772	315,449
24	174,406	273,860
25	151,827	238,549
	37,662,651	42,734,573

$$\text{Ratio } \frac{\text{Benefits}}{\text{Costs}} = \frac{42,734,573}{37,662,651} = 1.13$$

$253,222 (works minus research) which will benefit 120 hectares in the first phase, the per hectare cost comes to $2110. This compares to an estimated $2,500 per hectare on medium-sized coastal irrigation projects, such as those financed under IDB's Linea Global project, and an estimated $5,750 per hectare on the large northern coast irrigation project of Chira-Piura. Sierra irrigation is much less expensive on a per hectare basis, since it involves the channelling and regulation of rainwaters, which are non-existent on the arid coast; expected agricultural yields are also significantly lower in the sierra, given the soil conditions and rugged terrain.

2. Second Phase -- 200 Hectares

Since the project infrastructure will be constructed to handle the 1985 estimated capacity of the sewage treatment plant, 200 hectares will eventually be irrigated. The additional construction cost for full utilization of 200 hectares is estimated to be $31,000,which will be carried out in the seventh year of the project (1984). The phasing of costs over the twenty-five year life of the project is shown in Table 6. Table 7 calculates the new internal rate of return of 25.10% assuming a seventh year investment of $31,000 and increased production costs and income starting in the eighth year (based on estimated production as given in Table 2 of the Economic Analysis). The benefit cost ratio, at 15%, is 1.16 (See Table 8).

Since the relatively small new investment of $31,000 will bring 80 new hectares into production, the overall cost per hectare drops from $2,110 in the First Phase to $1,421 in the Second Phase.

E. Social Analysis

The overall social impact of the proposed program will, in large part, depend upon the extent to which it is eventually replicated with similar projects in reclaiming pure desert lands near the urban centers of the country. The pilot area in its first phase is necessarily limited in both size, (120 hectares)[1/] and beneficiaries, (25 families or 150 persons).[1/] While the social impact upon this small area and these few beneficiaries will be significant, the full benefits can only be approximated for the pilot area. If, as is expected, this first project serves as a demonstration which other urban areas will follow, significant social problems could be alleviated on a nationwide scale.

1/ 200 hectares by 1985, capable of supporting 45 families or 270 persons.

TABLE 6

FLOW OF INVESTMENT, MAINTENANCE, REPAIR AND PRODUCTION COSTS
DURING USEFUL LIFE OF PROJECT (25 YEARS)
(PHASE TWO: 200 HECTARES)

ITEM/YEAR	1	2	3	4	5	6	7	8	9	10	25
Investment	10,659,975										
Maintenance and Repair of Works								1,395,000			
Permanent Alfalfa I (40 has.)		50,000	50,000	50,000	50,000	50,000	50,000	50,000	83,333	83,333	83,333
Permanent Alfalfa II (35 has.)		1,075,000	665,280	665,280	665,280	1,075,000	665,280	665,280	665,280	1,075,000	665,280
Rotated Crops									940,625	582,120	582,120
Research		4,225,360	4,225,360	4,225,360	4,225,360	4,225,360	4,225,360	4,225,360	7,101,490	7,101,490	7,101,490
TOTAL		1,417,500	1,417,500								
	10,659,975	6,767,860	6,358,140	4,940,640	5,350,360	5,350,360	4,940,640	6,335,640	8,790,728	8,841,943	8,432,223

TABLE 7

INTERNAL RATE OF RETURN CALCULATION
(Phase two: 200 Hectares)

Year	Investment and Maintenance S/. 1/	Production Costs S/. 2/	Total Costs S/.	Income S/. 3/	Net Cash Flow S/.	Discount Rate 25%	Present Value at 25%	Discount Rate 30%	Present Value at 30%
1	10,659,975				-10,659,975	0.8000	-8,527,980	0.7692	-8,199,653
2	1,125,000	4,225,360	5,530,360	7,163,000	1,632,640	0.6400	1,044,890	0.5917	766,033
3	715,280	4,225,360	4,940,640	7,847,000	2,906,360	0.5120	1,488,056	0.4552	1,322,975
4	715,280	4,225,360	4,940,640	7,847,000	2,906,360	0.4096	1,190,445	0.3501	1,017,517
5	715,280	4,225,360	4,940,640	7,847,000	2,906,360	0.3277	952,414	0.2693	782,683
6	1,125,000	4,225,360	5,950,360	7,163,000	1,212,640	0.2621	317,833	0.2072	251,259
7	715,280	4,225,360	4,940,640	7,847,000	2,906,360	0.2097	609,464	0.1594	463,274
8	2,110,280	4,225,360	6,335,640	7,847,000	1,511,360	0.1678	253,606	0.1226	185,293
9	1,689,238	7,101,490	8,790,728	12,577,625	3,786,897	0.1342	508,202	0.0943	357,104
10	1,740,453	7,101,490	8,841,943	12,492,125	3,650,182	0.1074	392,030	0.0725	264,638
11	1,330,733	7,101,490	8,432,223	13,176,125	4,743,902	0.0859	407,501	0.0558	264,710
12	1,330,733	7,101,490	8,432,223	13,176,125	4,743,902	0.0687	325,906	0.0429	203,513
13	1,689,238	7,101,490	8,790,728	12,577,625	3,786,897	0.0550	208,279	0.0330	124,968
14	1,740,453	7,101,490	8,841,943	12,492,125	3,650,182	0.0440	160,608	0.0254	92,715
15	1,330,733	7,101,490	8,432,223	13,176,125	4,743,902	0.0352	166,985	0.0195	92,506
16	1,330,733	7,101,490	8,432,223	13,176,125	4,743,902	0.0281	133,304	0.0150	71,159
17	1,689,238	7,101,490	8,790,728	12,577,625	3,786,897	0.0225	85,205	0.0116	43,928
18	1,740,453	7,101,490	8,841,943	12,492,125	3,650,182	0.0180	65,703	0.0089	32,487
19	1,330,733	7,101,490	8,432,223	13,176,125	4,743,902	0.0144	68,312	0.0068	32,259
20	1,330,733	7,101,490	8,432,223	13,176,125	4,743,902	0.0115	54,555	0.0053	25,143
21	1,689,238	7,101,490	8,790,728	12,577,625	3,786,897	0.0092	34,839	0.0040	15,148
22	1,740,453	7,101,490	8,841,943	12,492,125	3,650,182	0.0074	27,011	0.0031	11,316
23	1,330,733	7,101,490	8,432,223	13,176,125	4,743,902	0.0059	27,989	0.0024	11,385
24	1,330,733	7,101,490	8,432,223	13,176,125	4,743,902	0.0047	22,296	0.0018	8,539
25	1,689,238	7,101,490	8,790,728	12,577,625	3,786,897	0.0038	14,390	0.0014	5,302
							31,843		-1,553,799

1/ Investment and Maintenance includes construction, supervision and maintenance, installation and maintenance of Alfalfa.

2/ Production Costs refers to corn, potatoes, squash and lima bean costs.

3/ Income is variable since every fourth year alfalfa must be installed. Two alfalfa rotations are used: Alfalfa I (40 has.) is installed in years 2, 6, 10, 14, 18, and 22; Alfalfa II (35 Has.) is installed in years 9, 13, 17, and 23. Production of rotation crops is constant changing only in year 9 when the additional hectarage is brought into production.

$$IRR = 25 + 5 \times \frac{31,843}{1,583,642} = 25 + 5\ (0.0201) = 25.10\%$$

TABLE 8

BENEFIT COST RATIO

(Phase Two: 200 Hectares)

Year	Present Worth (Costs) S/. 15%	Present Worth (Income) S/. 15%
1	9,269,914	--
2	4,045,407	5,415,944
3	3,248,471	5,159,403
4	2,825,058	4,486,915
5	2,456,486	3,901,528
6	2,572,341	3,096,565
7	1,857,187	2,949,687
8	2,071,121	2,565,184
9	2,499,204	3,575,819
10	2,185,728	3,088,053
11	1,812,085	2,831,549
12	1,575,982	2,462,618
13	1,428,493	2,043,864
14	1,249,367	1,765,137
15	1,036,320	1,619,346
16	901,405	1,408,528
17	816,659	1,168,461
18	714,429	1,009,364
19	592,785	926,282
20	515,209	805,061
21	466,788	667,872
22	408,498	577,136
23	338,975	529,680
24	294,285	459,847
25	267,238	382,360
	45,449.435	52,896,203

$$\text{Ratio } \frac{\text{Benefits}}{\text{Costs}} = \frac{52,896,203}{45,449,435} = 1.16$$

These 25 families will be selected by the A.R. VII, in conjunction with SINAMOS, from a list of eligible families who have indicated their interest in working the new farm area to be irrigated. At present 41 campesino families who previously were farming using untreated sewage in the Tacna area have signed up. In 1975 they were prohibited from using the untreated sewage and petitioned the Ministry of Agriculture to give them new lands.

The National University of Tacna recently conducted a study of the 41 families in an attempt to arrive at an overall socio-economic profile of the group and the results clearly indicate the marginal conditions in which they live. The principal results are summarized below:

1. 44% of the group is ten years of age or under, indicating a disproportionately high dependency ratio of population to potential working force.

2. Only 26% of the group is economically active and of this group 56% are categorized as eventuales, agricultural day laborers who work primarily during the limited planting and harvest seasons. Another 26% are classified as "independent" workers, which may generally be interpreted as tertiary sector services workers. A few carpenters and former soldiers comprise the rest of the population.

3. 55% of the group has migrated to Tacna from other geographical areas of the country -- 51.2% of these come from the altiplano department of Puno. Of the 45% who were born in the Department of Tacna, the majority are under ten years of age, children of migrants.

4. 93% of the dwellings occuped by this population are classified as "under construction", a situation typical of marginal urban areas in which phase construction is carried out -- as families save money, another room is added until the home is completed (studies conducted in Lima marginal areas by John Turner of M.I.T. have shown the average time needed for completion of a home is about eight years).

5. 80% of the houses lack potable water; 95% lack indoor plumbing; 84% lack electricity; 81% do not subscribe to municipal garbage collection services.

6. The majority of heads of household lack completed primary education, and four of the 41 were unable to sign their names to the membership list.

Per capita income in the Department is estimated at $710, compared to the nationwide average of $410 in 1972, and in terms of housing conditions, education and employment, the Department ranks above the national averages. The actual socio-economic characteristics of the pilot area would seem to demonstrate the dichotomies which exist throughout urban Peru or rural Peru immediately adjacent to the urban centers. Both the Department and Province of Tacna are atypical in that they rank high vis-a-vis other Departments and Provinces based upon selected socio-economic indicators. A recent Mission study on relative marginality showed that the Department of Tacna tied for first place with the Department of Ica while Tacna Province ranked third of the 150 Peruvian provinces.2/

Living conditions in the pueblos jovenes of urban Tacna however are little different than in other marginal urban areas of the country. The slums are characterized by crowded living conditions, few if any job opportunities outside of the unproductive tertiary service sector (street vendors, shoeshine people, etc.), and a substantial percentage of the residents are immigrants from highland farm areas of the country with little training for occupations outside of the agricultural sector. Nearly 40% of the Department's residents are migrants from other areas, and of these 57% come from the altiplano department of Puno, and 11% and 7% from the neighboring departments of Arequipa and Moquegua respectively. Coming from largely rural backgrounds, they generally find it difficult to adapt to the urban environment in terms of living conditions and employment opportunities. Since land pressures are a limiting factor to agriculture along the arid coast, including Tacna, migrants are unable to find work in the one area where they have some familiarity, and instead join the ranks of the under-employed. Income levels are well below the overall urban sector average and while urban living provides certain social benefits, such as schooling and availability of basic health services, the migrant families who populate the urban slums are generally no better off economically than when they left the sierra.

The proposed program is designed to directly benefit an estimated 25 marginal urban families and give them the opportunity to work cooperatively to turn 120 hectares of presently unproductive desert into agricultural production.

2/ The Mission is currently undertaking a study on relative poverty and marginality in Peru, and using such indicators as education levels, extent of use of indigenous languages, availability of health services, extent of use of agriculture machinery, etc. is preparing a marginality index of all departments and provinces within the country.

Women will benefit equally with men under the project. The Peruvian agricultural sector is one where women share workloads equally with men, and generally the distribution of income among men and women is much more equitable in rural areas than in urban areas, since women generally manage family budgets and handle most commercial transactions. By creating a new rural environment within the desert setting of the project area, near the city of Tacna, it is anticipated that those participating will have a greater degree of social and economic equity than under their present condition.

Additionally benefits which will accrue to Tacna and other project sites to be selected will accompany project objectives. At present, environmental contamination is prevalent in marginal urban areas throughout the country, and most pueblos jovenes are breeding grounds for epidemics caused by contaminated water supplies. Infant and child mortality is high, and work efficiency among the adult population is lessened as a result of illnesses. In those areas where similar projects are implemented, improved health conditions will be a non-quantifiable social benefit.

PART IV - IMPLEMENTATION PLANNING

A. Administrative Arrangements

1. Participating GOP Agencies

Administration of Project activities will be carried out by the General Directorate of Water Resources (DGA) in the Ministry of Agriculture (MOA). The DGA will coordinate with the Agrarian Zone VII for physical implementation of the project in Tacna and also with the Agrarian Bank to assure availability of credit to farmers for production expenses.

Ancillary technical support will be furnished to the Project from the Tacna office of the Ministry of Food, the Directorate for the Preservation of the Environment in the Ministry of Health and through the Ministry's Field Office No. IV.

MOA

The MOA shares its leadership of certain aspects of the agricultural sector with the Ministry of Food (MOF), but is the GOP agency most directly concerned with the preservation, improvement, and efficient use of renewable agricultural resources and the promotion of rural organizations associated with agriculture. Organizationally the MOA has clear lines of internal responsibility among its directorates, its small number of autonomous dependencies and its zonal administrations. Though personnel management problems do exist, the MOA is moving toward a personnel classification and salary scale system which is intended to resolve these. (The same is true of the GOP as a whole). The MOA has been a leader in decentralization and in delegation of authority to zone administrations which play an integral part in planning and budgeting and have a high degree of autonomy for budget execution under authority granted by the Minister.

DGA

The Organic Law of the Agricultural Sector places the DGA in charge of the preservation, conservation, and utilization of water resources and the preservation of agricultural lands. Specific objectives of the DGA are: i) the efficient administration of water and land resources; ii) rehabilitation and preservation of agricultural soils, and increased water supplies for agricultural pro-

duction; iii) education of farmers on the importance of rational utilization and conservation of water and land resources; and iv) long term planning of water supplies to meet future demands.

In pursuit of these objectives the DGA prepares, executes, and evaluates short, medium, and long-term water utilization programs. It also engages in programs for river basin improvement and management, erosion and flood control, and irrigation and drainage infrastructure. In addition, the DGA in conjunction with its regional staffs in the Zonal Offices, coordinates and evaluates irrigated crop plans, supervises operation and maintenance of irrigation infrastructural works, establishes and enforces water tariffs and quotas, studies and implements surface and sub-surface water projects, and trains district irrigation technicians. The organization of the DGA appears in Chart A, Page 43.

The unit of DGA directly involved in the implementation of this Project will be the Directorate of Preservation and Conservation (DIPRECO), one of three divisions of DGA. The major function of DIPRECO is to inventory, analyze, and implement programs related to rehabilitation of agricultural lands affected by salinity and drainage problems in coastal and sierra regions, and to engage in projects to improve existing and implement new small scale irrigation systems. These activities are intended to contribute to increased food production through rational use of scarce water and land resources and by bringing new land into production. The staff of DIPRECO is composed of 52 engineers (5 of which hold an advanced degree), 72 non-degree specialists (technicians, surveyors, and draftmen), 51 clerical workers, and 78 laborers.

The total 1975-76 DIPRECO budget is $ 5.19 million which represents a 49% increase over the 1973-74 biennial budget. A breakdown by category follows:

DIPRECO BUDGET 1973-74, 1975-76
($000)

Budget Category		1974-75	1975-76
Operations		141	1,313
Investment		2,239	1,153
Special Projects		1,101	2,720
	Totals:	$ 3,481	$ 5,186

Source: DGA

MOA Agrarian Zone No. VII (A.Z. No. VII

A.Z. VII has its headquarters in Tacna. Its physical jurisdiction includes the Departments of Moquegua and Tacna.

The major responsibility of A.Z. No. VII is to implement MOA programs at the field level, principally those related to Agrarian Reform, water and irrigation resources, forestry, rural enterprise promotion and development, and rural cadastre. The A.Z. VII organization is shown in Chart B, Page 44.

The staff of the A.Z. VII is composed of 45 professional, 162 employees and 287 laborers. The 1973-74 and 1975-76 budgets of A.Z. follow:

Budget Category		1973-74	1975-76
Operational		1'420,000	1'670,000
Investment		1'190,000	4'780,000
	Totals	$ 2'610,000	6'450,000

Source: Program Office of the A.Z. VII

The sharp increase in the investment budget for the current biennium is due mainly to the recent addition of funding for the Water Resources Improvement Project in the Tacna Valley. This project is being carried out by contracted personnel, thus the proposed project will not interfere with other activities of the A.Z. VII.

Agrarian Bank (A.B.)

The A.B. is responsible for promoting the development of agricultural production by providing agricultural credit to individual and associative farm units. It has an authorized capital of S/. 15,000 million ($ 333 million). A discount facility with the Central Bank supports short-term production lending.

The A.B. offers short-and long-term credit, generally with preferential rates of interest for activities producing priority

foods including meats, milk, and other products. It also offers credits for food marketing activities and, to a limited extent, for the purchase or improvement of on-farm infrastructure such as silos and fences. Furthermore the new organic law of the A.B. (Decree Law 21227 dated 7/24/75) expands its authority to provide credit for food industries in coordination with the Industrial Bank; and for Agricultural Social Property Enterprises. The law also enables the Bank to participate as a share-holder in associative farm enterprises.

Under the current GOP Agrarian Reform policy the A.B. orients its financial resources toward serving the associative enterprises, such as agricultural cooperatives, indigenous communities, and SAIS. Farmers organized into Water User Associations are similarly eligible for similar preferential treatment by the Bank. At least 60% of the A.B.'s short-term credits are presently provided to these groups. It is also expected that the Agrarian Reform process will expedite the flow of credit to larger number of producers.

The organization of the Bank is shown in Chart C, Page 45.

The A.B. has 17 regional branches and 45 field agencies. Each regional branch can approve loans of up to S/. 3 million ($ 66,667) and field agencies can approve loans up to S/. 600,000 ($ 13,333). The Tacna valley has one regional branch in the city of Tacna.

The Bank's role will be a key one in the success of this project since it will finance the farmers' seed, fertilizer and other production costs, especially during the initial crop year. Since commercial lending activity in the agricultural sector has been curtailed due to the uncertainties created by the Agrarian Reform, the A.B. is virtually the only remaining source of regular bank credit available to farmers, in addition to being the only available source of concessional farm credit.

Ministry of Food (MOF)

The Ministry of Food is a relatively new organization having been established in December 1974. It is in charge of all activities related to the production and internal marketing of food products, including livestock, and their livestock processing. In addition to the normal administrative and supervisory staffing, the MOF has four

basic line divisions: Production, Research, Marketing and Infrastructure.

