REPUBLIC OF THE PHILIPPINES
CABINET COORDINATING COMMITTEE

CAGAYAN INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT

FEASIBILITY REPORT
(MAIN REPORT)

APRIL 1976

JAPAN INTERNATIONAL COOPERATION AGENCY

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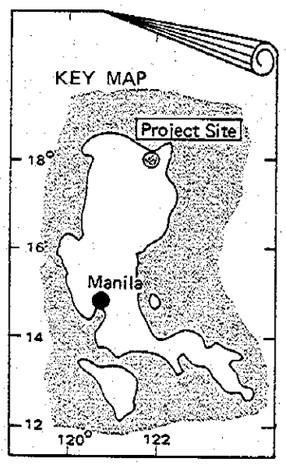
F O R W A R D

Japan International Cooperation Agency (JICA) dispatched a feasibility survey team to the Philippines for the Cagayan Integrated Agricultural Development Project from October 20 to November 10, 1975 and from January 25 to April 3, 1976, respectively, following the pre-feasibility survey carried out in May, 1975 and basing on the plan of operation made by the contact mission sent in September, 1975. The team completed the field survey and successfully made the final report in cooperation with the Philippine counterparts. The objective of the project is to attain the integrated agricultural development in the area of 13,200 ha in Cagayan Province, i.e. construction of irrigation, drainage, agricultural road, and rural electrification, together with technical cooperation through the agricultural supporting service, that is, the establishment of a pilot center to extend the improved agricultural techniques to the farmers. As a result of the survey, it is found out that the project has sufficient economic and technical feasibilities to be implemented at the earliest possible time. I take this opportunity to express my hearty gratitude to the officials in the authorities concerned of the Government of Philippines for the whole-hearted support and cooperation extended to the team, and I sincerely wish that our mutual efforts will serve to strengthen the closer relationship between the Republic of the Philippines and Japan.

April, 1976

SHINSAKU HOGEN
President
Japan International Cooperation Agency

GENERAL MAP OF CAGAYAN INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT (CIADP)

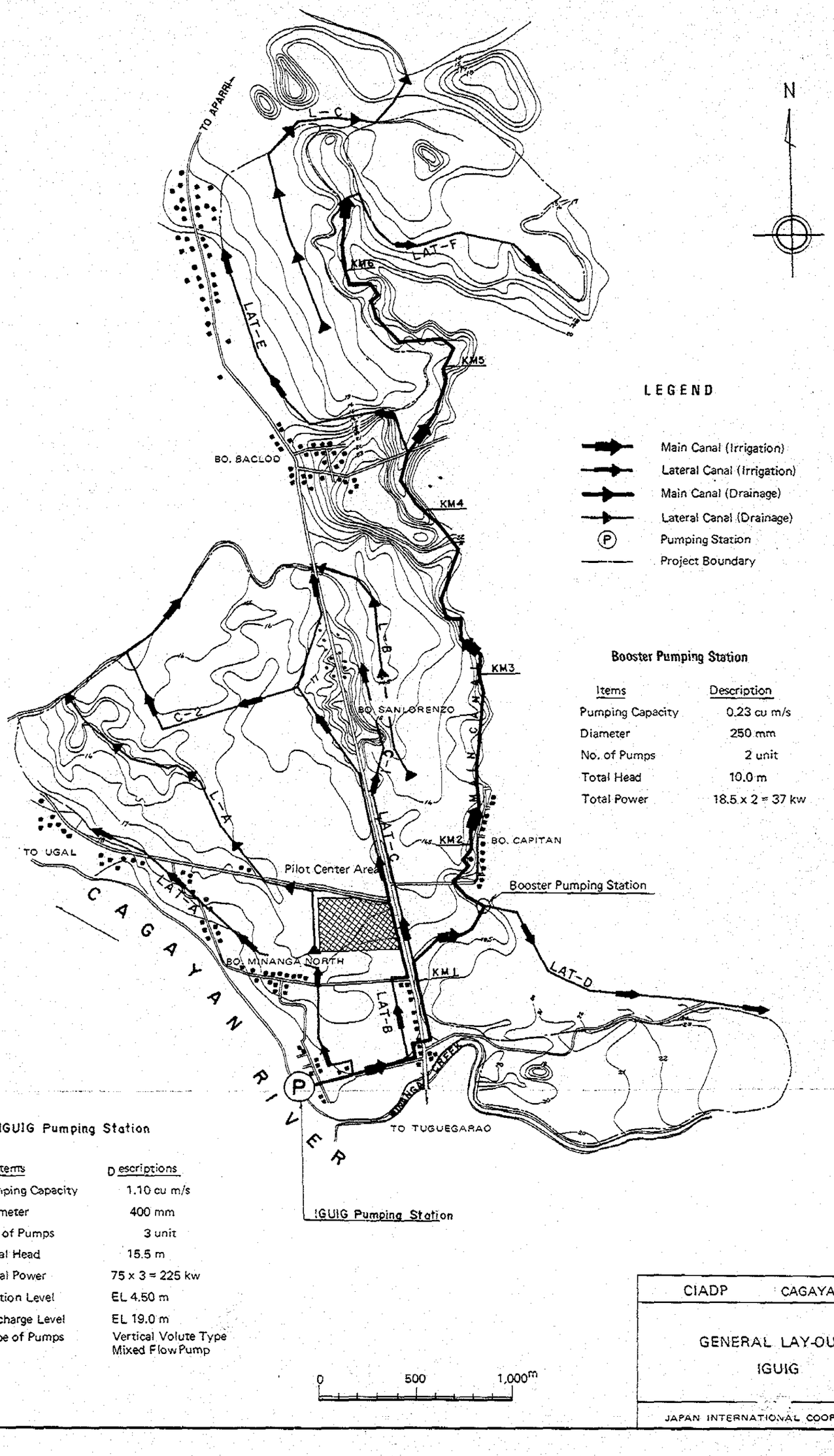


ABULUG
STA. ANA
APARRI
NIA
RUGUEY
LAL-LO
1
CAGAYAN
GATTARAN
RIVER
ALCALA
2
BAGGAO
AMULUNG
PACIFIC OCEAN
CALINGA-APAYAO
3
IGUIG
SOLANA
TUGUEGARAO
PENABLANCA
IBRD
TUMAUINI
ISABELA
ILAGAN
PALANAN
ADB/IBRD

LEGEND

- National Road
- Trail/Proposed Road
- Provincial Road
- Proposed Provincial Road
- Provincial Capital
- Municipality
- Provincial Boundary
- Project Area
- (1) Lower Cagayan — 11,200 ha
- (2) Alcala-Amulung — 1,400 ha
- (3) Iguig — 600 ha
- On Going or Proposed Project by Other Agencies Assistance or NIA's Own
- Proposed Distribution Line

0 10 20 30 40 50 km



Booster Pumping Station

Items	Description
Pumping Capacity	0.23 cu m/s
Diameter	250 mm
No. of Pumps	2 unit
Total Head	10.0 m
Total Power	18.5 x 2 = 37 kw