The MOF's programs are executed through its Zonal Offices which are, in effect, micro-models of the Ministerial organization. (Each zonal office has one head who is the regional equivalent of the Minister of Food). This form of organization is part of a nation-wide movement to decentralize governmental functions, including budgeting and administration. The Ministry establishes policy guidelines, provides leadership in the process by setting priority targets and advising zonal and sub-zonal offices on their probable budgetary requirements for personnel and support for field operations.

Decentralization has raised morale in the field by placing greater authority and responsibility at that level, lessening somewhat the preference for work in the city capital of Lima, and reducing the bureaucratic red tape.

The Tacna office of the MOF has jurisdiction over the Department of Tacna and Moquegua. The total personnel in the Tacna office numbers 191, of which 33 are professionals, 88 non-degree specialists with the balance being clerical workers and laborers. The Tacna office organization is shown in Chart D, Page 46.

2. AID

During the development of the Feasibility Study the DGA demonstrated good collaboration and a high degree of coordination with USAID, particularly in the selection of consultants, reviews of draft papers and technical design, and in joint field trips to various potential sites in the country. This is expected to continue throughout the implementation of the project; consequently, there appears to be no need for a rigid scheme of approval other than the following points:

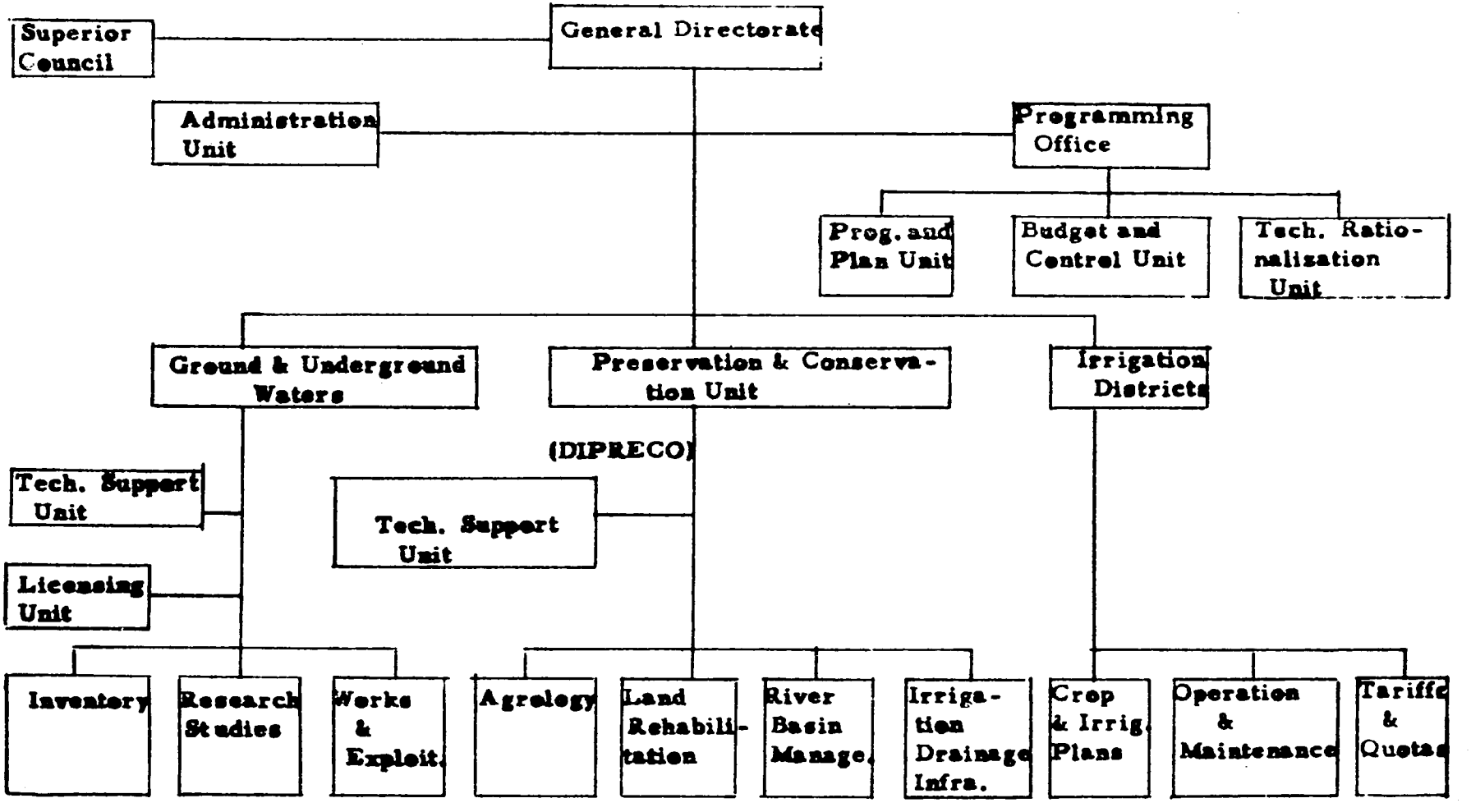
- Final Engineering study to be approved by USAID.
- A monthly expenditure report to be submitted to USAID by DGA.
- Quarterly Progress Reports to be submitted to USAID by DGA.

USAID Engineering has assigned one local engineer as the liaison officer for all project related offices in Lima and Tacna. The USAID Agriculture Office will provide support in all phases of the project, as needed.

Disbursement of funds through an Administration Contractor proved quite sucessful for the Feasibility Study and for this reason a similar service for the implementation of this Grant is deemed advisable by both DGA and USAID.

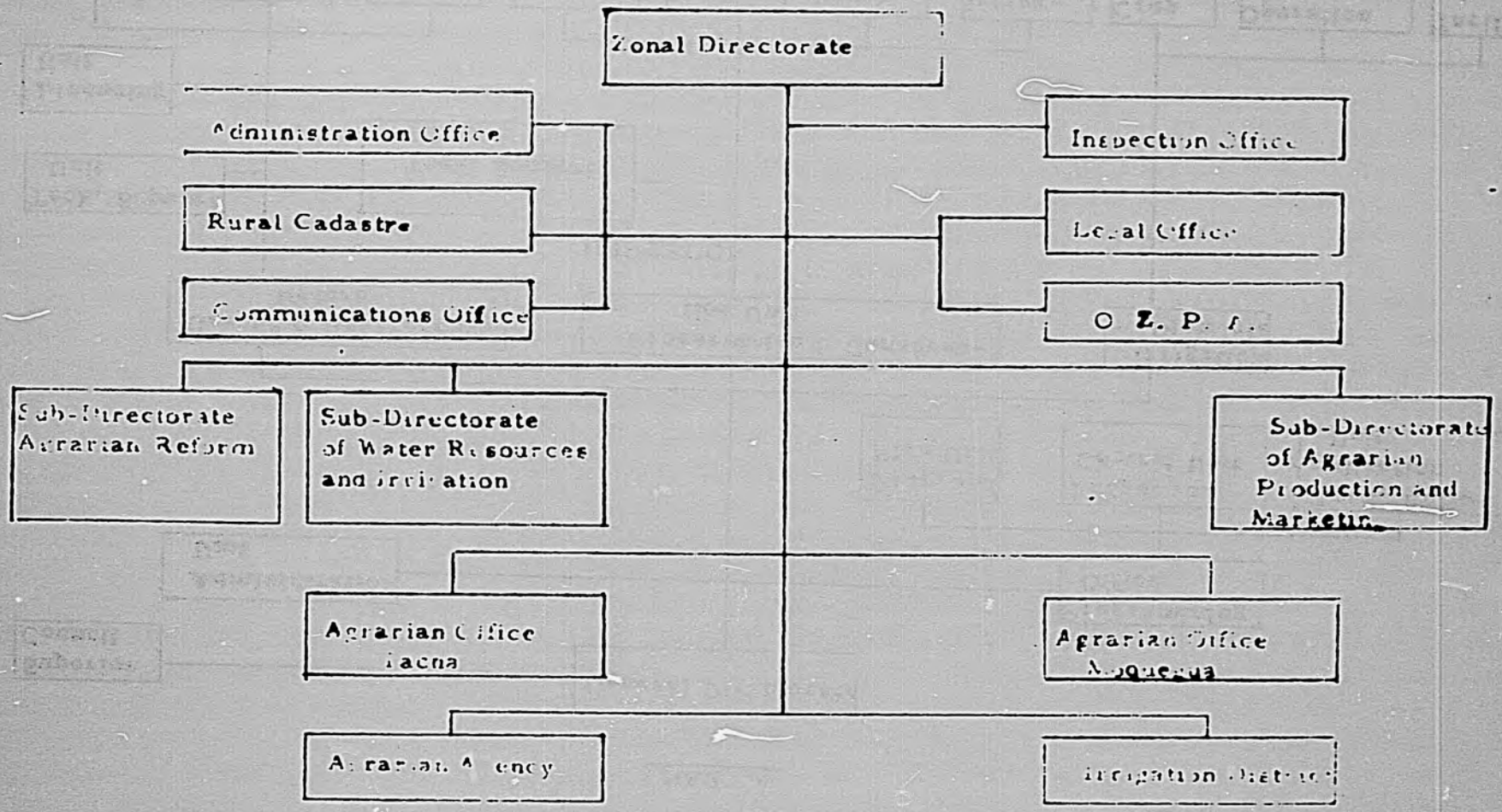
ORGANIZATION OF THE DGA

CHART A



ORGANIZATION OF THE AGRARIAN ZONE VII - TACNA

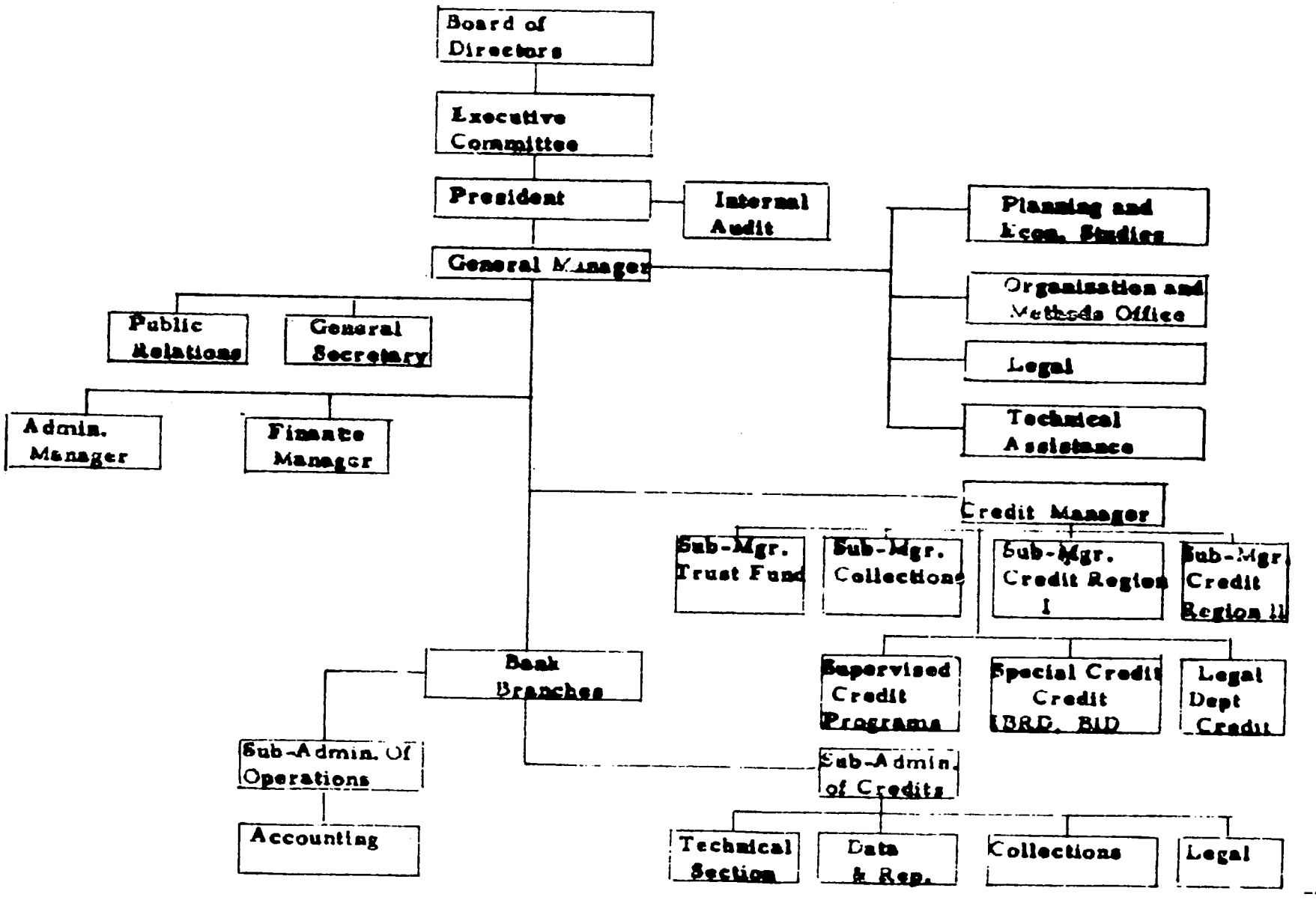
Chart 5



BEST AVAILABLE COPY

ORGANIZATION OF THE AGRARIAN BANK

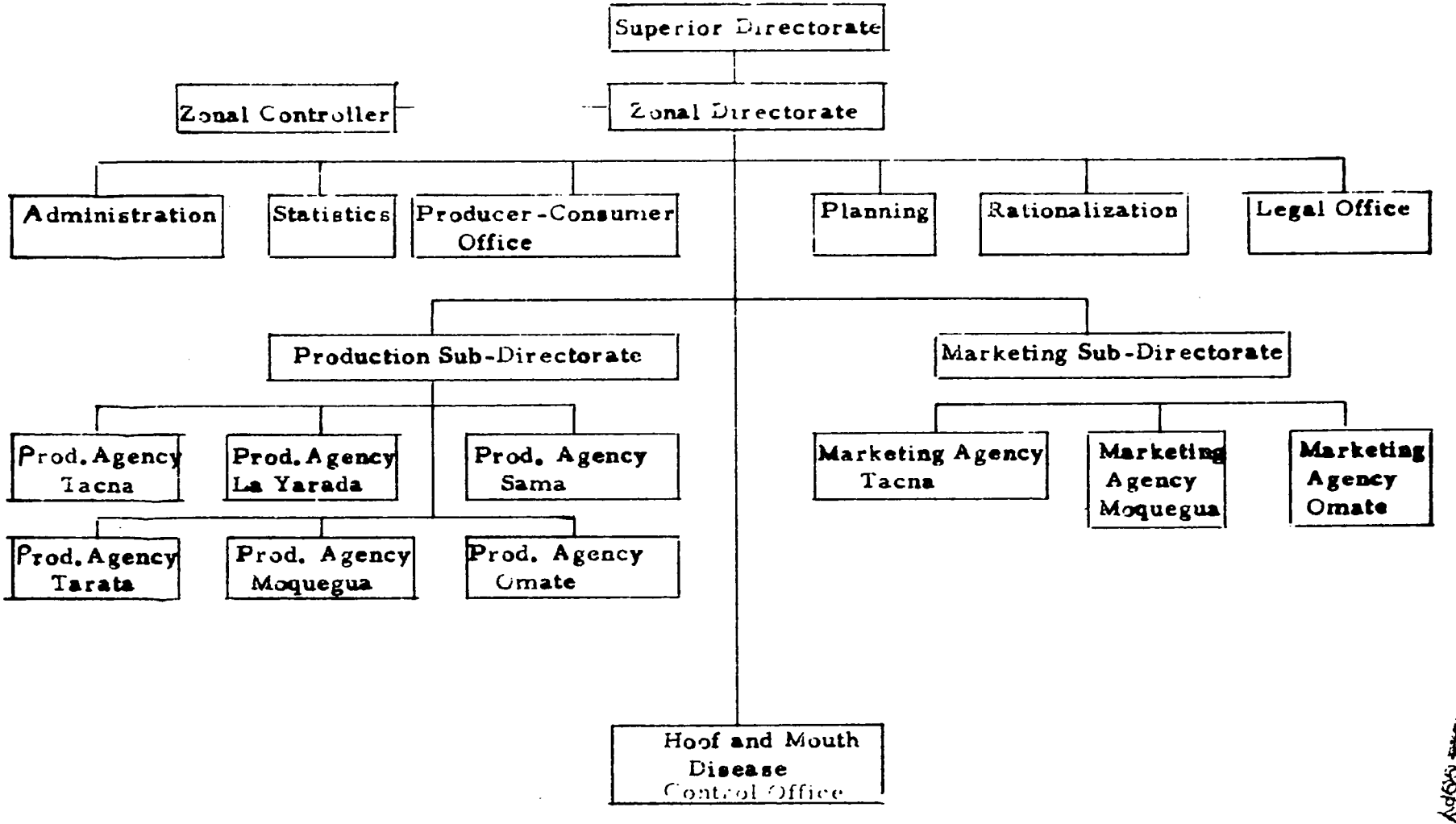
Chart C



BEST AVAILABLE COPY

ORGANIZATION OF THE TACNA OFFICE OF THE MOF

Chart 3



BEST AVAILABLE COPY

B. Implementation Plan

A project performance tracking network chart is presented in Annex E. It shows milestones against which project success and planned implementation are to be measured, the more significant milestones being:

Action	Date[1/]	Responsible Agency
-ProAg signed	Sept.76	USAID/GOP
-Final Engineering Study starts	Oct. 76	DGA
-Letter of understanding from A.B. to DGA assuring financing for production costs	Dec. 76	A.B./DGA
-Final Eng. Study completed and approved	Feb. 77	DGA/USAID
-Construction starts	March77	DGA/A.Z.VII
-FY 78 ProAg signed	Oct. 77	USAID/GOP
-Cooperative legally organized	Aug. 77	A.Z.VII/DGA
-Coop. obtains credit from A.B.	Dec. 77	A.B./A.Z.VII/DGA
-Construction completed	Feb. 78	DGA/A.Z.VII
-Pilot crops started	Mar. 78	DGA/A.Z.VII/MOF/MOH/ Area No.4

The DGA is the implementing agency of the project and as such is responsible for developing the final engineering study and carrying out the execution of the project. In the latter aspect they will work in close coordination with the Agrarian Zone No.VII (A.Z. VII) which will provide partial local logistics and promotion of the project in Tacna.

A key contribution by the A.Z. VII will be the selection of beneficiaries and the constitution of a farmers' cooperative in order to have a base for obtaining needed credit from the Agrarian Bank for their first crop production expenses. The DGA is currently seeking a formal understanding with the Agrarian Bank relative to this production cost financing.

Jointly the MOH, DGA and A.Z. VII will develop a program for research and agricultural management of the project. This program will be conducted by an ad hoc research team over a two year period with partial USAID Grant financing. This team will also carry out

1/ Dates differ from the PPT. Those given here are the projected dates for completion of Actions. The PPT lists critical dates by which Actions must be completed. See also Annex B for detailed construction schedule.

some specific extension and training functions by conducting informal on-farm demonstrations with participating farmers. This team will basically be 3 persons, a professional and two assistants. However, they will coordinate with technicians of all parties involved in the project. A detailed Research Program will be developed in the Final Study and Report.

The final engineering design will be accomplished in a manner similar to the way the feasibility study was carried out for the project. DGA will coordinate the required collaboration of all personnel and also provide the technical supervision of the supplementary personnel contracted with Grant funds. USAID Engineering and Agricultural Offices will review and approve the final design.

The construction schedule is shown in Annex B. During the construction period the DGA will provide a graduate engineer as Project Engineer. All construction will be done by force account in accordance with the approved final design. To complement the DGA supervision of construction, USAID Engineering will monitor the project based on frequent visits to Tacna, probably monthly, during the construction period.

The financial aspects of the project Feasibility Study were very satisfactorily handled by an Administrative Contractor. Based on this the DGA and USAID have agreed to use the same systems for this Grant. The proposed disbursement procedure includes an advance of Grant funds.

Research will focus basically on sanitary aspects of water, soil and crops including variation in soil salinity and composition. Essentially the whole area of the project will be covered by the research program; however, a 5 Ha. plot will be reserved for experimentation with selected truck crops and other vegetables which Peruvian law presently forbids being produced for human consumption when irrigated with treated sewage effluents. The results obtained from this 5 Ha. experimental plot are expected to induce the authorities to change the regulations regarding the use of treated sewage for certain crops.

A secondary research element, which will be explored if necessary funds can be acquired for this purpose through cost savings or other sources, is the determination of the productive potential of fish culture in the 4 sewage treatment lagoons. Potentially some 4 to 8 metric tons (4 to 6 tons for Carp, 6 to 8 tons for Tilapia) of edible fish per year might be produced in each of these one hectare lagoons. Full facilities for a study are estimated to cost up to $22 000 and would include small breeding ponds, early

growth ponds, fish handling facilities and technical assistance through one operational year of study on fishculture. If one of the 4 aeration lagoons were to be used as the breeding and early growth pond combined, then the handling facilities and technical assistance would require approximately $10,000.

During the farm production period the Farmer Cooperative will receive strong support from the Tacna office of the MOF, particularly in getting needed advice on crop inputs and also in the marketing process of outputs. Once the project becomes operational, the USAID Agriculture Office will monitor all aspects of production control, marketing and research.

As noted in Part III, E, Social Analysis Section, a list of eligible small farmer candidates already exists and the selected participants will be incorporated into a cooperative. This action is not expected to be completed early enough for the selected farmers to take part in the decision making relating to project design and initial implementation. However, promptly following the formation of the farmer cooperative organization the farmers will have a primary involvement, as the beneficiaries, in project operations.

C. Evaluation Plan

Periodic evaluation is most essential since project success or failure may determine, in great measure, future GOP commitments to and budgetary support of expanded similar activities along Peru's coast.

Three periodic annual evaluations are scheduled starting in January 1978 through January 1980. Special additional evaluations will be carried out as needed.

The second and third periodic evaluations will have the combined benefits of the inputs of the Research Team and the farmer cooperative. Senior officers of the following institutions will participate in all evaluations:

- Directorate General of Waters (DGA).
- Ministry of Health (MOH).
- USAID.

The project specific baseline data in this case is simple because the area to be developed now produces nothing. The socio-economic baseline for the participants will be obtained during the selection process to be made by the A.Z. VII. The data collection process will

become a regular activity of the Research Team, starting in 1978.

Implementation progress will be evaluated against the target verifiable indicators set forth in the Logical Framework, shown in Annex D. The planning assumptions will also be controlled as to their validity at the evaluation time.

The third regular evaluation is intended to be the final one. It will evaluate the overall achievement of the project purpose with special emphasis on the receptivity of the demonstration and indications of interest, feasibility, etc., for its concept of being carried out at several locations in Peru. The socio-economic impact of the Project will be determined in terms of the following:

1. Production effects

   - average yield per crop per hectare
   - length of growing season
   - crop diversity
   - crop losses.

2. Income effects

   - farm-generated cash income
   - food consumption/nutritional level
   - quantity and value of marketed production
   - credit rating/borrowing behavior.

3. Sanitation effects

   - incidence of any particular vector and disease (in crops and fish)
   - presence of plagues
   - quantity and quality of the effluent.

These illustrative indicators will be supplemented by others selected to provide a basis for a GOP decision whether to expand this type of Project to other coastal cities.

The DGA has expressed its strong support of Project evaluation. USAID will coordinate closely with the DGA in promoting maximum participation of other GOP agencies and high ranking Peruvian professional personnel will be strongly encouraged to participate in the evaluation process.

D. Conditions and Covenants

The Project Agreement for the first year's activities will contain the following condition precedent to disbursement of A.I.D. funds for construction:

1. The Directorate General of Waters (DGA) shall furnish a final engineering study acceptable to the USAID.

2. The Agrarian Bank Office in Tacna will provide a letter of understanding that credit will be available to the project farmers for the production costs of the first crop.

In addition to these CP's a covenant in the Project Agreement will require joint USAID-GOP annual reviews of the progress of the Project.

Annex A
Page 1.

Draft of Project Description for ProAg

One of the principal constraints to improve production of the agricultural sector in Peru is the very limited agriculturally productive land base, there being approximately 400 persons per Km^2 of arable land.

As a result of the country's dearth in arable land, the Government of Peru has fostered a policy of land reclamation through the use of traditional methods of irrigation. However, despite considerable efforts, there still remains a low arable land base. Due to limited supplies of natural water sources there is a limit as to what can be accomplished through conventional irrigation projects.

Meanwhile, substantial quantities of scarce water on Peru's coastal deserts are being lost every day by discharging all sewage, untreated, into the coastal streams and ocean fronts. This not only wastes water rich in organic fertilizers, but thoroughly contaminates the streams and ocean, and disrupts the aquatic environment. This sewage effluent offers great potential for making selected desert areas highly productive. Treating and utilizing the sewage of the coastal cities could bring literally thousands of coastal desert hectares into needed food production and provide a living to landless farmers. At the same time the use of low cost oxidation lagoon treatment of sewage would also have a favorable impact on the environmental and health conditions of much of Peru's large coastal population.

The purpose of this project is to demonstrate successfully the economic and technical feasibility of producing significant quantities of needed foodstuff by irrigating Peru's coastal desert lands with treated sewage effluents. This will be accomplished through the establishment of a pilot demonstration site outside Tacna city on Peru's extreme southern coast. Approximately 120 hectares of barren coastal desert will be under irrigation and cultivation at the project site by the middle of 1978 utilizing the treated sewage effluent from the aereation lagoons recently installed with the technical advice of a U.S. engineering consulting firm.

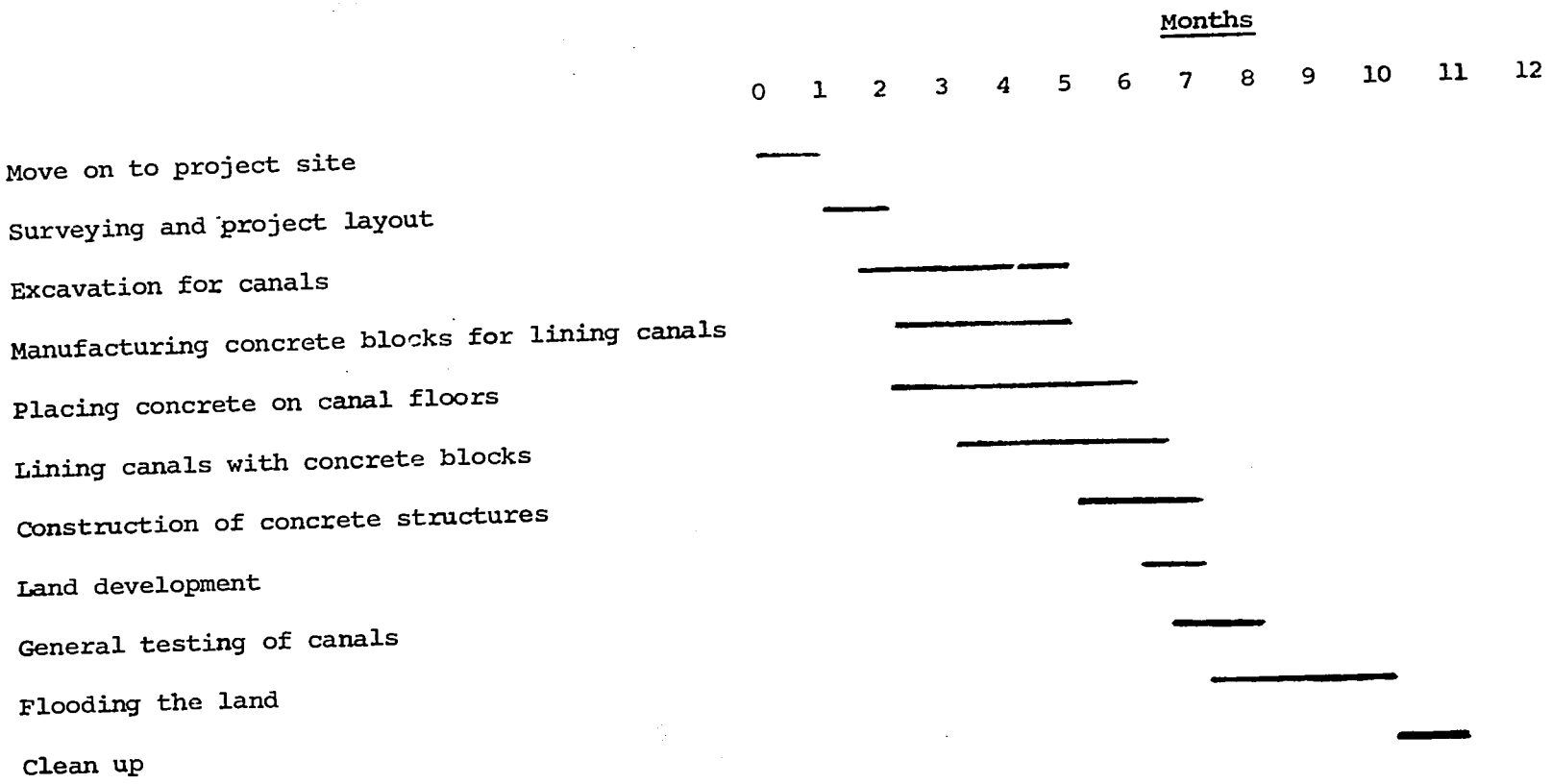
The Ministry of Agriculture's Directorate General of Waters (DGA) has already completed the feasibility study for the pilot project site, with support from AID. Under the proposed project, AID funds will assist in financing the final design and construction of the irrigation infrastructure at the project site. Although the demonstration facility initially will encompass 120 hectares, the basic infrastructure will be built to specifications that will permit expansion of the site to 200 hectares with relatively little additional effort and expense. Final selection of crops to be grown will be made during the development of the final engineering design/study to be undertaken by the DGA. Crops selected will be from among the type permitted by Peruvian law to be grown with treated sewage effluent. However a part of this demonstration project will be to experiment with other, high value, food crops, outside the "permissable list," e.g. tomatoes. This will be done to demonstrate that foods of the raw edible type grown with treated sewage effluent are sanitary and safe for human consumption. A control plot of approximately 5 hectares will be set aside for this particular experimental purpose.

The DGA will be the primary responsible Government of Peru agency for implementing the project and will provide, inter alia, 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. The Tacna branch of the Agrarian Bank will provide necessary production credit to the farmers participating in the project. The Ministry of Health's Tacna office will provide technical expertise for overall project sanitary control and for testing the crops produced on the separate five hectare plot mentioned above. A portion of the AID project contribution will assist in setting up simple, but adequate, research facilities at the project site.

The immediate participants/beneficiaries of the project will be approximately 150 members of poor former farmer families who presently reside in the "pueblos jóvenes" of Tacna. They will be organized into a production cooperative. Final selection of participants and legal incorporation of the cooperative will be undertaken simultaneously with construction of the irrigation infrastructure.

The benefits of a successful project at the Tacna demonstration site will be two-fold. On the one hand it will demonstrate the actual and potential value of treated sewage effluent otherwise wasted to produce hundreds and eventually thousands of hectares of needed food crops along Peru's desert. It will also promote improved health environment by showing that relatively inexpensive lagoon treatment systems can readily minimize water contamination to the point where waters can be used for growing all types of food crops, safe for human consumption. Expectations are that in the short term the project will be replicated at other coastal urban sites where sewage effluent is presently treated, and in the longer run to motivate the installation of sewerage treatment plants along the coast for joint agricultural/environmental benefits.

CONSTRUCTION SCHEDULE



ESTIMATED TONNAGE YIELD PER YEAR

Product	Hectares per Year	Ton/HA.	Tons
Alfalfa	40	54.6	2,184
Corn	55	3.0	165
Squash	20	8.0	160
Potatoes	50	12.0	600
Lima Beans	25	1.2	30
TOTAL:	190		3,139

ANNEX C

Environmental Assessment

Appendix 5C (Reserved) of Chapter 5 in Handbook 3 Part I is noted. Several of the aspects mentioned in the "Environmental Assessment Guidelines Manual" are covered already somewhere else in this PP and in the Feasibility Study made by DGA. Here we stress the most important environmental implications of the project starting with a general background.

The irrigation site is a barren area of sandy soil 4 Km.SW of Tacna. Recorded moisture fall at the nearby airport is less than 3 mm. (1/8") per year. Only very occasional cactus or other desert plants can be seen.

The sewage treatment plant (aeration lagoon system) is located about a kilometer from the nearest corner of the land to be irrigated. At present the treated effluent is being wasted into a natural draw in the desert which flows toward the sea. (See Figure 1 in Feasibility Study.)

The aeration lagoons, which have been functioning since October 1975, are being operated efficiently. For example, the secondary lagoons have more than 4 parts per million of disolved oxygen in the waters, which is sufficient to support fish and the local Gambucia fish has recently been planted therein and is doing well. The most recent analyses show a 10 times reduction in the Bacillus coli count and zero count for Salmonella and Shiguella bacteria. Algae of the Chorella and Coelastrum type are present but, so far, none of the Euglema type; these will be put into the lagoons in the near future.

The water table in the general area has been tested and is in excess of 50 meters (160 ft.) deep. It has been determined that there is no chance of ground water contamination due to phosphates in domestic detergents.

A potential problem could be created if, in the future, industrial plants should discharge their wastes into the sewerage system feeding the treatment plant. Industrial development in Tacna is presently at a very low level. The sanitary authorities will have to be cautioned of the need to be aware of the industrial waste problem and to enforce the existing Peruvian regulations control in the disposal of such wastes.

It is noted here that Peru's present Water Law establishes that it is permissible to irrigate with treated sewage effluent for the following:

- High stem food plants and those plants which must be cooked for human consumption;

- Food products which will be subject to industrial processing before human consumption.

These legal restrictions have been observed in designing the crop patterns for this project.

Resource linkage:

Implementation of the project will convert 120 Hectares of extremely dry desert into a fully productive green zone with the resulting environmental benefit. The agriculture technologies to be introduced will be the results of a permanent and systematic research activity to be carried out by the project research team. As a consequence of the project, habitats for wildlife will be created and a substantial change in the locallized ecosystem is expected. This, also, will be closely monitored by the research team.

Physical Aspects:

The project site is presently subject to minor wind erosion and drifting sand. The change into agricultural land will tend to fix the soil and prevent these losses. Erosion and sedimentation problems associated with the canal network will be minimized because the main canals will be concrete lined and hydraulic slopes have been carefully planned to frequently dissipate accumulating hydraulic energy. In addition to these design features the farmers' cooperative will be instructed in and will have to provide adequate maintenance for the system.

The introduction of plant diseases, insects or rodents is a possibility. These will have to be controlled and the research team will have the responsibility of keeping them controlled to permissible limits.

During the final engineering study a detail program will be designed for chemical and bacteriological effluent quality control, taking into consideration both normal operations and overload operation of the sewage treatment plant.

Social-cultural aspects:

Former farmers, now landless in Tacna, are eager for a piece of land to cultivate. Most of the selected beneficiaries are expected to be former farmers who at one time used raw sewage to irrigate (prior to 2 years ago). Thus the project will represent a positive step forward for the users. All beneficiaries will receive basic information as to how to put up their homes. A water main will bring potable water from the nearby Tacna Airport.

Public health aspects:

The potable water, mentioned above, will be available to farmers by means of public faucets conveniently located to minimized health hazards or nuisance at public watering sites.

A joint effort of the research team and the MOH Zone No. 4 will be needed to monitor sanitation, new diseases and vector patterns which may be introduced by the new water-related ecosystem, as well as the safety precautions related to pesticide/herbicide/fertilizer storage and use.