IGUIG Pumping Station

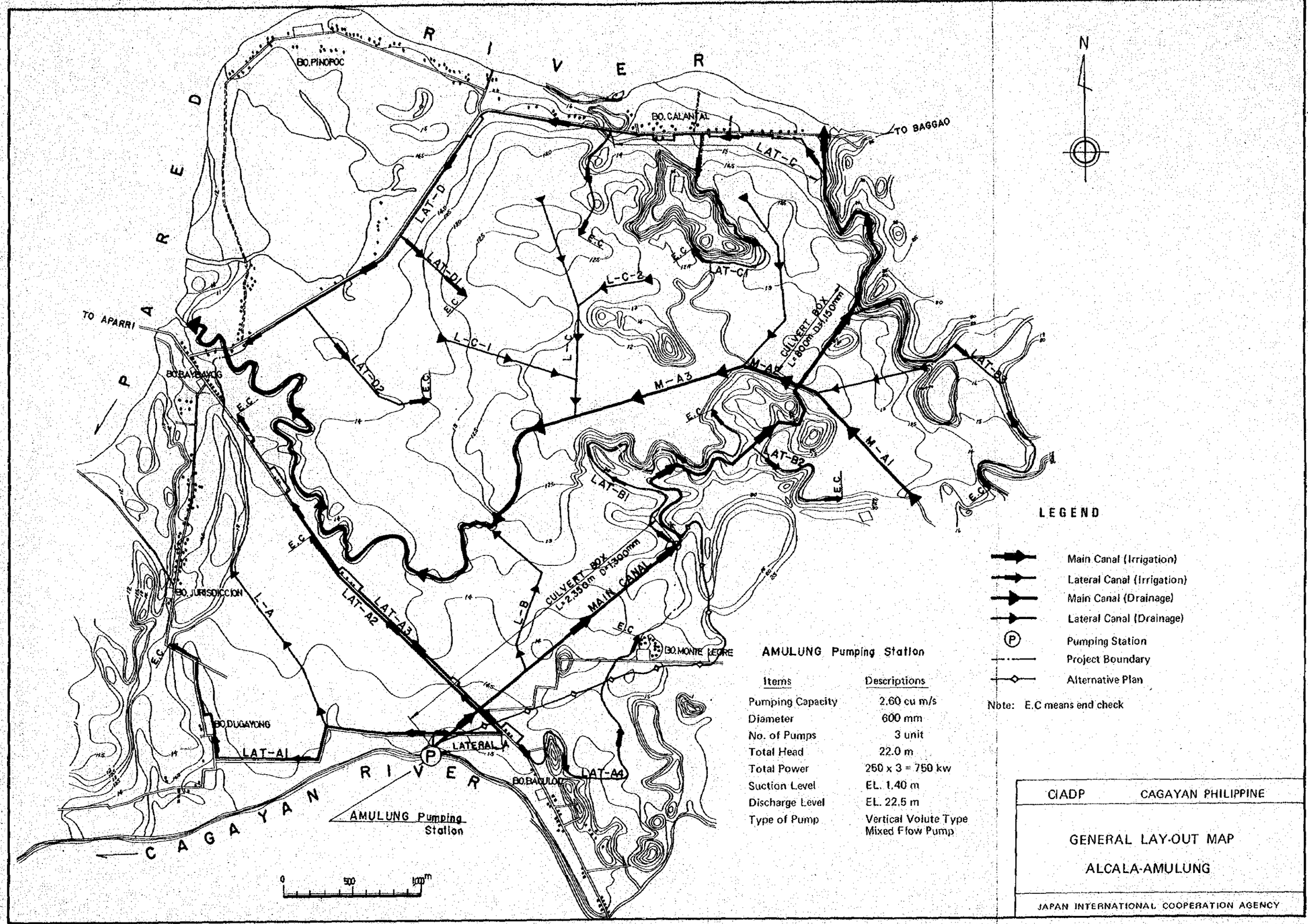
Items	Descriptions
Pumping Capacity	1.10 cu m/s
Diameter	400 mm
No. of Pumps	3 unit
Total Head	15.5 m
Total Power	75 x 3 = 225 kw
Suction Level	EL 4.50 m
Discharge Level	EL 19.0 m
Type of Pumps	Vertical Volute Type Mixed Flow Pump

CIADP CAGAYAN PHILIPPINE

GENERAL LAY-OUT MAP

IGUIG

JAPAN INTERNATIONAL COOPERATION AGENCY



N

LEGEND

- Main Canal (Irrigation)
- Lateral Canal (Irrigation)
- Main Canal (Drainage)
- Lateral Canal (Drainage)
- (P) Pumping Station
- Project Boundary
- Alternative Plan

Note: E.C means end check

AMULUNG Pumping Station

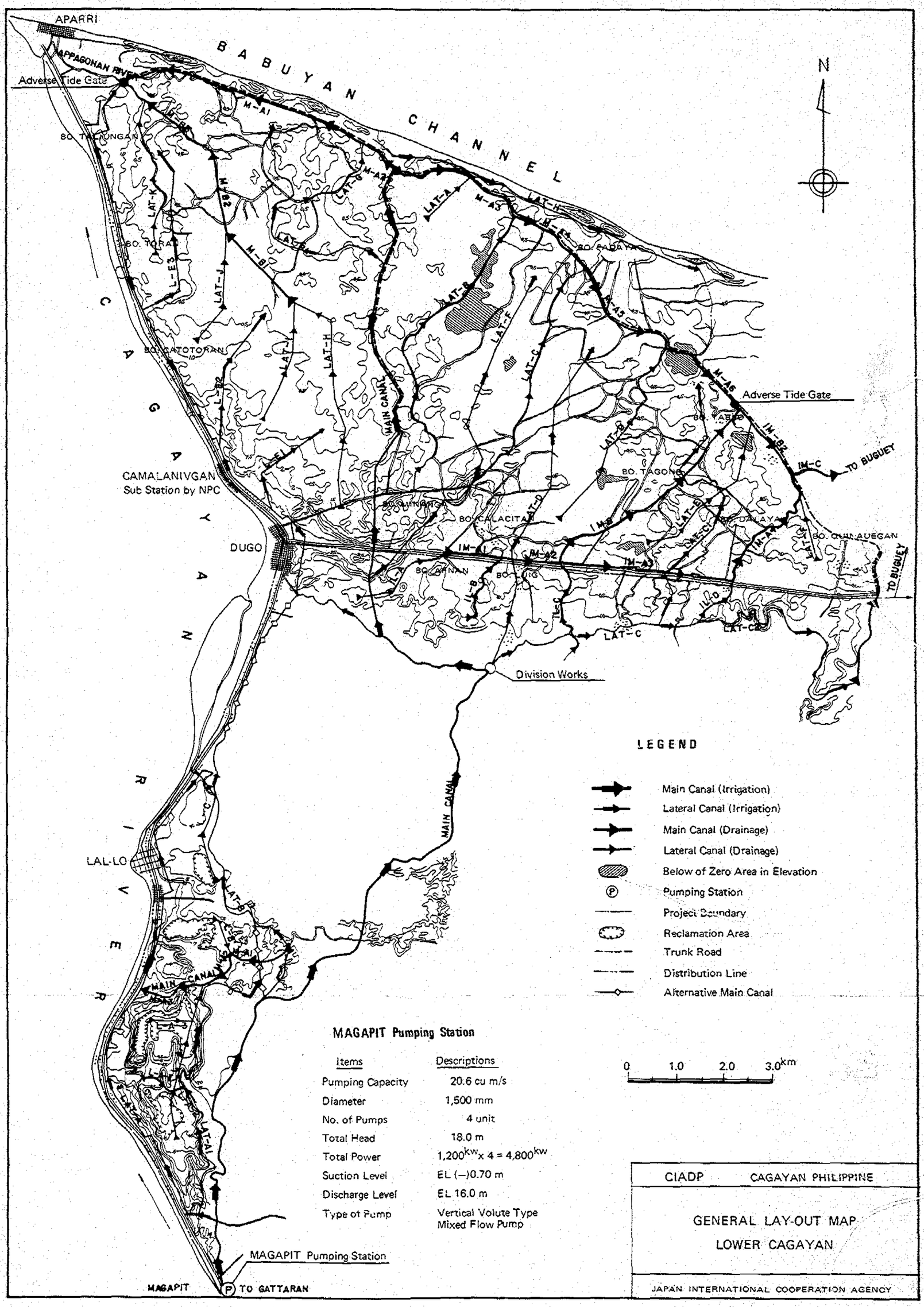
Items	Descriptions
Pumping Capacity	2.60 cu m/s
Diameter	600 mm
No. of Pumps	3 unit
Total Head	22.0 m
Total Power	250 x 3 = 750 kw
Suction Level	EL. 1.40 m
Discharge Level	EL. 22.5 m
Type of Pump	Vertical Volute Type Mixed Flow Pump