ANNEX D
Revision 1

AID 1020-28 (1-72)

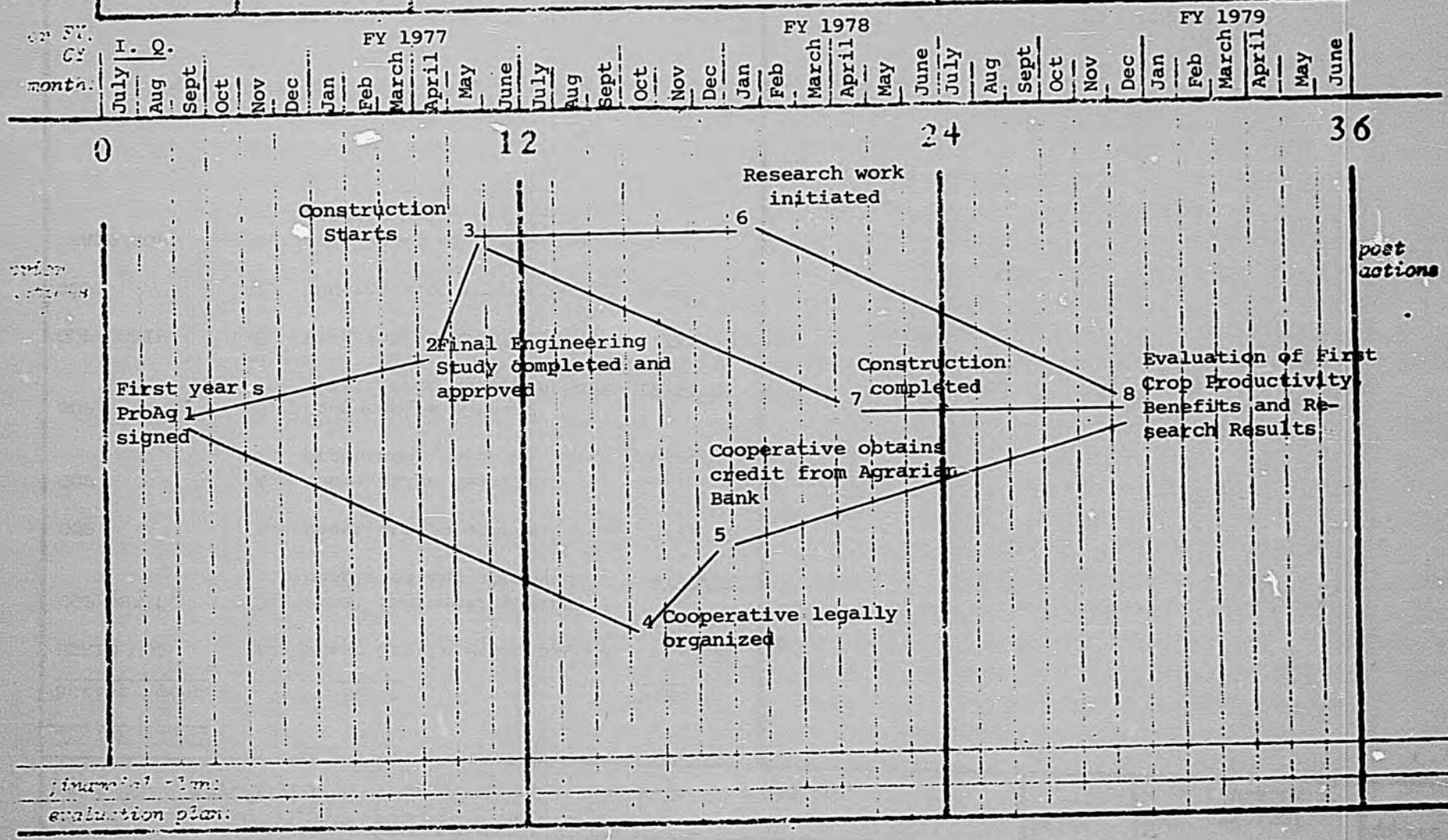
PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 70 to FY 78
Total U. S. Funding $200,000
Date Prepared: August 1976

Project Title & Number: Use of Treated Sewage for Irrigation (527-15-120-150)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To increase food production through expansion of arable land along Peru's populated coastal desert. Secondary Goal: Reduce environmental sewage contamination along Peru's coast.	**Measures of Goal Achievement:** - increase in arable coastal hectarage available for production of food: NLT 6000 hectares by 1985. - construction of sewage treatment systems for NLT six principal coastal cities, including Lima, by 1983.	- MinAg and Min. of Food statistics. - ONERN baseline studies - Census baseline data for agriculture - Ministry of Housing data	**Assumptions for achieving goal targets:** - Continued GOP high priority for increasing agricultural food production. - GOP interest in reclaiming coastal desert lands, continues as high priority. - Recognition of economical benefits that can be derived through use of treated sewage will result in priority selection of lagoon systems over alternative technologies.
Project Purpose: To successfully demonstrate the economic and technical feasibility of producing significant quantities of needed foodstuffs by irrigating desert lands with treated sewage effluent.	**Conditions that will indicate purpose has been achieved: End of project status.** - Establishment of on-going demonstration site. - At least 120 hectares at Tacna pilot site under cultivation by 1978. - Economic returns to the small producers of the magnitudes indicated in the financial analysis.	- MinAg Agrarian Zonal Office No. VII data. - Project Monitoring and Evaluation (joint DGA/USAID). - Agrarian Bank Zonal Office data. - Ministry of Health - Cooperative data on marketing returns and production costs.	**Assumptions for achieving purpose:** - Adequate support for project (by Agrarian Zone No. VII). - GOP agencies involved in project (MinAg, MOH, MinFood, Ag. Bank) will continue to support project. - Continued adequate operation of Tacna sewage treatment plant.
Outputs: 1. Construction of basic infrastructure at pilot site - irrigation canals and small water control structures. 2. Hectarage brought into cultivation at pilot site. 3. Production of selected crops. 4. Establishment of demonstration plot to test use of treated effluent on crops at pilot site. 5. Establishment of Agr. Cooperative.	**Magnitude of Outputs:** - See Annex B for Construction Schedule. - At least 120 hectares by end of second year. - See Annex B for projected food tonnage yield per year. - Research control program operating in second year. - Approximately 150 coop beneficiaries.	- On-site inspection by DGA and USAID technicians. - MinAg Agrarian Zone Office No. VII. - Agrarian Bank Zonal Office. - Project Monitoring by MOH Zonal Office No. IV (for sanitary controls). - MinAg Agrarian Zone Off. VII & SINAMOS.	**Assumptions for achieving outputs:** - Construction materials available without major delays. - Willingness of farmers to form a coop and participate in the project. - Availability of agricultural credit from the Agrarian Bank for participating farmers.
Inputs: A. USAID 1. Grant financial assistance 2. Engineering guidance/monitoring B. GOP: 1. MINAG a. DGA 1. Administrative & Tech. Staff 2. Final Engineering Design Study b. Agrarian Zonal Office No. VII 1. Supervisory personnel and partial local logistics 2. Land 2. Agrarian Bank provides credit 3. Ministry of Health 4. Ministry of Food	**Implementation Target (Type and Quantity)** - $200,000 grant for local construction and supplies and equipment. - One Civil Engineer (local direct-hire on part time basis). - Study completed approximately 7 mos after Project initiation (by April 30, 1977). - 120 hectares demonstration site. - Estimated agricultural production credit to cooperative: $120,000 - Part time services of lab technicians and sanitary engineer. - Technical assistance.	- Project monitoring - On-site inspections - Agrarian Bank records-number of loans made to project cooperative members. - Periodic reports of analysis	**Assumptions for providing inputs:** - Timely GOP budgetary & staff support. - Timely availability of AID resources, especially beyond first year of project. - Inflations does not exceed project budget estimates. - Agrarian Bank will honor its commitment to provide credit to participating farmers.

Country	Project No.	Project Title	Date	X original / revision #	PPT approval
PERU	527-15-120-150	Use of Treated Sewage for Irrigation	6/76		



PROJECT PERFORMANCE NETWORK

SAMPLE FORM

[illegible] PLAN	project no: 527-15-120-150	project title: Use of Treated Sewage for Irrigation	date: 6/76	/X/ original / / revision #	approd:

CPI NARRATIVE

Action Agent		Event	Date
USAID/GOP	1.	First Year's ProAg signed	9/30/76
GOP/USAID	2.	Final Engineering Study completed and approved	4/30/77
GOP	3.	Construction starts	5/31/77
GOP	4.	Cooperative legally organized	10/31/77
GOP	5.	Cooperative obtains credit from Agrarian Bank	12/31/77
GOP/USAID	6.	Research work initiated	1/31/78
GOP	7.	Construction completed	4/30/78
USAID/GOP	8.	Evaluation of First crop productivity, benefits and research results	12/31/78

ANNEX F

AID 1240-2 (5-74)

CHECKLIST OF STATUTORY CRI

(Alliance for Progress.

In the right-hand margin, for each item, write answer or, as appropriate, a summary of required discussion. As necessary, reference the section(s) of the Capital Assistance Paper, or other clearly identified and available document, in which the matter is further discussed. This form may be made a part of the Capital Assistance Paper.

The following abbreviations are used:

FAA - Foreign Assistance Act of 1961, as amended.

FAA, 1973 - Foreign Assistance Act of 1973.

App. - Foreign Assistance and Related Programs Appropriation Act, 1974.

MMA - Merchant Marine Act of 1936, as amended.

BASIC AUTHORITY	Answer or Discussion
1. *FAA § 103; § 104; § 105; § 106; § 107. Is loan being made*	
a. *for agriculture, rural development or nutrition;*	For agriculture and rural development
b. *for population planning or health;*	
c. *for education, public administration, or human resources development;*	
d. *to solve economic and social development problems in fields such as transportation, power, industry, urban development, and export development;*	

AID 1240-2 (5-74)

e. in support of the general economy of the recipient country or for development programs conducted by private or international organizations.

COUNTRY PERFORMANCE

Progress Towards Country Goals

2. *FAA § 208; §.251(b).*

A. Describe extent to which country is:

(1) Making appropriate efforts to increase food production and improve means for food storage and distribution.

The GOP has an active policy to increase food production, including extensive credit programs. A top priority activity is the Agrarian Reform program which among other things is consolidating and redistributing land holdings in an attempt to bring additional lands under cultivation. A new Ministry of Food has been established with responsibility for technical assistance in production and marketing of food crops.

(2) Creating a favorable climate for foreign and domestic private enterprise and investment.

In the context of its industrial reform program (Industrial Law) and its balance of payment management, the GOP is seeking foreign and domestic private investments in areas identified as being essential to growth. Also see Item No. 4.

(3) Increasing the public's role in the developmental process.	Programs in Industry (Industrial Law), fishing (Fishing Law), mining (Mining Law), Agrarian Reform, and Social Property are especially designed to achieve this objective, as are efforts to mobilize rural population.
(4) (a) Allocating available budgetary resources to development.	Sizeable portion of the GOP national budget are being allocated to the top priority programs of educational, agricultural and industrial reform (18%, 10% and 5% respectively).
(b) Diverting such resources for unnecessary military expenditure (See also Item No. 20) and intervention in affairs of other free and independent nations.) (See also Item No. 11)	"See item N° 19".
(5) Making economic, social, and political reforms such as tax collection improvements and changes in land tenure arrangements, and making progress toward respect for the rule of law, freedom of expression and of the press, and recognizing the importance of individual freedom, initiative, and private enterprise.	In recent years, tax collections have improved, the rule of law continues to be respected, and land reform has received top priority. Since the recent change of Government, deportees have been invited to return and previously closed newsmagazines been permitted to reopen.
(6) Adhering to the principles of the Act of Bogota and Charter of Punta del Este.	Sound monetary and fiscal policies leading to real growth in GNP, and relatively stable prices, coupled with significant economic and social reforms designed to restructure the Peruvian society along more equitable lines indicate Peru's compliance with Alliance for Progress goals.

AID 1240-2 (5-74)

(7) Attempting to repatriate capital invested in other countries by its own citizens.	Recent decrees requiring full repatriation of foreign capital of Peruvians have had an important impact on the balance of payments and make available resources for investments in Peru.
(8) Otherwise responding to the vital economic, political, and social concerns of its people, and demonstrating a clear determination to take effective self-help measures.	The GOP appears to be responding to the economic, political and social concerns of its people, particularly the poor, and has intensified self-help efforts as indicated above.
B. Are above factors taken into account in the furnishing of the subject assistance?	Yes.

Treatment of U.S. Citizens by Recipient Country

3. *FAA § 620(c). If assistance is to government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?*	No known instance.
4. *FAA § 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?*	The Government of Peru is fully aware of USG requirement for prompt, adequate and effective compensation regarding expropriation of U.S. investments. To date there have been several expropriation claims which have been settled to the satisfaction of GOP and the USG The only outstanding expropriation claim is that of the U.S. Marcona Mining company which is still subject to further negotiations.

AID 1240-2 (5/74)

5. FAA § 620(o); Fishermen's Protective Act, § 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing vessel on account of its fishing activities in international waters,

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

No deduction has been required.

b. has complete denial of assistance been considered by A.I.D. Administrator?

The Administrator has taken into consideration prior seizure of U.S. fishing vessels by the GOP in his determination to continue to furnish assistance to Peru. There have been no such seizures or sanctions since the 1972-73 fishing season.

Relations with U.S. Government and Other Nations

6. FAA § 620(a). Does recipient country furnish assistance to Cuba or fail to take appropriate steps to prevent ships or aircraft under its flag from carrying cargoes to or from Cuba?

No longer applicable.

AID 1240-2 (5-74)

7.	FAA § 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?	Yes.
8.	FAA § 620(d). If assistance is for any productive enterprise which will compete in the United States with United States enterprise, is there an agreement by the recipient country to prevent export to the United States of more than 20% of the enterprise's annual production during the life of the loan?	Any production increases resulting from efforts under this project will be consumed or marketed within Peru
9.	FAA § 620(f). Is recipient country a Communist country?	No.
10.	FAA § 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression?	No.
11.	FAA § 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property?	No.

AID 1240-2 (5-74)

12. FAA § 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, in convertibility or confiscation, has the A.I.D. administration within the past year considered denying assistance to such government for this reason?	The Administrator has taken Peru's limited guaranty program into consideration in determining to continue to furnish assistance to Peru.
13. FAA § 620(n). Does recipient country furnish goods to North Viet-Nam or permit ships or aircraft under its flag to carry cargoes to or from North Viet-Nam?	No longer applicable.
14. FAA § 620(q). Is the government of the recipient country in default on interest or principal of any A.I.D. loan to the country?	No.
15. FAA § 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?	No.
16. FAA § 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the A.I.D. Administrator in determining the current A.I.D. Operational Year Budget?	In March 1976 State/IO advised the following with respect to Peru's UN obligations: The amount currently owed by Peru to the UN is not sufficient to trigger the 620(u) provisions." According to State/IO this statement would apply over the next year even if Peru makes no payments to the UN this year.

AID 1240-2 (5-74)

17. FAA § 481. *Has the government of recipient country failed to take adequate steps to prevent narcotic drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?*

No. The GOP has taken such measures as are within its capacity to control narcotics traffic and in cooperating with U.S. efforts to eliminate production and trade in narcotics.

18. FAA, 1973 § 29. *If (a) military base is located in recipient country, and was constructed or is being maintained or operated with funds furnished by U.S., and (b) U.S. personnel carry out military operations from such base, has the President determined that the government of recipient country has authorized regular access to U.S. correspondents to such base?*

Not applicable.

Military Expenditures

19. FAA § 620(s). *What percentage of country budget is for military expenditures? How much of foreign exchange resources spent on military equipment? How much spent for the purchase of sophisticated weapons systems? (Consideration of these points is to be coordinated with the Bureau for Program and Policy Coordination, Regional Coordinators and Militar Assistance Staff (PPC/RC).)*

Approximately 15% of the 1975-76 GOP budget was allocated to military expenditures. The widely publicized GOP policy is to seek limitation of armaments throughout Latin America.

AID 1240-2 (5-74)

CONDITIONS OF THE LOAN

General Soundness

20. FAA § 201(d). Information and conclusion on reasonableness and legality (under laws of country and the United States) of lending and relending terms of the loan.	Not applicable.
21. FAA § 251(b)(2); § 251(e). Information and conclusion on activity's economic and technical soundness. If loan is not made pursuant to a multilateral plan, and the amount of the loan exceeds $100,000, has country submitted to A.I.D. an application for such funds together with assurances to indicate that funds will be used in an economically and technically sound manner?	For the reason given in the Project Paper the project is considered economically and technically sound.
22. FAA § 251(b). Information and conclusion on capacity of the country to repay the loan, including reasonableness of repayment prospects.	Not applicable.
23. FAA § 251(b). Information and conclusion on availability of financing from other free-world sources, including private sources within the United States.	The participation of other donors was considered when calculating the amount of AID's contribution to the project.

AID 1240-2 (5-74)

24.	FAA § 611(a)(1). Prior to signing of loan will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the United States of the assistance?	Yes.
25.	FAA § 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of loan?	No such legislative action expected to be necessary.
26.	FAA § 611(e). If loan is for Capital Assistance, and all U.S. assistance to project now exceeds $1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?	Not applicable.

Loan's Relationship to Achievement of Country and Regional Goals

27.	FAA § 207; § 251(a); § 113. Extent to which assistance reflects appropriate emphasis on: (a) encouraging development of democratic, economic, political, and social institutions; (b) self-help in meeting the country's food needs; (c) improving availability of trained manpower in the country; (d) programs designed to meet the country's health needs;	Project activities are uniquely designed to meet the objectives of (a), (b) and to a limited degree (c). Improved health (d) should result from increased food production. The project will also introduce the concept of using sewage effluent that has been treated. Replication of the project will require installation of sewage treatment facilities thereby contributing to general improvement of health conditions and environment. This will also thwart the illegal but nevertheless common practice of cultivating food crops with untreated sewage effluent.

(e) other important areas of economic, political, and social development, including industry; free labor unions, cooperatives, and Voluntary Agencies; transportation and communication; planning and public administration; urban development, and modernization of existing laws; or (f) integrating women into the recipient country's national economy.

28. FAA § 209. Is project susceptible of execution as part of regional project? If so why is project not so executed?

Not susceptible.

29. FAA § 251(b)(3). Information and conclusion on activity's relationship to, and consistency with, other development activities, and its contribution to realizable long-range objectives.

The projecy will be consistent with other GOP development activities, will contribute to development of the rural sector, and is consistent with A.I.D. activities and goals.

30. FAA § 251(b)(7). Information and conclusion on whether or not the activity to be financed will contribute to the achievement of self-sustaining growth.

Expansion of arable coastal desert lands available for cultivation by small farmers will contibute to self-sustaining growth.

31. FAA § 209; § 251(b)(8). Information and conclusion whether assistance will encourage regional development programs, and contribute to the economic and political integration of Latin America.

The relatively small assistance to this project is not expected to have a significant impact on the economic and political integration of Latin America.

AID 1240-2 (5-74)

32. FAA § 251(g); § 111. *Information and conclusion on use of loan to assist in promoting the cooperative movement in Latin America.*

Small farmers to be selected for participation in the project will likely be organized into one of the types of associative enterprises which are promoted under Peru's comprehensive Agrarian Reform program, thereby contributing to the cooperative movement.

33. FAA § 251(h). *Information and conclusion on whether the activity is consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress in its annual review of national development activities.*

The IBRD Consultive Group Meeting on Peru emphasized the justifiable need of international financial and technical assistance to Peru's development program.

34. FAA § 281(a). *Describe extent to which the loan will contribute to the objective of assuring maximum participation in the task of economic development on the part of the people of the country, through the encouragement of democratic, private, and local governmental institutions.*

The project is designed to assist small farmers (who will likely be organized into some type of cooperative enterprise) and thus encourage maximum participation at the local level in economic development.

35. FAA § 281(b). *Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.*

The project contemplates significant involvement at the small farmer level and therefore strengthens democratic processes at the grass-roots level.

AID 1240-2 (8-74)

36. FAA § 601(a). *Information and conclusions whether loan will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions.*

The project is uniquely designed to demonstrate improved agricultural technology by utilizing treated sewage effluents, rich in mineral fertilizer thereby economizing on the high cost of chemical fertilizer and water resources scarce to Peru's coastal desert area.

37. FAA § 619. *If assistance is for newly independent country; is it furnished through multilateral organizations or plans to the maximum extent appropriate?*

Not applicable.

Loan's Effect on U.S. and A.I.D. Program

38. FAA § 251(b)(4); § 102. *Information and conclusion on possible effects of loan on U.S. economy, with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving the U.S. balance of payments position.*

The total amount of costs under the project, although local in nature, is so small as to have negligible effect on the U.S. economy and insignificant adverse effect on U.S. balance of payments.

39. FAA § 252(a). *Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurements from private sources.*

There will be considerable procurement of supplies and equipment from local Peruvian private sources.

AID 1240-2 (6-74)

40. FAA § 601(b). *Information and conclusion on how the loan will encourage U.S. private trade and investment abroad and how it will encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).*

"See item No. 38"

41. FAA § 601(d). *If a capital project, are engineering and professional services of U.S. firms and their affiliates used to the maximum extent consistent with the national interest?*

Services of Peruvian Government and/or private firms will be used for procurement of good and for construction, as appropriate.

42. FAA § 602. *Information and conclusion whether U.S. small business will participate equitably in the furnishing of goods and services financed by the loan.*

Information for or about small businesses will be made available in accordance with A.I.D. policies.

43. FAA § 620(h). *Will the loan promote or assist the foreign aid projects or activities of the Communist-Bloc countries?*

No.

44. FAA § 621. *If Technical Assistance is financed by the loan, information and conclusion whether such assistance will be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis. If the facilities of other Federal agencies will be utilized, information and conclusion on*

No utilization of other USG agencies is anticipated.

whether they are particularly suitable, are not competitive with private enterprise, and can be made available without undue interference with domestic programs.

Loan's Compliance with Specific Requirements

45. FAA § 110(a); § 208(e). Has the recipient country provided assurances that it will provide at least 25% of the costs of the program, project, or activity with respect to which the Loan is to be made? — Yes.

46. FAA § 112. Will loan be used to finance police training or related program in recipient country? — No.

47. FAA § 114. Will loan be used to pay for performance of abortions or to motivate or coerce persons to practice abortions? — No.

48. FAA § 201(d). Is interest rate of loan at least 2% per annum during grace period and at least 3% per annum thereafter? — Not applicable.

49. FAA § 604(a). Will all commodity procurement financed under the loan be from the United States except as otherwise determined by the President? — Procurement will be in accordance with AID grant procurement regulations.

50. FAA § 604(b). What provision is made to prevent financing commodity procurement in bulk at prices higher than adjusted U.S. market price? — Not applicable.

51. FAA § 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will loan agreement require that marine insurance be placed in the United States on commodities financed by the loan?

Not applicable.

52. FAA § 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity?

Not applicable.

53. FAA § 604(f). If loan finances a commodity import program, will arrangements be made for supplier certification to A.I.D. and A.I.D. approval of commodity as eligible and suitable?

Not applicable.

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

Consideration of excess availabilities will be given at time of procurement.

55. FAA § 611(b); App. § 101. If loan finances water or water-related land resource construction project or program, is there a benefit-cost computation made, insofar as practicable, in accordance with the procedures set forth in the Memorandum of the President dated May 15, 1962?

Not applicable.

BEST AVAILABLE COPY

AID 1240-2 (6-74)

56. FAA § 611(c). If contracts for construction are to be financed, what provision will be made that they be let on a competitive basis to maximum extent practicable?	Not applicable.
57. FAA § 612(b); § 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the United States are utilized to meet the cost of contractual and other services.	No excess U.S. owned foreign currencies are available in Peru. About 27% of direct project costs will be borne by the GOP.
58. App. § 113. Will any of loan funds be used to acquire currency of recipient country from non-U.S. Treasury sources when excess currency of that country is on deposit in U.S. Treasury?	No. Peru is neither an excess nor a near excess currency country
59. FAA § 612(d). Does the United States own excess foreign currency and, if so, what arrangements have been made for its release?	No. U.S. owned excess foreign currencies available.
60. FAA § 620(g). What provision is there against use of subject assistance to compensate owners for expropriated or nationalized property?	No such financing contemplated.

BEST AVAILABLE COPY

AID 1240-2 (5-74)

61. FAA § 620(k). If construction of productive enterprise, will aggregate value of assistance to be furnished by the United States exceed $100 million?	No.
62. FAA § 636(i). Will any loan funds be used to finance purchase, long-term lease, or exchange of motor vehicle manufactured outside the United States, or any guaranty of such a transaction?	No.
63. App. § 103. Will any loan funds be used to pay pensions, etc., for military personnel?	No.
64. App. § 105. If loan is for capital project, is there provision for A.I.D. approval of all contractors and contract terms?	Any contracts financed by project funds will be subject to AID aproval.
65. App. § 107. Will any loan funds be used to pay UN assessments?	Not applicable.
66. App. § 109. Compliance with regulations on employment of U.S. and local personnel. (A.I.D. Regulation 7).	Not applicable.

AID 1240-8 (5-74)

BEST AVAILABLE COPY

67. App. § 110. Will any of loan funds be used to carry out provisions of FAA §§ 209(d) and 251(h)?

No.

App. § 114. Describe how the Committee on Appropriations of the Senate and House have been or will be notified concerning the activity, program, project, country, or other operation to be financed by the Loan.

This project was included in the FY 1976 Congressional Presentation.

69. App. § 601. Will any loan funds be used for publicity or propaganda purposes within the United States not authorized by the Congress?

No.

70. MMA § 901.b; FAA § 640C.

(a) Compliance with requirement that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed with funds made available under this loan shall be transported on privately owned U.S.-flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.

Not applicable

(b) Will grant be made to loan recipient to pay all or any portion of such differential as may exist between U.S. and foreign-flag vessel rates?

ANNEX G

Informal Translation of Ministry of Agriculture letter (No.831-76-DGA-DM) Submitted to USAID/Peru, dated June 2, 1976

Mr. Donald Finberg
Director
Agency for International Development (AID)

Subject: Use of Treated Sewage Effluents for Irrigation - Tacna

We refer to subject project, the feasibility study of which has been developed by the Directorate General of Waters of the Ministry of Agriculture.

I would like to thank you for your collaboration in the implementation of this important study and inform you that this Ministry is highly interested in the execution of this project. Accordingly, we have submitted through official channels a request for USAID financial assistance under a Technical Cooperation Program.

Sincerely,

General Enrique Gallegos Venero
Minister of Agriculture

ANNEX H

CERTIFICATION PURSUANT TO SECTION 611(e) OF THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, Donald R. Finberg, the principal officer of the Agency for International Development in Peru, having taken into account among other factors the maintenance and utilization of projects in Peru previously financed or assisted by the United States, do hereby certify that in my judgement Peru has both the financial capability and the human resources capability to effectively maintain and utilize the capital assistance project: USE OF TREATED SEWAGE FOR IRRIGATION.

Donald R. Finberg
Director, USAID/Peru

ANNEX I

DRAFT PROJECT AUTHORIZATION

PERU

Use of Treated Sewage for Irrigation
Project No. 527-15-120-150

Pursuant to the Authority vested in me as _____ _____, Agency for International Development (A.I.D.) by the Foreign Assistance Act of 1961, as amended (The "Act"), and Delegation of Authority issued thereunder, I hereby authorize the furnishing of a Grant pursuant to Part I, Chapter I, Section 103 of said Act to the Government of Peru (The Cooperating "Country") of not to exceed One Hundred and Twenty Five Thousand United States Dollars ($125,000) to assist in financing local currency costs of goods and services for the project described below.

The project consists of assisting the Ministry of Agriculture's Directorate General of Waters to design and construct a 120 hectare pilot irrigation experimental site to successfully demonstrate the economic and technical feasibility of producing significant quantities of needed foodstuffs by irrigating selected areas of Peru's vast coastal desert with treated sewage effluent.

I hereby authorize incremental funding for this Project. I approve the total level of A.I.D. appropriated funding planned for this Project of not to exceed Two Hundred Thousand United States Dollars ($200,000) Grant, of which $200,000 will be Grant funded, including that amount authorized above, during the period FY "TQ" through FY 1978. I therefore authorize the funding of an additional increment during the period of Grant Funding up to $75,000, subject to the availability of funds in accordance with A.I.D. allotment procedures.

I hereby authorize the initiation of negotiations for execution of the Project Agreement that will be subject to the following terms, covenants and conditions:

a) Source and Origin of Goods and Services:

Goods and services financed by A.I.D. under this Project shall have their source and origin in the Cooperating Country or in the United States.

b) Prior to any disbursement of A.I.D. funds for construction under the Project Agreement: The Directorate General of Waters (DGA) shall furnish a final engineering study acceptable to USAID/Peru.

_____ Signature

_____ Date

BEST AVAILABLE COPY

ANNEX J

MEMORANDUM

TO: Mr. Dallas Dale Fowler
Chief Engineer

DATE: July 23, 1976

FROM: Charles S. Pineo
Short Term Consultant

SUBJECT: Health Considerations of Proposed Project - Use of Treated Sewage for Irrigation (Project No. 527-15-120-150)

A. The following report is submitted in response to the clause, contained in cable Lima 6297 to AID/Washington: "Pineo will be responsible for assisting Mission in addressing Items 5, 7, and 10" draft guidance message - scope of work should provide for a written report to the Mission on these items prior to departure from Peru".

B. The comment contained in the report are based on the following:

1. Visits and discussions with

(a) Leonard Yauger, Acting Mission Director, AID
(b) Dallas Fowler, Chief Engineer, AID
(c) Carlos Yuta, Engineer, AID
(d) Gerald Gower, Program Officer, AID
(e) Luis Malmati, Dept. Environmental Sanitation, MOH
(f) Dr. Solis, Dir. Institute of Public Health
(g) Dr. Germán Battistini, Technical Advisor to INSP
(h) Ing. Criaólogo Matos, DGA
(i) Dr. Yañez, Consultant, CEPIS
(j) Dr. Ruben Roe, Chief of Tacna Hospital Area
(k) Dr. Pedro Quiñonez, Director Environmental Sanit. Tacna area
(l) Ing. Chavez, Min. of Housing, Mech. Engineer in charge of oxidation pond operation
(m) Ing. Manuel Vásquez, Director of VII Agricultural Zone
(n) General de Brigada, E.P. Eduardo Salhuana, Representative of Presidencia in the Region
(o) Abstracts from pertinent literature

2. Several quotations are given from the January 1968 report of the Federal Water Pollution Control Administration US Dept. of the Interior - Agricultural Utilization of Sewage Effluent and Sludge.

BEST AVAILABLE COPY

Page 19.- The sewage could be subjected to secondary treatment and through disinfection and the effluent used for unrestricted crop irrigation.

The sewage could be given minimum treatment and the effluent utilized without disinfection for irrigation of crops not eaten raw by human beings.

Significantly greater yields on sewage - irrigated plots were attributed to regular supply of nutrients throughout growing season instead of just at beginning.

Page 20.- Oceanside - California will use oxidation ponds for final treatment to prepare its sewage effluent for commercial and irrigation use.

Page 60.- A review of the literature leads to the following conclusion regarding the sanitary aspect of sewage irrigation:

(a) Raw, untreated sewage should never be used for irrigation regardless of the crop grown.

(b) Sewage effluent receiving at least primary treatment may be used for irrigation of crops not for human concumption.

(c) The use of primary treated, and preferably completely treated sewage effluent on feed and pasture crops for animal concumption is considered safe and should be encouraged.

(d) If handled properly, the use of treated sewage effluent will not be hazardous to the operators.

(e) Properly treated and clarified sewage effluent may be rendered bacteriologically safe for use on any irrigated crop by chlorination after treatment. The chlorination simply remove any uncertainty.

Page 61.- The concentration of coliform bacteria on the surfaces of tomatoes grown in polluted soil indicate no abnormal gross contamination. Even when sprayed with facal suspensions, surface coliform counts were no greater after one month than on control tomatoes. The failure to find Salmonella cerro seven days after its application to growing tomatoes upholds the contention that organisms of fecal origin will not be present in sufficient numbers to cause gross contamination.

It is felt that tomatoes grown on soils receiving right soil or sewage sludge fertilization would yield frint, which if eaten raw,

BEST AVAILABLE COPY

would not be likely vectors for the transmission of human bacterial enteric diseases.

C. Consideration will be given to the three items mentioned in the cable mentioned above:

Item 5.- A series of samples taken from the nearby River Uchusuma were examined bacteriologically in the Tacna Hospital laboratory and the results compared with samples taken from the effluent from the oxidation point. In all cases the coliform count was higher in the river samples. The implication is that the oxidation plant effluent is less dangerous than the water flowing in nearby rivers.

This presupposes efficient operation of the oxidation ponds with careful control at all times. The ponds were visited on July 22, 1976.

The timing of the visit was particularly appropriate as only a few days previously someone had plugged the main collector carrying raw sewage from the Tacna system to the oxidation ponds. This had been done to back up the raw sewage to irrigate some land on the edge of the town. Three things had happned; first, the plug had become lodged in the 30" pipe and raw sewage was coursing across the field seeking a natural water course; second, several days were required to locate the plug, remove it and reconnect the 30" concrete pipe; and three, because more than 50% of the raw sewage was not reaching the oxidation pond to dilute the extra heavy load reaching the plant from two other collectors, the plant was overloaded, sufficient oxygen was not being generated and the usually satisfactory operation of the plant was thrown so badly out of balance that the effluent appeared to be of worse quality than the raw sewage reaching the plant.

This highlights the importance of constant surveillance of the ponds and of the sewage collection system itself to prevent abuses. Actual operation is the responsibility of the Ministry of Housing carried out under the direction of an engineer and some assistant. These seemed to be more concern with the maintenance of the aerators than with the operation of the ponds. The outlet from the ponds was nearly chocked with weeds, bushes were growing along the outlet canal which would soon lift the canal lining. Floating material was on the service of the supposedly clear water effluent area of the ponds. Steel gratings over valve chambers, valve stems and operating hand wheels were badly rusted for lack of cleaning and painting.

The Ministry of Health through the Regional Hospital is responsible for supervising the plant operation. A capable man is assigned this responsibility, but lacks transportation so cannot provide regular supervision.

BEST AVAILABLE COPY

BEST AVAIL.

Periodic supervision is provided by the Ministry of Health of Lima through the Director of Environmental Sanitation (Ing. Luis Malnati) who accompanied us on the inspection of the oxidation ponds. He immediately gave instructions on what had to be done to correct the situation and made contact with the proper authorities.

The Director of the Regional Hospital, Dr. Noe has shown every evidence of his complete support of the project. Closer contact will be maintained with the oxidation ponds when a laboratory is set up and manned at the ponds. Space is available. Work at the laboratory will be handled by a chemist or microbiologist with a couple of helpers provided by the Project. He will be supported by the hospital laboratory and their work will be supplemented by the Laboratory at the National Institute of Health in Lima which has expressed interest and willingness to cooperate in all aspects of laboratory work particularly in that related to viruses.

Although the Project document shows the research work to be initiated about mid FY 1978 it is urged that some preliminary work be started much earlier in order that the research results may be available earlier in the project. The oxidation pond effluent is now being used without permission to irrigate some land well downstream from the projected test plot. Tests could be carried out here. The DGA representative in Tacna is most anxious to start using the effluent at once, even before the test plot are laid out. He is under great pressure to make the effluent available for use. He would like to use the effluent to start a reforestation project near the outlet from the lagoons until the infrastructure can be built to take the effluent to the proposed irrigation plot. This would provide a place for early research.

The International Development Research Centre (CEPIS) of the Pan American Health Organization is developing a project for the Evaluation of the San Juan Stabilization Ponds with the support of the Canadian Government. This is scheduled to start on December 1, 1976 but the date is dependent on the signing of the agreement. It is suggested that advantage might be taken of the existing capability at CEPIS and that proposed through this project in developing the research program to be carried out under the AID project. A copy of the proposed project is attached as Annex A.

See the conclusions included in the report dated June 1976 of Ing. Malnati -"Experiencias en el Perú en la Utilización de Desagües tratados y terrenos Rellenados con Basura" for further comments on the health implications of using the effluent from the Tacna oxidation ponds for irrigation purposes. These conclusions are based on an unpublished report prepared by Dr. Julio Morales former director of the

BEST AVAILABLE COPY

que los suelos en su mayoría son de textura media y ligera y no existiendo problemas de drenaje, se considera que un lavado de sales mediante láminas pequeñas pero frecuentes, tipo - riego, sería lo más práctico puesto que la pendiente y la superficie de los suelos en un sector del Proyecto no permitiría una nivelación completa, como para un lavado tradicional". Conversations with representatives of PGR indicate no preoccupation with a build up of salts such as might occur with clay soils. The area is very sandy underlain by deep strata of sand and coarse gravel. Part of the responsibility of the research program would be to study the possible salt accumulations and to advise on procedures to avoid to build up.

I am particularly grateful to Mr. Fowler, USAID, Ing. Malnaci and Ing. Carlos Ruta of USAID for their assistance during all phases of my short stay in Peru, including the time we spent at the site of the oxidation ponds in Tacna.

It should be pointed out that the oxidation ponds at Tacna are not typical. They are over 4 meters deep, the ponds are lines with pre-cast concrete slabs, and aeration is used. Outflow from the ponds is from the bottom instead of from about 50 cm. below the surface where the water is in the optimum condition (this is to be corrected). Efficiency could be increased by the addition of but more simple oxidation ponds following the existing ponds and this is under consideration.

Conditions are ideal at Tacna for setting up the demonstration project, particularly when the operation of the ponds is properly controlled. The families to farm the proposed irrigation plots can be selected on the basis of health assessment as well as capability to farm the plots. Continuing health examinations can provide another indicator of the effectiveness of the demonstration.

Clearance: RHA:CVuta

RHA:CMinaya

BEST AVAILABLE COPY

laboratory for Biological Control (Institutos Nacionales de Salud).

The consensus is that (a) it is safe to use the effluent from an efficiently operated system of oxidation ponds for crops for animal consumption; (b) there are differences of opinion on the use of this effluent for irrigation of crops for human consumption without chlorination - with chlorination it is considered safe - The research project should address itself, among other things, to the determination of the safety of using the unchlorinated water from the Tacna oxidation ponds for irrigation of crops for human consumption. This will include a study of the viruses as well as other pathogens; (c) the investigation will cover other aspects as well as the public health implications of the project.

Item 7.- There is no doubt about the institutional capability and willingness to carry out the present project, particularly for the agricultural aspects. The project represents a minimal addition to the work load of DGA at national and regional level. The institutional capability and willingness exists for the health aspects of the project. Provision should be made for transportation for the health inspector and for use of the laboratory to be installed at the oxidation ponds. This is in addition to the provision of necessary laboratory equipment and reagents for this laboratory and to a smaller degree for the virus laboratory at the National Institute of Health in Lima.

Consideration should be given to obtaining the advise of CEPIS in developing the detailed research program, equipment lists and reagents needed for the health aspects of the research program and in coordinating the activities with the CEPIS/CANDOA program.

The possibility of replicating the project to other areas will depend on the size of those projects. It can be done on similar size projects without need of major personnel increase, and will depend more on the interest of the people to be involved. This is one of the strong points in favor of the Tacna project. Everyone with whom we met was enthusiastic about the need for the project, first to meet their local requirements and then as a demonstration for the rest of the country.

The possibility of replication for the area of Lima will require a detailed study which can be made only after the results of the demonstration at Tacna are available and can be analyzed. Those results should make it easier to estimate the needs for the much larger Lima area project.

Item 10.- Reference is made to Page 40 of the Feasibility Study dated May 1976 (which should be attached to the Project Document as it contains much detail not contained in that Document). "Considerando

BEST AVAILABLE COPY

ANNEX K

Department of State TELEGRAM

UNCLASSIFIED 9450

PAGE 01 STATE 179480

66
ORIGIN AID-00

INFO OCT-01 OES-06 /065 R

DRAFTED BY LA/DR:HHASAN/KKELLY:RR:GAH
APPROVED BY AA/LA:DHLION
LA/EP:RCOHEN SER/ENGR:CSTEVENS
LA/DR:CWEINBERG TA/H:JTHOMPSON
LA/DR:MBROWN PPC/DPRE:HARLACH
LA/DR:BSCHOUTEN (DRAFT)
LA/DR:MDEMETRE (DRAFT)
LA/DR:MBRACKETT (DRAFT)
LA/DP:WTATE (DRAFT)
LA/DR:GSCHWAB (DRAFT)
DESIRED DISTRIBUTION
8M ACTION LA 11 INFO AATA OST IOC PPC CMGT CTR ENGR PERS INT AGRIC EPA

COMM NSC CHRON 1 2 8 58P

983312

R 202311Z JUL 76
FM SECSTATE WASHDC
TO AMEMBASSY LIMA

UNCLAS STATE 179480

AIDAC

E.O. 11652: N/A

SUBJECT: DAEC REVIEW - USE OF TREATED SEWAGE EFFLUENT FOR IRRIGATION GRANT PP

THE DAEC REVIEWED THE SUBJECT PP ON JUNE 29, 1976 AND CONCLUDED THAT IT MUST BE REVISED (AND RESUBMITTED) IN ACCORDANCE WITH THE FOLLOWING GUIDANCE:

1. ALTERNATIVE FUNDING SOURCES: THE DAEC EXPRESSED CONCERN OVER THE FACT THAT A.I.D. INPUTS TO THE PROJECT CONSIST SOLELY OF AN OPERATIONAL SUBSIDY. THE POSSIBILITY OF FUNDING BY OTHER INTERNATIONAL LENDING INSTITUTIONS OR THE

GOP SHOULD BE EXPLORED IN DEPTH AND THE MISSION SHOULD CLEARLY DEMONSTRATE THAT A.I.D. IS INDEED THE "GRANTOR OF LAST RESORT" FOR THIS PROJECT.