CIADP CAGAYAN PHILIPPINE

GENERAL LAY-OUT MAP

ALCALA-AMULUNG

JAPAN INTERNATIONAL COOPERATION AGENCY



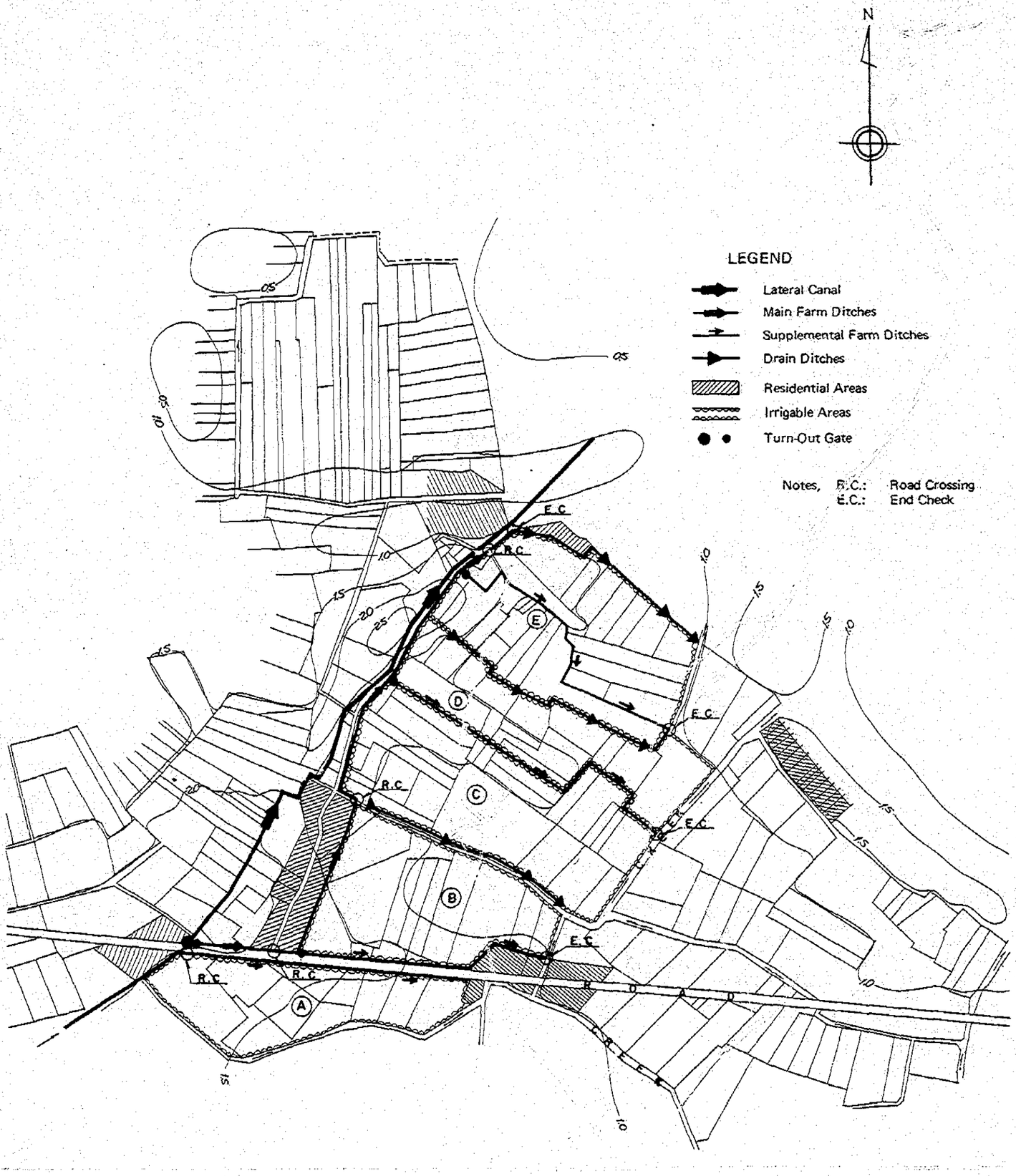
MAGAPIT Pumping Station

Items	Descriptions
Pumping Capacity	20.6 cu m/s
Diameter	1,500 mm
No. of Pumps	4 unit
Total Head	18.0 m
Total Power	$1,200^{kw} \times 4 = 4,800^{kw}$
Suction Level	EL (−)0.70 m
Discharge Level	EL 16.0 m
Type of Pump	Vertical Volute Type Mixed Flow Pump

CIADP CAGAYAN PHILIPPINE

GENERAL LAY-OUT MAP
LOWER CAGAYAN

JAPAN INTERNATIONAL COOPERATION AGENCY



Irrigable Area		Drainage Area	
A	12.0 ha	D.A.	12.0 ha
B	14.9 ha	D.B.	34.9 ha
C	20.0 ha	D.C.	20.6 ha
D	12.3 ha	D.D.	12.3 ha
E	20.6 ha		
	(79.8)		(79.8)

0 100 200 300 400 500m

CIADP CAGAYAN PHILIPPINE

GENERAL LAY-OUT MAP
MODEL AREA

JAPAN INTERNATIONAL COOPERATION AGENCY

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The pre-feasibility mission was dispatched in May, 1975, to direct the approach to CIADP. The feasibility mission furthered studies on CIADP along the guideline prepared by the pre-feasibility mission.

As stated in the Pre-feasibility Report, very few agricultural infrastructures such as irrigation and drainage facilities and transportation facilities exist in the Project Area and such absence of infrastructures has left the area intact in development, though holding a high potentiality therein.

Under the circumstances, a development plan was made as follows, in taking into account the best use of its potentiality to contribute to the agricultural development which is one of the vitally important policies of the Philippines and to the welfare of inhabitants in the area.

1. Plan of Development

1-1. The project consists of the construction of new irrigation and drainage systems providing three pumping stations and feeder roads in 13,200 hectares area and rural electrification for 5 municipalities. The project also includes establishment of processing facilities and marketing study. In addition, the pilot center scheme aiming at extension of modern farming techniques will be provided by Japan International Cooperation Agency (JICA). The Project Area of 13,200 hectares divided into three areas is as follows:

Iguig	600 ha
Alcala-Amulung	1,400
Lower Cagayan	11,200
Total	13,200 ha

1-2. Irrigation systems to be provided are as follows:

o Pumping Station

Name	Design Pump Capacity	Unit	Type of Pump	Designed Water Requirement
Iguig	22 cu m/min	3	Vertical Volute Ø 400 mm	1.1 cu m/s
Amulung	52 cu m/min	3	Vertical Volute Ø 600 mm	2.6 cu m/s
Magapit	309 cu m/min	4	Ø1500 mm	20.6 cu m/s

o Canal

Class	Length (m)	Density (m/ha.)
Main	44,110	3
Lateral	131,400	10
Main farm ditch	227,700	17
Supplementary farm ditch	526,400	40
Total	929,610	70

Note: Canal density was calculated on the basis of 13,200 ha of irrigable area.

1-3. Drainage systems are as follows:

°Canal

Class	Length (m)	Density (m/ha)	Remarks
Main	61,000	5	
Lateral	69,000	5	4 adverse tide gates to be provided
Farm drain	283,800	21	
Total	413,800	31	

Note: Canal density was calculated on the basis of 13,200 ha. of irrigable area.

1-4. Roads

Class	Length (m)	Density (m/ha)	Remarks
Existing road	81,000	6	
Trunk road	27,200	2	B = 6 m
Farm road	422,500	32	B = 2 - 5 m
Supplementary Farm Road	228,400	17	B = 2 m
Total	759,100	57	

1-5. Electrification

Towns and barrios in five municipalities vis., Buguey, Aparri, Camalaniugan, Lal-lo and Gattaran will be electrified by distribution system of 70 kilometers in total length excluding the district covered by CAGELCO - I Project. Necessary materials for distribution system are as follows:

Items	Quantity	Remarks
Main transformer	15,000 KVA	
Switchgears	4 sets	
Wood pole	930 each	
Total length of conductor		
ACSR	280 KM	Backbone line
Copper	165 KM	Low voltage line
Insulator	3,450 pcs.	
Pole transformer	4,750 KVA	
Watt hour meter	6,000 units	

2. Technical Feasibility

Technical feasibility study was made carefully on various facilities necessitated for accomplishment of the Project having regard to size of facilities, construction cost, construction schedules and necessary equipment to be purchased. It was natural that due considera-

tion should be given to local conditions including climatical and geological conditions prevailing over the Project Area. As a result, CIADP was found to be technically feasible.

Pre-construction works will take about one and a half years and the construction will last four years. Then, five and a half years will be required for completion of the project. The detailed construction schedule is presented in Fig. 4-1.