2. ALTERNATIVE IRRIGATION TECHNOLOGIES: THE REVISED PP SHOULD INCLUDE AN ANALYSIS OF OTHER IRRIGATION TECHNOLOGIES (I.E. SOLAR ENERGY FOR DESALINATION, DEEP WELLS, ETC.) AND SHOULD INDICATE WHY THE PROPOSED APPROACH IS PREFERABLE TO SUCH ALTERNATIVE TECHNOLOGIES. THE ANALYSIS SHOULD INCLUDE, BUT SHOULD NOT BE LIMITED TO, A COMPARISON OF BENEFITS AND COSTS, FEASIBILITY ISSUES, REPLICATION AND TRADE-OFFS AND CONSTRAINTS FOR EACH ALTERNATIVE.

3. ECONOMIC FEASIBILITY: THE REVISED PP SHOULD IDENTIFY ALL PROJECT BENEFITS SUCH AS IMPROVED HEALTH. COSTS SUCH AS THE VALUE OF LAND, PREVENTIVE HEALTH FACILITIES, AND OTHER INVESTMENTS NOT DIRECTLY RELATED TO THE PHYSICAL INFRASTRUCTURE OF THE PROJECT, BUT WHICH WILL CLEARLY BE NEEDED FOR ITS OPERATION, SHOULD ALSO BE IDENTIFIED. THE REVISED PP SHOULD ALSO ADDRESS ADDITIONAL COSTS NOT APPLI-CAELE TO THIS PROJECT BUT WHICH ARE IMPLIED FOR ITS REPLI-CAS SUCH AS PUMPING COSTS FOR PROPOSED REPLICATION OF THE PROJECT IN THE LIMA AREA.

4. ESTIMATES OF COST: THE REVISED PP SHOULD INCLUDE RECOMPUTATIONS OF THE ESTIMATES OF COST OF THE PROJECT TAKING INTO CONSIDERATION THE RECENT DEVALUATION OF THE SOL AND HOW THAT MIGHT AFFECT PROJECT LOCAL COSTS. IN THIS REGARD, THE MISSION SHOULD REEXAMINE AND REVALIDATE ESCALATION AND CONTINGENCY ALLOWANCES (20 PERCENT AND 15 PERCENT RESPECTIVELY) INCLUDED IN THE ESTIMATE.

5. POTENTIAL HEALTH HAZARDS: THE ADVERSE HEALTH IMPLICATION OF HAVING NON-POTABLE SEWAGE EFFLUENT RUNNING THROUGH OPEN CANALS AND THE LIKELY CONTACT OF FARM FAMILIES, PARTICULARLY THE YOUNG, WITH THIS EFFLUENT SHOULD BE ADDRESSED IN THE REVISED PP. THE POTENTIAL HEALTH HAZARDS OF THE EFFLUENT, BOTH AS A SOURCE AND AS A VECTOR, SHOULD BE DISCUSSED IN TERMS OF PROTECTIVE MEASURES, INFORMATION AND EDUCATION PROGRAMS ETC.

BEST AVAILABLE COPY

Department of State TELEGRAM

6. PROJECT SITE: THE SUITABILITY OF TACNA AS THE SITE OF THE PILOT PROJECT SHOULD BE REEXAMINED WITH PARTICULAR ATTENTION TO ITS SIMILARITIES WITH OTHER PROJECTED PROJECT AREAS AND HOW DISSIMILARITIES WILL BE HANDLED IN REPLICATION, E.G. PUMPING REQUIREMENTS, PRESENCE OF TOXIC ELEMENTS IN EFFLUENT DUE TO INDUSTRY DISCHARGES.

7. INSTITUTIONAL CAPABILITY: THE IMPLICATION OF PROJECT REPLICATION ON THE INSTITUTIONAL CAPABILITY OF ALL PARTICIPATING GOP AGENCIES SHOULD BE EVALUATED IN TERMS OF ADDITIONAL MANPOWER, BUDGET RESOURCES AND TECHNICAL SKILLS. THE REVISED PP SHOULD ALSO DESCRIBE HOW SUCH ADDITIONAL REQUIREMENTS ARE LIKELY TO BE MET AND WHAT COMMITMENTS HAVE BEEN MADE BY THE GOP.

8. DEMAND AND DESIRABILITY OF GROWN CROPS: THE REVISED PP SHOULD DESCRIBE IN MORE DETAIL HOW ACCEPTABLE THE PROPOSED CROPS ARE TO CONSUMERS AND SHOULD INCLUDE A DEMAND ANALYSIS FOR THESE CROPS AND THEIR MARKETABILITY, PARTICULARLY ALFALFA AND LIMA BEANS.

9. MONITORING PARAMETERS: ADDITIONAL DISCUSSION IS REQUIRED ON THE ROLE OF THE MINISTRY OF HEALTH IN MONITORING HEALTH PARAMETERS (READINGS ON EFFLUENT BACTERIA COUNTS, ETC.) ESTABLISHED BY THE PROJECT. THE METHODOLOGIES TO BE EMPLOYED BY MOH IN THIS ROLE SHOULD BE DISCUSSED IN DETAIL.

10. SALT ACCUMULATIONS: THE REVISED PP SHOULD ADDRESS THE LONG-TERM EFFECTS OF SALT ACCUMULATION ON IRRIGATED LAND AND HOW SUCH EFFECTS MAY BE CONTROLLED THROUGH LABORATORY RESEAR AND FIELD APPLICATION (EITHER WITHIN THE SCOPE OF THE PROJECT OR OUTSIDE OF IT). THE MAGNITUDE AND SOURCE OF FUNDS THAT WILL BE REQUIRED TO DEAL WITH SUCH EFFECTS SHOULD ALSO BE ADDRESSED.

11. PROJECTED LAND VALUE: THE PROJECTED APPRECIATION IN PROJECT LAND VALUES AS A RESULT OF THE IRRIGATION SYSTEM SHOULD BE REAPPRAISED.

12. SUBSIDY TO WATER USERS: THE REVISED PP SHOULD

INCLUDE AN ANALYSIS OF THE EXTENT OF THIS SUBSIDY TO PARTICIPATING FARMERS, AND ITS IMPLICATION FOR REPLICATION. GOP ENTITIES SHOULD BE MADE AWARE OF THE RESULTS OF THE ANALYSIS IN ORDER TO ILLUSTRATE THE EXTENT OF THEIR COMMITMENT.

13. PROJECT CIVIL WORKS: THE REVISED PP SHOULD INCLUDE A CONCISE (BUT DETAILED) IMPLEMENTATION PLAN OF THE CIVIL WORKS OF THE PROJECT OUTLINING THE DIFFERENT STEPS REQUIRED FOR PROJECT COMPLETION AND TIME PROVISIONS FOR EACH. IN THIS REGARD, THE ROLE AND COMPENSATION CONTEMPLATED FOR THE ADMINISTRATIVE CONTRACTOR SHOULD BE CLEARLY DEFINED.

14. THE MEXICAN EXPERIENCE: THE MISSION MAY WISH TO AVAIL ITSELF OF THE RESULTS OF THE MEXICAN EXPERIMENT IN THIS AREA IN THE CONTEXT OF WHAT MIGHT BE RELEVANT TO THE PERU PROPOSAL.

15. ENVIRONMENTAL ANALYSIS: THE MISSION'S ATTENTION IS DIRECTED TO THE NEW AGENCY ENVIRONMENTAL PROCEDURES. THE DRAFT COPY CIRCULATED TO THE MISSION EARLIER SHOULD BE UTILIZED IN THE REVISION AND EXPANSION OF THE ENVIRONMENTAL ASSESSMENT OF THE PROJECT.

16. EVALUATION PLAN: PROBLEMS WITH THE EVALUATION PLAN, SPECIFICALLY WITH THE PURPOSE LEVEL INDICATORS, WERE DISCUSSED WITH MISSION PROGRAM OFFICER SUBSEQUENT TO PROJECT REVIEW. REVISED PP SHOULD REFLECT THE PROBLEMS DISCUSSED.

17. TDY ASSISTANCE: WITH THE SUBSTANTIAL INCREASE IN ECONOMIC ANALYSIS NEEDED FOR THE REVISED PP, THE MISSION MAY FIND TDY ASSISTANCE USEFUL. AID/W HAS LOCATED AN ECONOMIST/ENGINEER CONTRACTOR, RUSSELL SCARATO, WHO HAS RECENTLY WORKED ON THE ECONOMIC ANALYSIS AND FEASIBILITY OF USING SEWAGE EFFLUENT FOR IRRIGATION IN MOROCCO AND YEMEN. HE WOULD BE AVAILABLE FOR A 2 WEEK TDY UNDER A PERSONAL SERVICES CONTRACT. PLEASE ADVISE. KISSINGER

ANNEX L

Addendum to Project Paper for
Use of Treated Sewage for Irrigation
Project No. 527-15-120-150

The following modifications and elaborations to the Project Paper for a $200,000 grant to assist in the financing of a pilot project to demonstrate the economic and technical feasibility of producing significant quantities of foodstuffs by irrigating desert lands with treated sewage effluents are provided in response to the comments and instructions of the DAEC as contained in STATE 179480. This addendum has been prepared in close collaboration with officials of the Ministry of Agriculture and the Ministry of Health and included additional field investigations in Tacna. The Mission wishes to particularly acknowledge the assistance of AID/W Environmental Sanitation consultant Charles S. Pineo in further analyzing health and environmental aspects of the pilot project. Mr. Pineo's report is incorporated into the PP as Annex J.

The discussion below is arranged in the same order as the points raised in the DAEC message.

1. Alternative Funding Sources.

The project proposed for AID financing is designed to demonstrate the technical feasibility and economic benefits that may be derived in an arid region such as coastal Peru by using treated sewage effluent for crop irrigation. The treatment of sewage effluents would also produce significant environmental protection benefits. The USAID's role in the development of this project has been that of a catalytic agent, bringing together the Ministries of Agriculture and Health to sponsor experimentation with this presently unused technology. The AID grant would assist with the financing of both civil construction and the agricultural and health research components of the program.

As requested by the DAEC, the Mission has consulted with other donors as to the possibility of incorporating the Tacna pilot project within their assistance programs. The Mission has also reexamined the capacity of the Government to assume total financing of the project.

More specifically, the Mission has discussed the Tacna Project with the Resident Representative of the United Nations Development Program. The Mission was advised by the Resident Representative that in view of UNDP budget limitations funds can not be made available from that source. Similarly the Mission consulted with the Representative in Peru of the IDB. The IDB Representative indicated

that it was impossible at this time to incorporate the Tacna project within existing or planned IDB programs. As the IBRD does not have resident staff in Peru it has not been possible to consult directly with that agency. The Mission has, however, analyzed the IBRD's existing portfolio and projects under consideration. The latter category does include a proposed loan aimed at rehabilitation, desalinization and drainage projects in areas already selected. Given the fact that the focus is on rehabilitation of existing facilities, the Tacna project would not qualify under the planned IBRD loan, according to information available to the Mission. Lastly, as to the ability of the GOP to assume full costs of the project, recent GOP austerity measures totally preclude this possibility. The Ministry of Agriculture investment budget for the remainder of the biennium, as part of total Government-wide budget cuts of over 14 billion soles, has been reduced by some 600 million soles. Similar restrictions in the GOP investments budget are anticipated for at least the next 18 months. The Ministry is thus not in a position to assume an increased share of project costs.

In sum, financial participation in the project by other donors is not feasible at this time, nor is the Government able to assume full costs. Thus, AID support in the amount of $200,000 is required to enable the pilot demonstration project to be undertaken.

2. Alternative Irrigation Technologies

The Mission has reexamined various alternatives for expanding arable land along Peru's populous arid coast through irrigation. A summary of these examinations follow.

a) Solar Energy for Desalination

Discussion with AID/W technical offices and review of available literature indicate that solar energy technology for desalination for irrigation purposes has not yet advanced to the stage that it can be considered technically or economically viable. Only in isolated cases involving very limited production requirements does solar desalination primarily for hydroponic growing of vegetables appear feasible at the present time. Reliable cost estimates for these pilot efforts are not readily available for comparative purposes. It should also be noted that for certain potential sites for treated sewage irrigation (e.g., Tacna and Piura, both of which already have sewage lagoon treatment facilities) the distance from the sites to the sea is a further limitation. The city of Tacna, for example, lies inland some 37 kilometers.

Peru's Institute for Industrial Technology Research and Technical Standards (ITINTEC) is the only Peruvian agency currently involved in energy research. With French assistance, some experimentation is being conducted in Arequipa on the potential of solar energy for pumping purposes, as well as heating and electricity. ITINTEC has not yet, however, developed a level of applied technology sufficient to provide the "know how" to make use of solar energy for desalination for any more than the most elementary experimentation, i.e., a few liters of water per day.

USAID/ENG maintains close contact with the ITINTEC staff and the possibility of using solar energy for sea water desalination might prove to be a good demonstration project in the future, at such time as the world state of the art has advanced much more. For the immediate future, however, solar energy can not be considered an available alternative technology.

b) Deep Wells

The Feasibility Study reports indications that the water table is approximately 50 meters deep at the project site and that a flow of 60 lt/sec. might be expected per well. Accordingly, two wells would be necessary for the first phase of the project, and two more for the second.

This solution, while technically feasible, involves considerable uncertainty. This was proven by a recent experience by the Tacna City Authority when, following a consultant's recommendation, a deep well was drilled for water supply. The well was dug to a level of 80 meters but yields only 20 lt/sec.

As to relative costs, at the Tacna site the use of the deep well alternative would result in additional phase I costs totalling approximately $49,000. This calculation is based on cost estimates provided by a well drilling firm in Lima. The costs stated for the project area are $31,000 for one well and $29,000 for the second well, or $60,000 for the two wells. The only potential savings over the costs of civil works under the treated sewage alternative is the cost of the primary canal from the lagoon treatment plant to the project site. The latter cost is $10,900.

In brief, water is a scarce resource in the Tacna valley and experience to date has demonstrated that medium depth wells are relatively expensive and risky. Most importantly, the potable water requirements of the growing urban population take priority on each new source identified. Thus groundwater is not a readily available alternative for coastal irrigation near urban populations.

c) Bring Water from the Andes

With an excess of water on the eastern slopes of the Andes and a lack of water in the Coast, this alternative would be feasible if the costs were not a problem. The nature of the infrastructure works (tunnels through the Andes, reservoirs, pumping stations, etc.) are such that only a few big hydroelectric/irrigation projects can afford this alternative, as present irrigation costs per hectare run between $4,000 and $6,000, as compared to under $2,000 per hectare using treated sewage.

d) Rehabiliation of irrigation systems

Another alternative at selected sites along the coastal desert is the rehabilitation/extension of existing or former irrigation systems. The IBRD is currently considering a project of this nature. A very preliminary, and probably optimistic, estimated cost of this project is $2,160 per hectare, or slightly higher than the estimated costs per hectare ($1,821) of treated sewage irrigation systems.

e) Treated Sewage Alternative

The treated sewage alternative involves no additional project cost for water generation as would be required in most of the alternatives discussed above. However, in order to replicate the pilot project throughout the coast, pumping costs will be involved at several potential sites to move the sewage from its present dischange point to higher levels for lagoon treatment and subsequent gravity flow to the lands to be irrigated. Such costs would be significantly less than that to bring water from the eastern slopes of the Andes. Deep well projects would also involve significant pumping costs. Moreover as the lands to be irrigated are near to the point of water generation, the costs of primary canals under this system will be minimal relative to most available alternatives. Sewage lagoon treatment systems will be required for project replicability. At three such potential sites these systems already exist and are projected for others.

Lagoon treatment facilities represent a low cost technology for sewage treatment along Peru's coastal desert and is the only method of treatment currently installed in the area. To the extent that the lagoons are constructed primarily to serve health and environmental purposes, these costs, including pumping costs, do not represent any real additional cost to the irrigation portion of the project.

In the case of the Tacna project, the most important component of the system already exists and is operating, i.e., the sewage treatment facility. With this in operation the major expenditure of the project will be irrigation canal construction. Sewage treatment technology exists in the country but needs to be improved. Thus the second expense of the project will be for research which will benefit not only the Tacna project but future projects using treated sewage for irrigation in Peru and elsewhere.

f) Conclusion

Mr. Ralph Stone, writing in the June 1976 issue of the American Society of Civil Engineer's Journal of the Environmental Engineering Division, page 501, states the case well for Tacna, for Peru, or for any place where water is in short supply. "The solution to anticipated future water shortages involves both development of increased water sources and also more efficient use of the existing water supplies. Included in both categories is the alternative of reclaiming wastewaters, a practice that conserves existing water supplies through recycling, at the same time providing an important additional source of water."

The question then in an arid region such as coastal Peru is not to select a single technology from among the several alternatives but to make maximum use of all available efficient technologies. The use of treated sewage for irrigation is one such economic and technically viable technology which is currently underutilized. Its application would result in multiple benefits. Firstly, substantial quantities of food could be grown on lands irrigated with the effluent. Secondly, it ameliorates the competition between use of traditional water sources for irrigation and for potable purposes. Thirdly, the use of treated sewage for irrigation encourages the establishment of sewage lagoon treatment facilities, providing important protection to the environment. Thus the Mission reaffirms the selection of treated sewage for irrigation as an appropriate technology for the pilot project and for subsequent adoption along the coastal desert.

3. Economic Feasibility; Identification of Project Benefits and Costs

The Mission has re-examined the economic feasibility of the Tacna project as computed in the Feasibility Study executed by the Ministry of Agriculture and which served as the basis of the economic analyses contained in the PP, and has confirmed the reliability of the computations. For the initial 120 hectares, the project yields a benefit cost ratio of 1.13. The expansion of the project to 200 hectares increases the ratio to 1.16. The cost per hectare of phase I is $2,110. The average cost per hectare through phase II is reduced to $1,421.

The main benefits of the project are those presented in the Revised Logical Framework of the Project Paper (Section 16). Other benefits will be: a) Employment generation for landless small farmers, e.g., 3.3 jobs per irrigated farm plot, b) improvement of an existing technology in the country for irrigating with treated sewage; this, to be complemented by research activities in health and sanitation, and c) the basis for replication of this project to improve the health and environmental surroundings of the coastal population as a result of an abatement of the present pollution of streams and coastal waters in and adjacent to the coastal cities.

The revised costs of the Tacna project are presented in section 4 below. In this project, as well as in other similar ones, the cost of the land to be irrigated is nil. All such land is owned by the GOP, based on Peruvian legislation which states that all arid land which does not have any specific economic use belongs to the government (Decree Law 17716 - Title XVI and Supreme Decree 163-69-AP). It is precisely this type of land which is to be used in the Tacna project and also in all similar ones elsewhere on the coast. There is ample availability of such Government owned lands for replicability of the Tacna pilot project, including the Lima area.

For this and similar projects there are no additional costs anticipated for preventive health facilities. Existing urban hospitals have the capacity to meet such needs as may arise. In the case of Tacna, for example, the Central Hospital will check the health of project participants at the outset and then will perform periodic control of them during all phases of the project. Similarly, no health or environmental benefits are included in the economic analyses due to the lack of reliable data and the satisfactory benefit cost ratios and internal rates of return without inclusion of these additional benefits.

The project in Tacna requires no pumping of treated sewage. However, it is expected that most other sites will have a pumping cost component. Such costs are difficult to estimate with precision until pre-feasibility studies have examined the many variables, such as volume of sewage, distances to be pumped, topography of terrain, power availability, etc.

A pre-feasibility study has been made by the Planning Institute of Lima, working jointly with other local institutions and agencies. The plan calls for the irrigation of 11,000 Ha. southeast of Lima, between Lurín and San Bartolomeo. Pumping cost estimates presented in this study have been revised by USAID/ENG with the finding of an estimated cost of $400 per Ha. These costs are based on a plan which calls for gravity collection of sewage only from the eastern and southeastern parts of the city, gravity flow to the treatment system, gravity flow some 22 kms. southerly to a point along the coast some 10 meters above sea level. From here the effluent would be pumped in two stages to an elevation of 160 meters. From this elevation some 11,000 Has. have been identified as irrigable by gravity flow. Based on present knowledge of potential coastal projects, the Lima project will probably have maximum pumping installations costs.[1/]

The costs per hectare for project replication may thus be estimated at $1,821 ($1,421 per hectare per Tacna Phase II analyses plus $400 per hectare for pumping costs). Assuming the same cropping pattern and yields for the Tacna project, a positive benefit cost ratio of 1.09 is obtained. If, as is anticipated, it will be possible as a result of this demonstration project to use treated sewage for higher value truck garden crops in the future, the benefit cost ratio would, of course, improve.

1/ The PP figure of $70 per Ha. was extremely low because in extracting information from the feasibility study we had addressed only these pumping requirements which would have been for a hypothetical project comparable in size to our Tacna project and requiring only minimal height of pumping. We did not calculate the pumping costs for the whole of the Lima project, which the DAEC rightly suggested as being more representative of pumping height requirements throughout the country.

COMPARATIVE BENEFIT/COST ANALYSIS

200 hectare project requiring
Pumping at a cost of 400 per hectare
and utilizing the cropping pattern planned for Tacna

Year	Present Worth (Costs) S/. 15%	Present Worth (Income) S/. 15%
1	12,402,613	
2	4,045,407	5,415,944
3	3,248,471	5,159,403
4	2,825,058	4,486,915
5	2,456,486	3,901,528
6	2,572,341	3,096,565
7	1,857,187	2,949,687
8	2,071,121	2,565,184
9	2,499,204	3,575,819
10	2,185,728	3,088,053
11	1,812,085	2,831,549
12	1,575,982	2,464,618
13	1,428,493	2,043,864
14	1,249,367	1,765,137
15	1,036,320	1,619,346
16	901,405	1,408,528
17	816,659	1,168,461
18	714,429	1,009,364
19	592,785	926,282
20	515,209	805,061
21	466,788	667,872
22	408,498	577,136
23	338,975	529,680
24	294,285	459,847
25	267,238	382,360
	48,582,134	52,896,203

$$\text{Ratio} \quad \frac{\text{Benefits}}{\text{Costs}} = \frac{52,896,203}{48,582,134} = 1.09$$

4. Revised Cost Estimate

The cost estimate for the project has been recalculated by the DGA and the Mission to determine the effect on project costs occasioned by the devaluation of the Sol on June 28, 1976. This 44% devaluation, however, was just one of a series of economic measures taken at the time. Other measures included a doubling in the price of gasoline, reductions in food subsidiaries as well as overall food price increases, cost of living increases for both public and private sector employees, and increased prices for construction materials. Price increases to date especially affecting project costs, including agricultural credit requirements, include cement (28%), unskilled labor (67%), and equipment rental and operations (117%). Substantial increases have also been effected in professional contracts and transportation costs.

Recalculation of project costs at current prices included a complete reworking of civil works construction (Annex 38 of the feasibility study) as well as the costs for project supervision and the research component. This recalculation indicates that the combined net effect of devaluation on the one hand and upwardly adjusted prices on the other is negligible. Some small savings are realized, principally in in-kind personnel costs, as public sector salary increases were limited to a maximum of 15 percent. Such savings reduce the cost of the civil works component of the project by less than 10%.

In addition to immediate price adjustments decreed as part of the economic reforms, substantial increases in the rate of inflation are anticipated. Embassy and private sector estimates are that as a result of the economic measures the retail price index will increase 4.0 - 4.7 percent a month in the short term, representing a 45 to 50% increase in the rate of inflation.

Appropriate cost escalation and contingency factors have thus been included in the revised cost estimates. If, at the time of the second planned obligation, funds in the full amount budgeted are not required the obligation will, of course, be adjusted downward accordingly.

The revised project cost estimate is thus as follows:

Design Engineering Cost	25,420	6,450	18,970
Supervision and Field Control	44,620	29,000	15,620
Construction Cost	168,040	29,740	138,300
Research and Production Management	59,280	32,220	27,060
Agrarian Bank Credit	120,000	120,000	-
Total	417,360	217,410	199,950

5. Potential Health Hazards

As AID/W environmental health consultant Charles Pineo reports in Annex J, a series of samples taken from the nearby Ushusuma River were examined bacteriologically in the Tacna Hospital laboratory and the results compared with samples taken of the treated effluent. In all cases the coliform count was higher in the river samples. It is also noteworthy that tests of the effluent of the plant have not indicated any traces of Salmonella or Shigella pathogenes.

Agrarian Zone VII, which is in charge of the Farmer Cooperative organization, together with the Ministry of Health Area No.4 will coordinate an information and education campaign among the beneficiary families to make them aware of the characteristics of the treated effluent running in the open irrigation canals. Moreover, despite the fact that the plant effluent is less dangerous than the water presently used in irrigation, regular medical tests will be given to all project beneficiaries to timely detect any potential negative effects on personnel.

It is also important to note that the project includes the installation of a potable water supply at public fountains; this potable water is to come from the main pipe which supplies Tacna's nearby airport. Thus, project participants, per se, will have no reason to use the effluent for other than its intended purposes. There is currently no other population near the project site. Nevertheless, the lagoon treatment facilities have been enclosed by fencing, and signs will be posted along the primary canal indicating that the water therein is treated sewage effluent.

Lastly, as indicated elsewhere in the PP, the effluent from the treatment facility being used for irrigation purposes will be regularly tested by the project research team and officials of the Ministry of Health Zonal Office. In the event of malfunction at the treatment plant resulting in the discharge of waters considered potentially harmful for use for irrigation, these waters will be diverted from the primary irrigation canal inlet to the present outlet of the lagoon system which empties into unused desert land.

In sum, Ministry of Health officials do not anticipate any health hazards resulting from the project and will constantly monitor the quality of the water, the health of the farm families, and the quality of the food produced to detect any potential health hazards. Precautions will also be installed to minimize any attractive nuisance aspects of the project. The AID/W consultant reviewed these aspects of the project and confirmed the Mission's judgement that if appropriately implemented the project should not result in undue health hazards.

6. Suitability of Tacna as the Site of the Pilot Project

Mr. Pineo concluded that, in general terms, "conditions are ideal at Tacna for setting up the demonstration project." In regard to its similarities with other projected project areas, Tacna has many common features, the important ones being:

- An abundance of nearby arid land suitable for irrigation development.
- A severe scarcity of water resources
- A sizeable and increasing demand for food stuffs
- An increasing number of Sierra immigrants, former small farmers, who come to the coast and live in continued misery.

The principal difference between Tacna and most other sites where replication is projected is the addition of pumping costs. This project design requirement has been discussed in item 3. It is expected that, when required in other projects, the pumping infrastructure may represent up to 20% of the total cost of a given project.

The presence of toxic elements from industrial waste discharges is not a problem in Peruvian cities, with the significant exception of Lima, owing to their present relative low level of industrial development. In Lima, most of the industrial areas are located to the north of the city and discharge their wastes either directly to the ocean or into the Rimac River. Collection stations for raw sewage can be located so that they will handle household and office wastes almost exclusively.

A point which is most important in selecting Tacna as the site of the pilot project is the keen interest of all local people associated with the project. This is clearly described in Mr. Pineo's report. "Everyone with whom we met was enthusiastic about the need for the project, first to meet their local requirements and then as a demonstration for the rest of the country."

7. Institutional Capability

Quotations from Mr. Pineo's report are again appropriate in amplifying the conclussions of Part IV-A of the PP.

"There is no doubt about the institutional capability and willingness to carry out the present project, particularly for the agricultural aspects.

The project represents a minimal addition to the workload of DGA at national and regional levels. The institutional capability and willingness exists for the health aspects of the project." 1/

"The possibility of replicating the project in other areas will depend on the size of those projects. It can be done on similar size projects without need of major personnel increase."

"The possibility of replication for the area of Lima will require a detailed study which can be made only after the results of the demonstration at Tacna are available and can be analyzed. These results should make it easier to estimate the needs for the much larger Lima area project."

The Ministries of Agriculture and Health have also confirmed their readiness to make available such personnel as necessary relative to the future replication of the project.

1/ The health sector institutions referred to by Mr. Pineo are the Office of Environmental Sanitation of the Ministry of Health, the Tacna Zonal Office of the Ministry of Health and the National Institute of Health. In addition, assurances of the cooperation of the International Development Research Center (CEPIS) of the Pan American Health Organization have been obtained concerning health research and control aspects of the project.

8. Demand and Desirability of Grown Crops

The Tacna valley has a total cultivated area of approximately 22,000 hectares, producing more than 500,000 MT of food crops per year. Sixty percent of this area is planted with alfalfa, 31% with transitional crops, e.g., corn, wheat, barley, potatoes, squash, and peppers; 8% with principally permanent fruit crops, e.g., oranges, lemon, apples, peaches, olives, grapes; and 1% is planted to forest trees.

A second and more important activity in Tacna is the production of milk and meat. The production of the various species presently raised is as follows:

Species	Number of Head
Cattle	28,100
Sheep	38,114
Pork	7,078
Poultry	111,096

Source: Agrarian Zone VII

More than 50% of the total cattle population is dairy cattle. Tacna produces approximately 7,000 MT of milk per year, 70% of which is sold fresh to "Leche Gloria" in Arequipa - the largest milk processing plant in the South. The remaining 30% scarcely meets the actual demand for fresh milk in Tacna.

The annual production of beef meat is on the average 500 MT. This production covers only 30% of the current demand. Production of sheep meat is also insufficient. Only pork and poultry production are adequate to meet present local demand and also allow for some exports to other regions. Generally speaking, the two activities mentioned above have shown little growth during the last 5 to 10 years due principally to the shortage of water in the valley which impedes expansion of cultivated areas.

Production and Demand for Proposed Crops

a. Alfalfa

The project at full capacity will have 75 has. producing a total of 4,095 MT of alfalfa per year. This output is obtained

assuming an average yield or 54,625 Kg per hectare per year; however, the project water can permit attainment of much higher yields given its rich nutrient content. Optimum alfalfa yields could reach 70,000 Kg. per hectare per year.

The output of 4,095 MT is equivalent to 256 animal units/year, i.e., the alfalfa produced can feed 256 cows per year. This is assuming each will consume 16 MT or less of forage per year which is the prevailing average for Tacna. However, the recommended optimum consumption rate is at least 18 MT per cow per year, i.e., approximately 50 Kg. per cow per day assuming it has to consume 10% of its live weight to permit maximum milk yields.

To improve the existing "criollo" dairy cattle of Tacna, the Ministry of Food imported 348 Holstein cows from Uruguay during 1975. It will also complete during 1976 importation of a herd of 200 Holstein heifers from Holland, and during 1977-78 will import 2,000 Holstein cows for individual farmers and 800 cows for two associative farm units to be established in the La Yarada irrigation project. The new stock of Holstein which is being introduced will begin producing during the 1976-78 period. This of course means raising milk yields and consequently total milk output of the valley.

The proposed project production of alfalfa falls in line with andwill greatly complement the current policy of improving existing dairy cattle. Improved herds will require increased volumes of alfalfa, approaching progressively the optimum consumption of 50 Kg. per cow per day. In this regard Food Zone VII has initiated agricultural extension activities aimed at raising levels of agricultural technology including improved alfalfa production practices and improved management of dairy cattle. These include the introduction and establishment of a Forage Production Support Unit within its regional organization. This Unit will work to assure higher alfalfa yields and application of optimum feed formulas for dairy cattle implying increased consumption of forages, in this case alfalfa and complementary feed concentrates.

In addition, Food Zone VII of Tacna, which comprises the valleys of Tacna and Moquegua, will establish during 1977 the first milk processing plant in Tacna with an initial capacity of 16,000 liters per day. The machinery has already been purchased. The Plant will represent an additional demand for milk, and thus also for feed.

Finally, there is a market for alfalfa for feeding small animals in the area, principally guinea pigs or "cuyes". Production of this rodent, which is a very popular meat source in the South, requires significant amounts of alfalfa during its growth period, further contributing to increased demand for this forage.

The above facts and considerations indicate assurance of a ready market for the alfalfa produced under the proposed project. In fact, the expected increase in demand for alfalfa will be larger than the planned increase in supply.

b. Corn

The project producing at full capacity will produce 270 MT of corn per year in 90 hectares. The planned yield is 3,000 Kg/Ha., however, Agrarian Zone VII reports this yield could be raised through improved agricultural extension services and the introduction of improved varieties of hybrid corn. The improved PM-205 corn variety considered in this case has an experimental yield of 5,000 Kg/Ha. The expected commercial yield of this variety falls between the range of 3,500 to 4,000 Kg/Ha.

Agrarian Zone VII administers the only concentrate feed plant existing in Tacna. This plant has a capacity of 10 MT per day. It can work in two shifts thus doubling its capacity to 20 MT per day if necessary. The agrarian zone officer in charge of the plant states it is capable and willing to purchase all the corn (270 MT) produced under the project. Corn plus other feed inputs are processed by the plant to produce feed concentrates principally for poultry, hogs and dairy cattle.

Current production of this plant falls 40% short in meeting the demand of the dairy cattle industry which requires 400 MT of concentrates per month. The shortage is due reportedly to unavailability and/or irregular supply of the various inputs required. The proposed corn production will greatly contribute to reduce the prevailing shortages of animal feeds particularly in connection with the improved dairy cattle project mentioned above. This cattle will require not only increased volumes of alfalfa as mentioned above but also of adequate feed formulas for principally calves and heifers.

c. Beans

There is presently only very limited production of beans in the Tacna valley in spite of the fact that soil and weather

conditions are appropriate for its cultivation. Agrarian Zone VII reports as causes of this situation the following:

1) The existence of a traditional and well established bean supply flow forthcoming from the valleys of Camana and Ica, north of Tacna.

2) The fact that Agrarian Zone VII has not emphasized this crop in its past Zonal Plans. However, the Agrarian Zone has the capacity and interest in encouraging farmers to produce beans in the future in project areas, i.e., technical assistance and research work will be made available for assuring successful production of project beans.

As a consequence of the above, farmers in Tacna have not been motivated to pioneer with bean production on their own.

Available data for 1975 shows a total demand for beans of 503 MT per year, only a portion of which was met with the supply from Camana and Ica. The deficit amounted to 295 MT. Reportedly this deficit is not exceptional and constitutes a trend which is expected to worsen in proportion to the increasing immigration of people working or seeking jobs in mining and commerce. Another favorable factor, is the higher price ($1.38/Kg.) paid for this crop in the Chilean border city of Arica. Actually prices of most staple products in Arica are much higher than those paid in Tacna for the same products.

The project will plant beans on 40 hectares producing 48 MT per year. Production prospects for this crop are highly favorable given the technical assistance support which will be provided by Agrarian Zone VII. Market prospects are equally favorable given the increasing shortages of supply in the area.

d. Potatoes

Presently Tacna has an area of approximately 1,200 hectares planted in potatoes, producing 8,000 MT per year. The 1965-76 historical trend shows a decline in production and an increasing shortage which Agrarian Zone VII is attempting to reverse through introduction of improved varieties, viz, principally the "Cuzco" and "Revolution" varieties. The Agrarian Zone is also allocating additional resources and time to give potato producers the necessary technical assistance and extension services for assuring higher yields and promoting expansion of areas planted to this crop. In this respect the 1975-76 Zonal Plan set a target of

1,900 hectares producing 16,800 MT of potatoes which will hopefully be attained during early 1977. Even this target, however, is not sufficient for meeting the 1976 Zonal demand estimated at 17,846, i.e, a deficit of 1,832 MT is anticipated which will be covered with potatoes from Cuzco and Puno. This is the without project situation.

The project production of potatoes (1,020 MT in 85 hectares) therefore supports Agrarian Zone VII in its current effort of reducing and hopefully closing the existing gap between supply and demand for potatoes in Tacna. Within this context there is reasonable assurance that potatoes produced with the project will be readily absorbed by the market in Tacna at the guaranteed price fixed by the MinFood which presently is $0.14 per Kg. There are also ample opportunities for sale of potatoes to other urban markets, which have experienced supply shortages in recent years.

e. Squash

Tacna farmers are traditional producers of squash obtaining average yields of 8-10,000 Kg/Ha. Total production of the valley is estimated at 800 MT. This output is approximately in balance with the actual demand. However, with the high rate of growth (4.7%) of the urban population, corresponding annual increases in supply are required. To this effect the project will contribute modestly to maintain this equilibrium with 35 hectares producing 280 MT of squash per year. As with potatoes, any over supply in the area finds ready markets elsewhere along the food-deficit coastal region.

f. Summary Conclusion

Reasonable assurances of market demand exist for each of the crops projected for production under the pilot projects. Cropping patterns for similar projects would, of course, be determined by supply and demand factors in each locale. As regards acceptability to consumers of products grown with treated sewage waters, GOP officials anticipate no problems in this regard. The case is clear of course with alfalfa and corn which will be consumed as feed. Experience elsewhere, for example in Mexico, indicates no consumer acceptability problems even for vegetables grown with untreated sewage. In part this may depend on whether the product loses its source identity in the marketing chain. Limited experience with crops grown with treated sewage near Lima

(an uncontolled project at San Juan de Miraflores) has not resulted in marketing problems. Thus reasonable assurances of consumer acceptability also exist. Evaluation of marketing experience is included in the project design.

9. Monitoring Parameters 1/

The monitoring of the health parameters of this project will be carried out by bacteriological analyses, biological analyses and research on viruses. Presented herewith is an outline of the elements which will be included within this monitoring. Provisions for the execution of this monitoring program will be incorporated into the project implementation plan of the Project Agreement.

a. Bacteriological Analyses will be carried out through three types of tests; Confirmative, Presumptive and Affirmative. These will establish the Coli count content and the bacteria count in Petri plates. Salmonella and Shiguella bacteria presence will be investigated by selective cultures.