3. Financial and Economic Aspects

3-1. Project Cost

The project requires considerable amount of fund to be financed by both the Philippine government budget and the Japanese Yen-loan for the local currency portion and the foreign currency one, respectively. The project cost is composed of the initial cost and the recurring costs such as operation and maintenance cost and replacement cost.

1) Initial Cost

The initial cost consists of the total construction cost and the price escalation and will be disbursed for the consecutive six years starting from 1976. Items of the total construction cost are preparation works, major construction works including materials, land acquisition, engineering, government administration, equipment and contingency. Price escalation for both the foreign and local currency is enumerated by computing 8 per cent of price increase in prior year and one half of the rate of increase in the year concerned.

The initial cost is shown as follows:

(Unit: thousand pesos)

	F C.	L C	Total
Total Construction Cost	138,652	93,725	232,377
Price Escalation	27,960	29,186	57,146
Total Initial Cost	166,612	122,911	289,523
(US$ x 10^3)	(22,215)	(16,388)	(38,603)
(%)	(57.5%)	(42.5%)	(100.%)

2) Operation and Maintenance Cost and Replacement Cost

After completion of the construction works, the operation and maintenance cost will be necessitated annually and borne mainly by farmers to be benefited as water charge, and the replacement cost of pumping facilities will be required at the 25th of project year.

Amounts of the operation and maintenance cost and the replacement cost are estimated at ₱5,000,000 and ₱15,217,000, respectively.

3-2. Project Benefit

Taking into consideration the components of the project, only the direct tangible benefit arising from the irrigation aspect would be used for the economic evaluation. This benefit can be measured as the difference between the net production value with and without the project and be estimated at ₱55,054,000 annually after attaining the target yield of rice as follows:

(Unit: thousand pesos)

	Without Project	With Project	Increment
Net Production Value			
Paddy	11,309	66,523	55,214
Corn	160	0	-160
Total	11,469	66,523	55,054
(US$ x 10^3)	(1,529)	(8,870)	(7,341)

3-3. Present Worth Value

(Unit: thousand pesos)

Discount Rate	10.0%	12.5%	15.0%
Benefit	254,428	172,727	121,967
Cost	177,609	157,320	141,433

3-4. Economic Internal Rate of Return (EIRR):

13.5%

3-5. Sensitivity Analysis

Alternative	EIRR (%)
(1) Construction costs increased 10%	12.6
(2) Benefit decreased 10%	12.4
(3) One year prolongation of construction works	12.6
(4) One year delay of full development	12.9
(5) Combination of (1) and (2)	11.6

Conclusion

It is learned from the results of study mentioned above that Cagayan Integrated Agricultural Development Project (CIADP) is found to be technically sound, economically feasible and socially promising, and would contribute to acceleration of the regional development as well as enhancement of the peoples' living standard in the Project Area.

Ninety-seven (97%) per cent of 13,200 ha paddy fields (12,790 hectares) will be developed to the double cropping paddy fields in providing new irrigation and drainage facilities and 3 per cent (410 hectares) to the single cropping paddy fields in the first crop. And 82,000 tons of increased paddy yielding per year will be created after attaining the target yield.

Recommendations

As a result of feasibility study of the CIADP, recommendations are presented as follows for serving the project works in the coming stages.

1) Additional Surveys

a) To modify the existing topo-map 0.5 meter contour of the Aparri area with 0.25 meter interval contour lines and show elevations at basic points so that the detailed design team may easily make interpretation of the map of the area, the topography of which is so flat.

b) To make re-survey of the alingment of main and lateral canals for both irrigation and drainage in referring to the existing General Layout Map, especially, main canals in Alcala-Amung area for preparation of Alternative Plan for the upper portion of main canal and, furthermore, to change the alignment of the main canal in Lower Cagayan subject to decision of the necessary water lavel as 15 meters El. at the starting point of the canals.

c) For making the drainage scheme, to set up a discharge observation point at any creek available in the Project Area for continuous observation for one year at minimum, so that such collected data may help to derive the relationship between rainfall and run-off by carrying out the actual run-off analysis; in the case, to select an observation point along the creek running through hilly lands for avoiding the effect of back water; and also to set up water level observation points in the confluences of each proposed main drainage canal with the relevant rivers for continuous observation (Iguig, Alcala-Amulung and Lal-lo areas),

d) To make route survey for establishment of electric distribution system,

e) To complete the additional soil survey to cover the whole Project Area and also to complete the soil map of the swamp area in the Lower Cagayan based on the analysis of the said survey result.

2) Salinity

To carry out the salinity survey of the proposed pumping site on the Cagayan river from which the water will be conveyed to the Lower Cagayan areas. The mode of survey is as follows;

Survey period: April - June

Survey frequency: Minimum three (3) surveys or more per month

Method of sampling: Surface water and at every 2 meters interval deep in vertical up to 10 meters deep in water.

3) Water Resources

To make a detailed analysis on influences to CIADP given by many other water resources development projects, not only existing ones but in planning.

4) Boring Test

a) To carry out boring tests to the extent of 30 meters deep for the pumping sites in Iguig, and Amulung which have been hunted at different locations from those in the pre-feasibility stage, and in parallel with boring test to carry out the standard penetration tests thereon to investigate the bearing power of the ground,

b) To carry out boring tests in minimum drilling depth reaching up to the invert of proposed canals to clarify the geology and groundwater conditions and so forth, as preparatory works for detailed design on the inlet and outlet points of the tunnel (460 meters) which is to be constructed as a portion of main irrigation canal in Lower Cagayan area; and also to make the standard penetration test in parallel with boring tests.

5) Detail design of trunk roads

To have consultation with Department of Public Highway (DPH) in the final design stage regarding implementation of construction and operation/maintenance of trunk roads so as to execute the said works smoothly.

6) Electrification Program

To complete by February, 1979, electric transmission lines which are now in contemplation by National Power Corporation (NPC).

7) Transmigration

To make a plan for transmigration; because CIADP will improve the existing swamp area in Lower Cagayan into arable lands and better utilization of these newly reclaimed lands will require further farming labour power, and the transmigration plan is to be established with reference to the actual results of resettlements carried out in the other areas in the Philippines.

8) Samahang Nayon

To try to expand and strengthen Samahang Nayon as cores for successful achievement of the Project through ready-established Samahang Nayon, which remains at only 10 per cent to total farm households in the Area.

9) Marketing

a) To establish branches of Area-Marketing Cooperatives (AMC) in the Project Area as well as existing ones on the provincial level in expecting their function as a core of future distribution system.

b) To give guidance along with the policy that the members of the Area Marketing Cooperatives should pay attention to securing the outlets of farm products, one of the main role of the said organization.

10) Communication System

To provide communication system within the Proj-ct Area, and between the Project Area and its outer areas for closer communication with each other.

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LIST OF TABLE AND FIGURE

ABBREVIATIONS, CONVERSIONS AND OTHER TERMINOLOGY

ACA	Agricultural Credit Administration
ADB	Asian Development Bank
AMC	Area Marketing Cooperatives
BAEcon	Bureau of Agricultural Economics
BAEx	Bureau of Agricultural Extension
BCS	Bureau of Census and Statistics
BPI	Bureau of Plant Industry
BS	Bureau of Soil
CAGELCO	Cagayan Electric Cooperative
CCC	Cabinet Coordinating Committee
CIADP	Cagayan Integrated Agricultural Development Project
CB	Central Bank of the Philippines
DA	Department of Agriculture
DANR	Department of Agriculture and Natural Resources
DAR	Department of Agrarian Reform
DF	Department of Finance
DLGCD	Department of Local Government and Community Development
DPH	Department of Public Highway
DPWTC	Department of Public Works, Transportation and Communication
FaCoMa	Farmers Cooperatives Marketing Association
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IRDP	Integrated Rural Development Project
JICA	Japan International Cooperation Agency
NAFC	National Food and Agricultural Council
NEA	National Electrification Administration
NEDA	National Economic and Development Authority
NGA	National Grain Authority
NIA	National Irrigation Administration
NPC	National Power Corporation
OECF	Overseas Economic Cooperation Fund

PNB	Philippine National Bank
RB	Rural Bank
SN	Samahang Nayon
USAID	United States Agency for International Development
USDI BR	United States Department of Interior, Bureau of Reclamation

mm	millimeter(s)
cm	centimeter(s)
m	meter(s)
km	kilometer(s)
m/s	meter per second
km/h	kilometer per hour
sq.mm, mm^2	square millimeter(s)
sq.m, m^2	square meter(s)
sq.km, km^2	square kilometer(s)
ha.	hectare(s)
cu.m, m^3	cubic meter(s)
l	liter(s)
MCM, $10^6 m^3$	million cubic meter(s)
qt, Qt	quart(s) = 1/4 gallon or 9.46 liters
l/s	liter per second
l/s/sq.km, km^2	liter per second per square kilometer
cu.m/s	cubic meter per second
cu.m/min.	cubic meter per minute
g	gram(s)
kg	kilogram(s)
t	ton(s)
MT	metric ton(s)
EL	elevation
H.H.W.L.	highest high water level
H.W.L.	high water level
M.W.L.	mean water level
L.W.L.	low water level
N.W.S.	normal water surface

W.S.	water surface
STA	station
min.	minute(s)
hr	hour(s)
sec., S	second(s)
kw	kilowatt
P.S.	Horse Power(s)
A	ampere
Hz	hertz per second
KV	kilo volt
KVA	kilo volt ampere
KWH	kilowatt hour
MVA	mega volt ampere
V	volt
Ω	ohm
%	per cent
^{o}C	degree centigrade
LS	lump sum
eq	equivalent
Ave.	average
Max, MAX	maximum
Min., MIN	minimum
Ph	potential of Hydrogen
PPM	part(s) per million
FC	Foreign Currency
LC	Local Currency
FY	Fiscal Year
GNP	Gross National Product
¥	Yen (Japanese currency)
₱	Peso(s) (Philippine Currency)
$	Dollar(s) (US currency)

$1.0 = 7.5 pesos

Banca	small wooden-made boat
Barangay	small unit of organization in the barrio

Barrio	administrative subdivision of town
Carabao	water buffalo
Cono	large scale rice mill
Kiskisan	small rice mill
Masagana 99	national campaign of rice production increase on loan system
Palay	(Oryza sativa) the rice plant which bears a staple cereal, or the cereal itself, unhulled rice, sometimes called rough rice
Sitio	administrative division (similar to town)
Samahang Nayon	a non-stock association (Barrio Association) aiming to strenthening of cooperative movements.

Introduction

In response to the request of the Government of the Republic of the Philippines for plan formulation and study of the Cagayan Integrated Agricultural Development Project (CIADP), the Government of Japan had dispatched two Study Missions in July, 1974 and May, 1975. While these Missions had been working respectively, the Government of the Philippines provided the new organization of the Cabinet Coordinating Committee (CCC), under the jurisdiction of the National Economic and Development Authority (NEDA), which is responsible for carrying out the CIADP as one of its functions. Under such efforts and mutual cooperation, the plan has been formulated in furthering the step to the feasibility study from the pre-feasibility study.

Prior to the Mission, a Study Team was sent to the Philippines in October, 1975 as the forerunner for the fundamental works of the feasibility study of the Mission.

Based upon these results, the Mission made the detailed study for a period beginning 25th January to 3rd April, 1976 to finalize the feasibility study of the Project.

Under mutual understanding and close cooperation between the two countries, the Republic of the Philippines and Japan, it can be said that this Project (CIADP) will, in due time, come into realization.

MEMBER OF THE MISSION FOR CIADP

Name	Speciality	Present Position in Japan
Mr. Junichi Kitamura	Leader	Head of Development Planning Div. for Agriculture & Forestry, JICA
Mr. Toshiharu Kai	Development Planning	Staff of Development Planning Div. for Agriculture & Forestry, JICA
Mr. Takeshi Adachi	Agronomist	Staff of Technical Affair Division for Agriculture & Forestry, JICA
Mr. Susumu Takamine	Sub-leader (Manager)	Senior Managing Director, Sanyu Consultants Inc.
Mr. Ikuzo Iwamoto	Irrigation	Director, Sanyu Consultants Inc.
Mr. Shizuo Sato	Construction Planning	Director, Sanyu Consultants Inc.
Mr. Taira Suetsugu	Electricity	Deputy Director of Overseas Affairs, Tokai Electric Installation Co., Ltd.
Mr. Satoshi Hirai	Pumping Facilities	Head of Planning Survey Div. JIRCO
Mr. Masahiro Iida	Drainage	Engineer, Sanyu Consultants Inc.
Mr. Yasunori Hasegawa	Cultivation and Agricultural Facilities	Engineer, Sanyu Consultants Inc.
Mr. Masaru Matsuyama	Water Distribution Facilities	Engineer, Sanyu Consultants Inc.
Mr. Hiroaki Kawachi	Agricultural Road and Water Distribution Facilities	Engineer, Sanyu Consultants Inc.
Dr. Yoshihiro Takano	Social Development	Engineer, Sanyu Consultants Inc.
Mr. Yoshitami Iseki	Pumping Station Structure	Engineer, JIRCO
Mr. Yoshitomo Miyanishi	Economy	Engineer, Sanyu Consultants Inc.

FILIPINO COUNTERPARTS FOR CIADP

INFRASTRUCTURE

Name	Agency	Area
Amado Jugueta	NIA*	Team Leader/Irrigation Engr.
Patricio Marquez	NIA*	Irrigation
Ernesto de Peralta	NIA**	Irrigation
Bibiano Alonzo	NIA**	Irrigation
Asterio Dagang	NIA*	Irrigation
Rufino L. Santos	BS*	Agronomy/Soils
Arturo Dayot	BS*	Agronomy/Soils
Isaac Marinas	BS**	Agronomy/Soils
Romeo Mapagu	BS**	Agronomy/Soils
Edilberto Fragante	BAEx**	Social Development
Elpidio Pauig	BAEx**	Social Development
Jose Taguba	BPI**	Development Planning
Nicolas Naval	DPH**	Roads/Highways
Avelino Buenafe, Jr.	PPDO/DPWTC*	Regional Development
Alex Dayo	NEA*	Electrification
Eugenio Batarao	NEA*	Electrification
Prudencio Baranda	DPH*	Roads/Highways
Rene Mondragon	BPI*	Development Planning

* National Office
** Provincial Office

CIADP STAFF

Name	Area
Hegino Ma. Orticio	Project Director
Andres Limcaoco	Coordinator
Hiroyiko Iwasaki*	Agro-Economics
Susumu Siraisi*	Irrigation
Narciso Padilla	Irrigation