The Tacna Sewage Treatment Plant is satisfactorily reducing the Coli count, according to tests already made. The efficiency of the plant can and will be improved by taking actions based on recommendations made by the MOH.

b. Biological Analyses will be performed by the Sedgwick-Rafter method. Some tests have been run already and have shown the presence of algae, type Euglena, among others. This explains a high rate of dissolved oxygen in the secondary lagoons and demonstrates the effectiveness of the aeration system.

c. The Virus Research will be carried out in two different aspects. Efforts will be made to isolate enteroviruses from both the untreated and the treated sewage. Investigation will also be made to determine the presence of enteroviruses in project participants (farmers and their families). Sampling of the sewage will be carried out in accord with a method developed by Dr. Dorothy Horstmann, Yale University. Detection of enteroviruses in the participants will be accomplished by standard methods.

1/ Discussions for monitoring were prepared for USAID/Peru by Ing. Luis Malnati F., Director of Environmental Health and Sanitation and by Dr. José Madalengoitia Q., Chief of the Virus Division, Institute of Public Health.

10. Salt Accumulations

The soils of the area are very sandy and are underlain by deep strata of sands and coarse gravel to the extent that no drainage problems will develop. Soils analyses conducted during the feasibiligy study indicated the existence of only a low to moderate degree of salts presently in the soils (4 to 16 mmhos/cm^2) 1/. A series of soil washings will be conducted during a three month period following construction of the irrigation system and will assure the reduction of any moderate salt content to levels fully acceptable for agriculture purposes. Subsequently, in the event of nitrate or other accumulation from the organic content of the water, the removal of such salt accumulations will be accomplished as and when needed, by short duration flooding of the portion of the project area involved.

Part of the responsibility of the research program will be to study possible salt accumulations and to advise on procedures as to how to avoid the build up. Research will be carried out both in the laboratory and in the field. Funding for salt accumulation research will be from the "Research and Production Management" element of the cost estimate (see section 4) which is 45% financed by AID grant and 55% by the GOP counterpart contribution. It is the judgement of the Utah State Irrigation Research Advisor in Peru that any potential salt accumulation problem at the project site is well within the experience and capacity of the DGA to deal with. No difficulties are thus foreseen in maintaining salinity at levels quite acceptable for all proposed agricultural purposes.

11. Projected Land Value

Agricultural lands may be considered to have a value equal to the discounted sum of the net returns of the crops they will produce over time. This is the criterion applied below for estimating the value of the project lands upon installation of irrigation. It should be noted that the agrarian reform places strict limitations on the sale of agricultural land in Peru. Thus current "market value"

1/ mho is the unit of measure of the inverse of electrical resistivity; mmho is 1/1000 of one mho. Water or salts present in soils tend to decrease the resistivity, i.e., increase the inverse of resistivity or mho count. Since moisture is not present in these desert soils all mho measurements are attributed to salts. Measurements of less than 20 mmhos/cm attributed to salts are considered of low to moderate concern for agricultural purposes.

prices for land similar to that which will be developed under the project do not exist. The Mission also wishes to clarify that the value of irrigated land stated in the PP is the rate allowed by the GOP for compensation for expropriated land under the Agrarian Reform (which undervalues its worth) rather than a calculation of its economic worth.

The Table below shows the five project crops and their (1) area, (2) yields, (3) production, (4) prices, (5) total gross values, (6) total costs, (7) total net values and (8) net value per hectare in dollars.

Product	Area (Has.)	Yield (Kg/Ha)	Prod. (MT)	Price ($xKg)	Gross Value ($)	Cost ($)	Net Value ($)	Net Value ($xHa)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Alfalfa	75	54,625	4,096	0.02	81,937	26,325	55,612	741
Corn	90	3,000	270	0.17	45,900	42,930	2,970	33
Potatoes	85	12,000	1,020	0.14	142,800	85,510	57,290	674
Beans	40	1,200	48	0.54	25,920	12,280	13,640	341
Squash	35	8,000	280	0.18	50,400	23,870	26,530	758
Total:	325 1/						156,042	780 2/

Source: Updated PP data.

The net values in column (7) add a total of $156,042 obtained by the 5 project crops at the latest prices and production costs. This figure divided over the 200 hectares of the project yield a net weighted value of $780.00 per hectare. This value projected over 24 years of the project life (no production during the 1st year) and discounted at an opportunity cost of capital of 15% give a per hectare value of project land of $5,018.

1/ Producing area upon completion of Project Phase II: 200 hectares of irrigated area plus an "equivalent" of 125 hectares obtained thru double cropping. The expansion or land use intensity factor applied is 1.65.

2/ Average net return per hectare for one year's production for the given cropping pattern.

12. Subsidy to Water Users

In 1969 the Peruvian Government established a new Water Law (D.L. 17752). The law establishes state ownership of all water resources and specifies that the full costs of developing water supplies should be recovered from the users. Under the law such tariffs are to be established at a level sufficient to cover amortization of investment, maintenance of the system and administrative costs relative to its operation.

In practice, however, the Ministry of Agriculture, which has responsibility for implementing the law, has been and continues to follow the traditional policy of charging tariffs only high enough to assure coverage of operation and maintenance of water infrastructure. Investment costs continue to be absorbed within the budget of the DGA. Only in certain higher income valleys in the northern coast where sugar, cotton and rice are grown have efforts been made to include investment costs in the tariffs levied.

The law, then, represents a goal towards which the GOP hopes to move. In the meantime, implementation of tariff considerations under the law are relaxed in favor of production and redistribution benefits. The GOP is fully aware of the subsidy inherent in this approach. This matter has been one of discussion between the USAID and the Ministry of Agriculture and the subject of special consideration under the MinAg-USAID Agricultural Institutional Development and Operations project. For example, a special study was completed in July 1975, on the "Values, Costs and Pricing Alternative for Irrigation Water." This study was the subject of two seminars, one at the Ministry of Agriculture, the other at the Ministry of Economy and Finance. It may reasonably be anticipated that as the social objectives of the Agrarian Reform are attained, implementation of the Water Law in its tariff aspects will be realized to a greater degree than at present. Further studies are underway within Min.Ag on this subject. Thus, the GOP is well aware at the policy level of the costs and implications of its present water tariff policy.

The tariff established for the Tacna valley is one centavo per cubic meter of water. Reportedly collection of tariffs amounts to 80 - 90% of expected revenues. This is a very high collection record as compared to other Water Districts, and is 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 also be set at one centavo per cubic meter, thus covering maintenance and operation costs of the project irrigation works.

13. Project Civil Works Implementation Plan

Regarding time provisions for the civil works construction, reference is made to the Construction Schedule - Annex B of the PP, which is also included herein for ready reference. All civil works will be executed under the supervision of the DGA. The fole of the administrative contractor is described at the end of this section. The primary civil works steps are the following:

a. Move on to project site, (4 weeks): This activity will include construction of a combination warehouse and office, a masonry water reservoir plus provision for storage of tools and materials. The warehouse and office will later serve the research team.

b. Surveying and Project Lay-Out, (4 weeks): This initial field work step will be a complete verification of all elevation benchmarks of the project and of the canal alignments; next will come the setting of stakes which will indicate the amounts of excavation and embankments required throughout.

c. Excavation for canals, (16 weeks): As soon as stake setting is well along the excavation for the canals will start. This will be done entirely by hand labor, using picks and shovels. The sandy soils readily permit this.

d. Manufacturing concrete blocks, (13 weeks): As soon as the warehouse and office are finished a carpenter and his crew will start working on concrete forms for the manufacture of concrete blocks for canal lining. Systematic manufacturing of the blocks will follow and be dependent upon an adequate supply of cement and aggregates. All mixing will be done with a small concrete mixer.

e. Placing concrete on canal floors, (18 weeks): This activity will follow closely the excavation for canals in order to avoid loose material accumulations on the trimmed earth bottoms.

f. Canal lining (15 weeks): This activity will be coordinated with the manufacturing of concrete blocks and with the completion and curing of concrete canal floors. The use of special templates giving exact shape of the completed lined canals will provide for accuracy and time savings.

g. Construction of Concrete structure (9 weeks): These will be made by a special crew. The most important single structure is the culvert under the Pan-American highway.

h. Land Development (1 week): A bulldozer (to be rented) will do the major part of this job. Hand labor will accomplish all needed complementary work.

i. Installations for Potable Water Supply, (1 week): This action is included with land development in the construction schedule. As shaping and development progresses the main pipe and service lines will be installed for potable water and then the land will be given its final leveling. The source of potable water will be the water line which supplies Tacna's airport which is located just across the highway from the project.

j. General Testing of Canals, (4 weeks): This activity will start following completion of the canal lining, construction of culverts and control gate installations.

k. Flooding the Land, (12 weeks): The flooding to prepare the land for planting will also serve to remove any salts from the soils.

l. Clean up, (4 weeks): This is the final step of the project civil works.

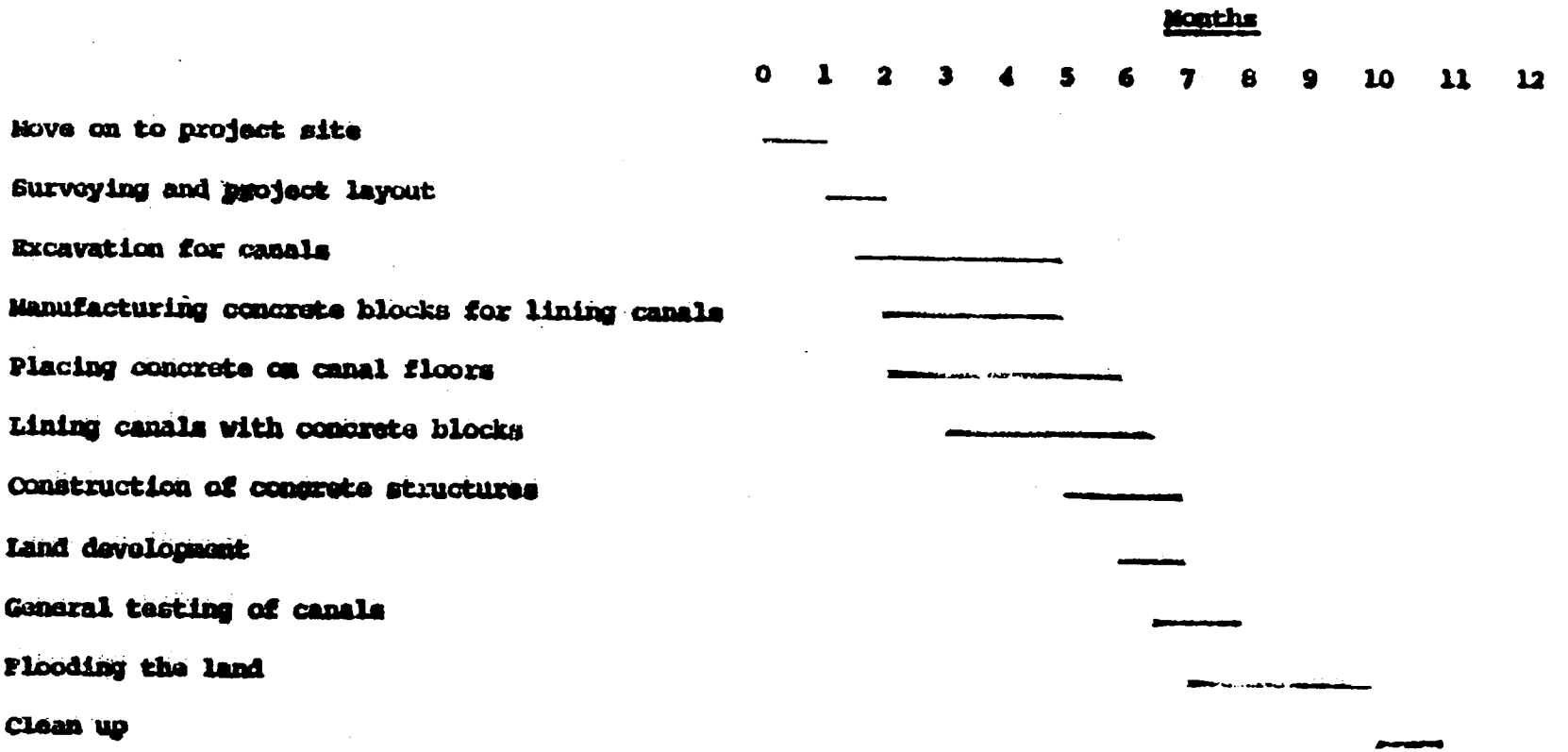
Procurement Contracting and Financial Support Services: These support services will be provided to the project through an existing USAID task-order type contract with Mr. Hugo Osorio (Servicios Administrativos y Contratos Institucionales - SACI). This mechanism has been utilized at the request of the Ministry of Agriculture for other AID assisted projects due to cumbersome and time consuming administrative procedures of the Ministry as well as similar problems associated with the procedures for incorporation of assistance funds into the budget of the Ministry.

Under this mechanism the implementing agency is responsible for identifying personnel required to supplement GOP counterpart personnel, materials, and equipment to be procured and/or rented, logistical support requirements such as transportation and reproduction, etc., necessary for project execution. Such personnel, materials, etc., are then contracted, procured, and/or provided by Mr. Osorio on behalf of the implementing agency with funds made available by USAID under and in accordance with the terms of the task order. All funds for local costs under the project will be disbursed in this manner and accounted for by Mr. Osorio.

The SACI contract is on a cost reimbursement basis and involves no fee. No additions to "core" personnel under the contract will be necessary to provide the administrative support services for the project. Thus, no additional cost are involved in this mechanism.

ANNEX B

CONSTRUCTION SCHEDULE



14. The Mexican Experience

The Mission has carefully reviewed the Mexican Experience in the context of its relevancy to the proposed project. For this review the Mission has relied primarily on the report of Mr. Belford L. Seabrook, Office of Water Programs Operations, U.S. Environmental Protection Agency, dated November 1972.

The Mexican Experience is relevant to the proposed project. A short distance (42 miles) from Mexico City, a total of 45,240 hectares are irrigated in the State of Hidalgo with untreated sewage pumped from Mexico City. This sewage irrigation project was started over 70 years ago and involves some 28,570 farm families. It is reported to be the largest such system in the world.

The crops cultivated in the project are of a wide variety. By hectares, the most important crops are corn (36%), alfalfa (26%), and wheat (16%). Over ten percent of the area, however, is planted in fresh vegetables for direct human consumption, including cabbage, onions, melons, cucumbers and tomatoes.

Despite the fact that this large Mexican project uses raw sewage for irrigation, Mr. Seabrook states that there is no known report of any health problem attributable to this raw sewage irrigation in the 70 years it has been so utilized. Similarly there is no report of consumer acceptance problems. For feed crops, such as alfalfa, the farmers actually receive a premium price because the alfalfa is heavier.

In the case of the Tacna project, sewage which has passed primary and secondary treatment will be utilized, rather than raw sewage as in Mexico. The absence of health and marketing problems associated with the Mexican Experience lends even greater confidence to the Peruvian experimental project. The carefully planned research component of the Tacna project will also contribute a data base which appears absent in the Mexican Experience.

15. Environmental Analysis

This Analysis has been prepared in accordance with the New AID Environmental Procedures (sent to Missions 4/20/76) as published in the Federal Register, re. 22 CFR Part 216. This analysis replaces Annex C of the PP.

Present Environment at Project Site and Probable Effects if project is not executed.

The areation lagoon sewage treatment system which will supply the treated sewage effluent for this project is located about one kilometer from the project plot. The treated effluent presently flows into a natural draw (quebrada) in the desert which heads toward the sea. Without control these waters sink into the sands and are lost forever. The alternatives are to do nothing or to make the best use possible of this potentially valuable resource. The paucity of water in the Tacna valley (and on the entire Peruvian coastal desert) cannot be over-emphasized.

If nothing is done to put this water to controlled use there will be an effort made by a few squatters to cultivate and irrigate scattered patchy fields along the sides of the quebrada where this water presently flows and disappears. Under these conditions, squatter farmers (perhaps some of the very same families who would be selected for this Project) would be growing a wide variety of crops without regard to possible health hazards in some of the vegetables. Many weeds, some of them very undesireable, would grow along the banks of the quebrada. Whatever rodent and insect life might develop would also go unchecked, opening opportunities for fostering diseases. There would be no research work accomplished. Peru would be no further ahead in their urgent need to develop their knowledge on how to make best possible use of all water they now have or can, in the future, bring to their desert coast.

Environmental changes anticipated as a result of project execution

This project proposes to make full use of valuable treated sewage effluent through controlled irrigation plus a research program which will cover both agricultural and health considerations.

Within the small area to be irrigated there will be a significant change in the ecological system. The absolute desert site for this project is virtually a zero ecological system, i.e. an area where nothing grows or lives. With the introduction of cultivation and irrigation the ecological system within the confines of the project and its immediate adjacent area will change. Continuous cropping will take place on formerly barren soils.

The human dimension

The presence of the farmers and their helpers will add a human element to an ecology which now knows little if any human contact.

This will introduce certain sanitary problems, but no more than on any other farming operation of comparable size. No public health problems are foreseen for this small project. Should they develop, the measures being taken by the Ministry of Health will effect adequate controls. These controls are detailed in section 9, which was prepared by the Ministry of Health. The Ministry will include regular health checks of project participants.

Effect of the project on plant and animal life

As noted in the PP, the introduction of common plant disease may be anticipated and will be addressed through controls effected by the farmers in response to advice from the research team and from agriculture advisors of A.Z. VII. Likewise, insects and rodents which do not now exist on this plot of ground will likely be attracted to the farmed area. The farmers will control these, following advice from the A.Z. VII technical personnel, as they do in other farming areas.

The water-soil relationship within the irrigated area will change. Soils presently subject to minor wind erosion will tend to become fixed with water and plant roots, thereby preventing these soil losses. With the present water table at a depth of over 50 meters (160 ft.)it has been determined by Ministry of Health and Ministry of Agriculture officials that the irrigation waters will not contaminate the ground water.

The PP noted that canal erosion will be fully controlled with the use of concrete lined canals and hydraulic slopes, carefully built to dissipate water energy. The farmers, acting on advise from their cooperative advisors, will provide the necessary maintenance of their irrigation system, including any erosion and/or sedimentation which may occur.

With the water table at its great depth (160 ft.), plants whose roots draw from a water table (phreatophyte growths) will not develop. Other aquatic vegetation, normal to all irrigation systems, will develop. But with the concrete lined canals from the source (sewage lagoons) to the points of application to the land, the control of these weeds will be handled routinely by the farmers.

Threshold Decision

From this Environmental Analysis it is concluded that an Environmental Assessment and an Environmental Impact Statement will not be required. Therefore we recommend a negative Threshold Decision.

16. Evaluation Plan

The project Logical Framework, which establishes the project benchmarks for execution of project evaluation, has been revised in accordance with discussion held subsequent to the DAEC review with LA/DP/ES and is attached hereto. In addition to changes in purpose level indicators, as requested in STATE 179480, modifications have been introduced in the measurements of goal achievement and the statement of the secondary goal.