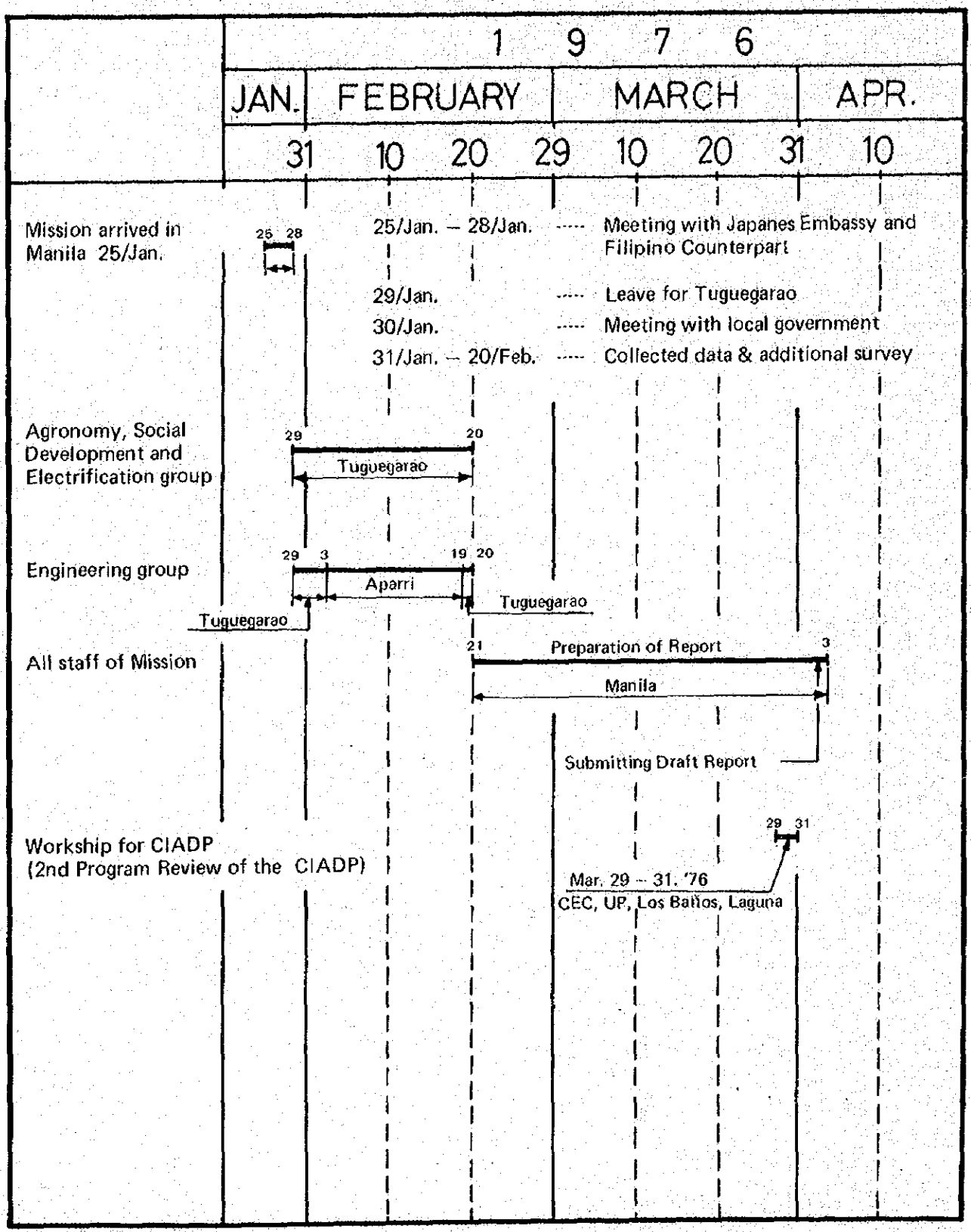
Name	Area
Gloria Macatol	Soil Technology
Antonio Hinayo	Farm Mechanization
Delfin Cruz	Entomology/Pathology
Lydia Almeron	Agr-Economics
Carmelita Cruz	Credit
Napoleon Carino	Field Audit/Monitoring
Jorge Cruz	Soils/Agr-Engineer
Kathryn Pineda	Communication
Melanio Mina	Staff Assistant
Aurelia Tayao	Staff Assistant
Alwyn Abella	Research Assistant

Short-term JICA Consultant assigned to the CIADP Office

MAIN COLLECTED DATA

Name of Data	Remarks
1. Daily Climatological Data	Rainfall, Temperature, etc. of Aparri and Tuguegarao station. Collected by Philippine counterparts, 1949 to 1975.
2. Hydrological Data	
Daily water level and discharge data	Aparri gaging station, etc. in Cagayan river
Water level	Buguey River, Aparri and Magapit in the Cagayan River
3. Ground Survey Data	Topo-Map and Profiles of Main Canals and Existing Creeks. Plane Survey of Proposed Pumping Site
4. Soil Survey	
5. Boring Test	Proposed Pumping Sites (about 30 m deep)
6. Design Criteria	
7. Reports of Other Project and Books	Solana-Tuguegarao, Baggao and Angat-Magat Projects, etc.
8. NEDA Report on the Economy for Fiscal Year 1975	
9. Brief Socio-Economic Profile, Province of Cagayan	
10. A Socio-Economic Study of Farmers in Selected Towns	
11. Characteristics of Present Seed Bed Recommended Lowland Rice Variety for CIADP	BPI Region II
12. Area Harvested and Production of Rice in each Municipality concerned to Project Area	Average number of past 5 years 1969 to 1974
13. Flood Damage Record	1947-1974
14. Grain Journal Volume I No.1, February 1976, NGA	
15. The Regional Development Program for Cagayan Valley DLGCD, 1974	

ITINERARY OF MISSION



CHAPTER 1. ECONOMIC BACKGROUND

1-1. National Level

The Philippines covers about 300,000 square kilometers of land, comprising over 7,000 islands scattered between the Pacific Ocean and South China Sea and is separated mainly into three parts, namely, Luzon, Visayas and Mindanao from north to south. The 45 bigger islands occupies 98 per cent of the land. The population is about 41.46 million in 1974 and population density is, thus, 138 persons per square kilometer. The population growth rate per annum during the last decade is estimated at 2.7 per cent.

Real GNP increased by 5 to 6 per cent per annum during the last decade. Economic was improved dramatically in 1973 when real GNP increased by 10 per cent by booming exports, remarkable recovery in agriculture after the 1972 floods and favorable investment climate. GNP in 1975 was estimated at 42,115 million pesos and 106,072 million pesos at 1967 constant prices and at current prices, respectively. The real GNP of 1974-75 increased by 6.0 per cent and GNP per capita in 1975 is estimated at US$132 and US$332 at 1967 prices and current prices, respectively (see Appendixes A-1 and A-2).

Out of a total land area of some 30 million hectares, more than half of it, is covered by forest and about one-third is under cultivation or in plantation. About 2.0 to 2.5 million hectares of fairly level is still available for growing crops, though some 1.0 million hectares of this is "cogon" (a kind of coarse grass) grassland which would be difficult to be reclaimed. Bringing this additional land under cultivation would be insufficient by itself to meet increasing food demand and to improve farmer's income in rural areas. These goals call for increased production from currently cultivated areas through yield improvements and increased cropping intensity where water is available.

The combined agriculture-fishery-forestry sectors substantially has decreased the growth rate from 6.7 per cent in FY 1974 to 2.7 per cent in FY 1975. In absolute terms, net value added to this sector

reached ₱9,657 million in FY 1975 increased only by ₱258 million from FY 1974 level.

Major contributing factors to the slow performance of the sector in FY 1975 were: i) the substantial decline in forestry production due to continued depressed construction activity abroad and the log phase-out program and ii) the decreased performance of sugar and coconuts, inspite of improved world prices, owing mainly to supply bottlenecks. Except for poultry, bananas and corn, all other agricultural crops likewise registered growth deceleration.

The semestral performance of the sector was seasonal in nature. Net value added in the sector dropped by 9.1 per cent and by 12.5 per cent during the second semesters of FY 1974 and FY 1975, respectively. A better performance was recorded during the first semester of the two fiscal years, with the net value added growing by 12.4 per cent and 15.1 per cent, respectively.

1-2. Provincial Level

The province of Cagayan is situated on the northeastern part of Luzon. The Balintang Channel lies on the northern border, the Pacific Ocean on the east, the provinces of Ilocos Norte and Kalinga-Apayao on the west and province of Isabela on the south. The Sierra Madre Mountain lies along her eastern seaborad and the Cordillera Mountain Range stands on her west flank. Cape Engano guards her northeastern tip and point "Lacay-Lacay" stands on her northwestern edge.

Significantly, the Cagayan river runs its course meandering slightly diagonal from south to north through the middle of the province and serves as dividing line between two congressional districts. Fourteen municipalities lie on the eastern part, comprising the First District and an equal number on the western part, forming the Second District. Across the Babuyan Channel is the island town of Calayan Municipality, a part of the First District.

The land surface of the province is 18.37 per cent (165,420 hectares) level, 9.63 per cent (86,670 hectares) undulating to rolling and 72 per cent (648,177 hectares) hilly to mountainous.

Among the total area of 900,267 hectares, 33.79 per cent (304,119 hectares) was classified as cultivated land, 33.67 per cent (303,071 hectares) commercial forest, 17.76 per cent (159,973 hectares) non-commercial forest and 14.78 per cent (133,104 hectares) others, as of April, 1970.

The province has two types of climate: Type III for the northwestern portion of the province and Type IV for the rest of the province, covering Tuguegarao to Sta. Ana. Type III means that seasons are not very pronounced, relatively dry from November to April and wet during the rest of the year. Type IV means that rainfall is more or less only distributed throughout the year.

The average frequency of typhoons per year is 1.18, there being 38 typhoons occurring during a period of 32 years (1942-1974). The occurrence of these typhoons is most frequent during the month of October, while no typhoon occurred at all during the months of January through April.

The province has 29 municipalities and 737 barangays, with a total population of 637,376 as of May 1975 (see Appendix A-3). Population density is 70.8 in 1970. Annual growth rate of population during the last 15 years is estimated at 2.4 per cent.

The unemployed was 10.5 per cent of the economically active population in 1970.

The province has a total length of 2,149.6 kilometers of national, provincial, municipal and barangay roads and a total of 8.70 kilometers of national and provincial bridges (see Appendix A-4).

There are two airports, one in Tuguegarao and the other in Aparri; three seaports situated in Aparri, Claveria and Sta. Ana; 684 school buildings and 98 health clinics (see Appendix A-5).

As to communication facilities, it has 29 postal offices, one in each municipality, 10 telegraphic offices and 2 telephone firms, one government-owned operated with a central station in Tuguegarao and three sub-stations in Iguig, Penablanca and Solana in the second,

a privately-owned operated company, the Republic Telephone Company situated in Tuguegarao. In March 1974, a frequency modulated transceiver serving as the Provincial Law Enforcement Communication System (PLECS) under the Police Commission (POLCOM) was installed at the Provincial Capitol connecting all towns of Cagayan.

Out of 29 towns, there are at present only seven (7) towns being served with electric power.

For irrigation purposes, the province has 3 national irrigation systems and 139 communal irrigation systems, all gravity type and covering 29,509 hectares of land.

There are 7 Metro Water Works Systems operating in 7 municipalities and approximately 527 wells throughout the province serving more or less 300,000 people (see Appendix A-6).

CHAPTER 2. THE PROJECT AREA

2-1. Physical Features

2-1-1. Location

The Project Area, for which this feasibility study was made, is located at about 18° N Latitude and 122° E Longitude. in the province of Cagayan, the northernmost part of the so-called Cagayan Valley. The subject area oxtends on the right side plain of the Cagayan river, around 600 kilometers north of Manila, the capital of the Philippines, and was known as an isolated island in Luzon. As seen in the General Map, the Project area comprises three areas of Iguig, Alcala-Amulung, and Lower Cagayan which includes Lal-lo and Aparri areas as subdivisions.

1) Iguig

This area is located some 20 kilometers north of Tuguegarao, the Provincial Capital of Cagayan Province. In this area, there lies a long and narrow paddy field between the Cagayan river in the west and a hilly land in the east. The Philippine-Japan Friendship Highway goes across the central part of the area.

2) Alcala-Amulung

Alcala-Amulung area is situated further north of Iguig area some 40 kilometers north of Tuguegarao, being surrounded by the Cagayan river and the Pared river (one of the tributaries of the Cagayan river) and the eastern hilly land. The above-mentioned highway runs along the southern boundary line of the area.

3) Lower Cagayan

The area occupies the northern end part of the Cagayan Province being apart approximately 100 kilometers north of the Provincial Capital. The area is bounded by the Cagayan river at the west, the sea at the north and a mountainous range at the other sides. There are national road running along the western and southern boundaries.

2-1-2. Demography

The municipalities concerned with the Project Area are Aparri, Buguey, Camalaniugan, Lal-lo, Alcala, Amulung and Iguig.

On the basis of 1975 census, the total number of households and total population within the project area were estimated at 8,878 and 50,765, respectively.

Around 70.4 per cent of labor force was estimated to have been employed in the agricultural sector in 1970.

Table 2-1 shows the present situation on demography in the Project Area and Table 2-2 does the projected situation in 1990 applying the annual population growth of 2.3 per cent over the project area.

2-1-3. Topography and Geology

1) Iguig

As illustrated in the general layout map, each of these three areas, Iguig, Alcala-Amulung and Lower Cagayan, has a special feature of its own.

Iguig area can be divided into three areas again based on its topographical features. The largest one occupies about 250 hectares of paddy fields extending in both sides of the Philippine-Japan Friendship Highway with an elevation ranging from 15 to 18 meters above the mean sea level. The land slopes down toward the north with a gradient of 1/500 to 1/1000.

The second one occupies some 200 hectares of paddy field along the Highway at the north of Barrio Baculud. Generally, the slope is extremely small, down to the north, but there are some lands with a comparatively steep slope of 1/200 to 1/500, starting from the Highway and hilly lands down to the existing creek which crosses the mid-center of the area.

The last 150 hectares of paddy fields are located at the east of the Highway with a comparatively higher elevation and a slope of

TABLE 2-1. DEMOGRAPHIC SITUATION IN THE PROJECT AREA, 1975

Area	Municipality	Total				Farmer				Non-Farmer			
		No. of House-hold	Population			No. of House-hold	Population			No. of House-hold	Population		
			Total	Male	Female		Total	Male	Female		Total	Male	Female
Lower Cagayan	Aparri	1,358	8,085	4,171	3,914	956	5,693	2,936	2,757	402	2,392	1,235	1,157
	Buguey	625	3,751	1,841	1,910	440	2,640	1,295	1,345	185	1,111	546	575
	Camalaniugan	2,044	11,374	5,734	5,640	1,439	8,007	4,039	3,968	605	3,367	1,695	1,672
	Lal-lo	2,742	15,558	7,836	7,722	1,930	10,956	5,517	5,439	812	4,602	2,319	2,283
	Sub-total	6,769	38,768	19,582	19,186	4,765	27,296	13,787	13,509	2,004	11,472	5,795	5,677
Alcala Amulung	Alcala	586	3,497	1,687	1,810	413	2,462	1,188	1,274	173	1,035	499	536
	Amulung	438	2,655	1,310	1,345	308	1,869	922	947	130	786	388	398
	Sub-total	1,024	6,152	2,997	3,155	721	4,331	2,110	2,221	303	1,821	887	934
Iguig	Amulung	327	1,912	934	978	230	1,347	658	689	97	565	276	289
	Iguig	758	3,933	1,975	1,958	534	2,768	1,389	1,379	224	1,165	586	579
	Sub-total	1,085	5,845	2,909	2,936	764	4,115	2,047	2,068	321	1,730	862	868
	Total	8,878	50,765	25,488	25,277	6,250	35,742	17,944	17,798	2,628	15,023	7,544	7,479

TABLE 2-2. DEMOGRAPHIC SITUATION IN THE PROJECT AREA, 1990

Area	Municipality	Total				Farmer				Non-Farmer			
		No. of Household	Population			No. of Household	Population			No. of Household	Population		
			Total	Male	Female		Total	Male	Female		Total	Male	Female
Lower Cagayan	Aparri	1,910	11,371	5,866	5,505	1,345	8,007	4,129	3,878	565	3,364	1,737	1,627
	Buguey	879	5,275	2,589	2,686	619	3,713	1,821	1,892	260	1,562	768	794
	Camalaniugan	2,875	15,998	8,065	7,933	2,024	11,262	5,681	5,581	851	4,736	2,384	2,352
	Lal-lo	3,857	21,882	11,021	10,861	2,715	15,410	7,760	7,650	1,142	6,472	3,261	3,211
	Sub-total	9,521	54,526	27,541	26,985	6,703	38,392	19,391	19,001	2,818	16,134	8,150	7,984
Alcala -Amulung	Alcala	824	4,919	2,373	2,546	581	3,463	1,671	1,792	243	1,456	702	754
	Amulung	616	3,734	1,842	1,892	433	2,629	1,297	1,332	183	1,105	545	560
	Sub-total	1,440	8,653	4,215	4,438	1,014	6,092	2,968	3,124	426	2,561	1,247	1,314
Iguig	Amulung	460	2,690	1,314	1,376	323	1,894	925	969	137	796	389	407
	Iguig	1,066	5,532	2,778	2,754	751	3,894	1,954	1,940	315	1,638	824	814
	Sub-total	1,526	8,222	4,092	4,130	1,074	5,788	2,879	2,909	452	2,434	1,213	1,221
	Total	12,487	71,401	35,848	35,553	8,791	50,272	25,238	25,034	3,696	21,129	10,610	10,519

1/300-1/500 from east down to the west.

Taking into account the higher elevation of the area, it is necessary to use a booster pump for irrigation. The soil is classified in a range between clay and silty clay.

2) Alcala-Amulung

This area presents a deep plate shape. There is the Canseritan creek at the bottom of the plate, running across the center of the area, and the land inclines from the boundary downward this creek with a gradient of 1/400-1/500 or 1/1,500-1/2,000. The main canal is, therefore, laid out along the boundary line at the higher portion to surround the irrigable area. The soil is classified in a range between clay and clay loam.

3) Lower Cagayan

This area consists of the Lal-lo and Aparri areas. The former one is a long and narrow paddy field of 1,200 hectares located between the national road along the Cagayan river and the mountainous area at the back (eastern side). As a whole, the area has a slope from the mountainous area down toward the national road, though partly the area has some complicated features with a considerable number of swamp areas at the lower portion. The whole area has an elevation ranging between 4 meters and 8 meters above the mean sea level.

The paddy fields of around 10,000 hectares including Aparri-Buguey area extends quite flatly except the higher portion along the national road, having as a whole, a gentle slope from the southern mountainous area down to the seashore. The gradient shows some 1/300-1/500 along the national road and 1/5,000-1/7,000 at the flat center part. Almost all of the area has an elevation ranging between 0 and 0.5 meters above the mean sea level. The soil is classified in a range between clay and clay loam, same as other areas.

2-1-4. Climatology

There are two climatological stations, the one in Aparri and the other in Tuguegarao, providing necessary data such as rainfall,

temperature, wind direction and wind velocity, etc. Analysis was made on these data collected, resulting in the following issues. That is, the average rainfall per annum is about 2,300 millimeters at Aparri and about 1,760 millimeters at Tuguegarao. Maximum monthly rainfall is concentrated to occur during October and/or November and the average maximum rainfall of 1,342 millimeters is recorded at Aparri and 959 millimeters at Tuguegarao. Though it is rather difficult to divide completely the whole year into dry and wet seasons at the project area, it can be said for convenience that dry season covers five months from January to May and wet season starts in June and lasts up to December.

As for the temperature in the area, it is higher in Tuguegarao than in Aparri, having a maximum of more than 40 degrees centigrade. Annual average ranges from 20 to 30 degrees centigrade.

According to field survey on evaporation at Tuguegarao, the maximum reveals 7.8 millimeters per day in April and minimum is 4.4 millimeters per day in December. All these climatological conditions prevailing over the area make the Project Area provide quite a high potential in agricultural production except during the flood season in October and November (see Appendix B-1).

2-2. Hydrology

2-2-1. The Cagayan River

The Cagayan river is the biggest and longest river in the Philippines, which gives favorable effect to the people living in the Cagayan Valley. Contrarily, however, this river sometimes seriously the area by violent floods caused from typhoons. The catchment area was approximately estimated at about 28,000 square kilometers in commanding at Aparri, the estuary, and the river course extends for a distance of 380 kilometers. Yearly average specific discharge is about 10 l/sec/sq. km. and the specific discharge with a return period of 10 years was estimated at around 5 l/sec/sq, km.

While in wet season, average flood discharge reaches up to 0.5 cu.m/sec/sq km. Maximum flood discharge, then, was estimated to

to reach at 1.1 cu m/sec/sq m and 1.6 cu m/sec/sq m at 10 years and 100 years return period, respectively. Basing upon the above, it was estimated that big flood might happen with a discharge as much as 45,000 cu.m/sec. at Aparri, the estuary of the river.

As for water source in dry season, refer to para. 3-3-1.

2-2-2. The Pared River

The Pared river is one of the tributaries of the Cagayan river. The length of the river course is about 35 kilometers from the conjunction with the Cagayan river up to the Paranan river, one of the tributaries of the Pared river. The river bed has a slope of approximately 1/2,500-1/3,000. The total catchment area is about 950 square kilometers and the yearly average flood discharge was estimated at 630 cu m/s (0.7 cu m/s/sq km), in 10 years return period at approximately 2,900 cu m/s (3.1 cu m/s/sq km), and in 100 years return period at approximately 5,100 cu.m/s (5.4 cu m/s/sq km). These figures show that the specific discharge of the Pared river is rather bigger than that of the Cagayan river(see Appendix B-2).

2-2-3. Salinity

1) Salinity of the Cagayan river water

The survey results in October and November 1975 and in February, 1976 show salinity of the Cagayan river water approximately is 100 PPM at maximum in the proposed pumping site on Lower Cagayan, and this value appears to suggest that the irrigation water taken from said river, will not in any way, harm the paddy. It is difficult, however, to jump into a conclusion due to lack of data surveyed of spring tide during the drought months of April and May.

Although for further confirmation, shellfish which were gathered from the river bed around Magapit were examined by a professor of Aparri College to ascertain the salinity in the river water and found such a family inhabitating only in fresh water. It is presumed, therefore, that sea water will not come up to the proposed pumping site.

As the said presumption, however, was not derived from the scientific analysis basis, it is recommended to carry out further salinity surveys at high tide during the months of April and May.

2-3. Existing Irrigation Systems

2-3-1. Irrigation Area

The existing irrigated area occupies approximately 5 per cent only to the whole paddy fields in the Project Area, and the details are shown in Table 2-3. It is learned from the said table that most of the paddy fields are now rainfed, and then, urgent implementation of the project is required for establishment of the irrigation system to cover the Project Area.

TABLE 2-3. IRRIGATED AREA AND RAINFED AREA

(Unit: ha)

	Irrigated Area	Rainfed Area	Total	Irrigated Area Rate (%)
Iguig	0	660	660	0
Alcala-Amulung	145	1,285	1,430	10
Lower Cagayan:				
Lal-lo	110	940	1,050	10
Aparri	245	7,425	7,670	3
Grand Total	500	10,310	10,810/1	5/2

NOTE: /1 - The swamp area, 3,840 hectares are not included.
/2 - Average.

2-3-2. Existing Irrigation Facilities

Ninety-five (95%) per cent of the paddy fields is rainfed and it can be said that no systematized irrigation facilities exists within the Project Area.

Irrigation method employed in the existing irrigated area, 5 per cent to the total paddy fields, is to pump up the water from

creeks by privately owned small-scaled facilities, and the absence of well-arranged terminal facilities forces irrigation water to be supplied by plot-to-plot system. And yet, insufficient water amount and inadequate water allotment leave many paddy fields unirrigated (see Appendix B-3).

2-4. Existing Drainage Systems

In the Project Area, there exist many poorly provided main, lateral drainage canals, mainly with insufficient sections in rough layout, improper location, incomplete terminal facilities and so forth, and these inadequately provided drainage facilities cause poor drainage in areas of approximately 3,800 hectares or about 30 per cent of the gross irrigable area. Especially, the low-lying flat land in Aparri area, Lower Cagayan, has become the tidal compartment due to lack of adverse tide facilities in the Appagonan river and the Buguey river. Run-off coming down from the mountainous catchment area with nearly the same acreage as the Aparri area concentrates to make about 3,400 hectares of the low-lying flat land swampy. In Lal-lo and Pared areas, inadequate maintenance of terminal facilities has made the areas of 240 hectares and 140 hectares swampy (see Appendix E-1).

2-5. Existing Road Networks

The Philippine-Japan Friendship Highway will be the trunk line in the Project Area after its completion at the end of 1976. The said Highway running along the Cagayan river is to provide with two traffic lanes in concrete pavement.

The Highway, existing national and provincial roads to be connected therewith, and other provincial roads under construction will improve traffic and trnasportation conditions to a greater extent, when all these roads begin to function in inter-linking main municipalities in Cagayan province.

Few road plans, however, are made for transporting farming materials and products in the Project Area, and only a provincial road plan between Aparri and Buguey was proposed, but the commence-

ment for the construction works of the said road has not been decided yet (see Appendix F-1).

A total length of roads is approximately 81 kilometers and the road density in the Project Area was estimated at about 5.5 m/ha., approximately 80 per cent of which is occupied by the national and provincial roads. This fact shows clearly that farm roads as terminal facilities have not been developed yet.

Especially, scarcity of road networks is remarkable in the Aparri area (Lower Cagayan) at approximately 50 per cent as compared with other two areas. The density of the road in the said area is about 4.8 m/ha., of which 4 m/ha (82 per cent) is occupied by the national and provincial roads. Such scarcity of the road networks in the Aparri area is considered to come from the fact that the swamp area of about 3,400 hectares lies in the center of the area, and to make the matters worse, creeks running in criss-cross have inhibited road development. Under the circumstances, only Banca (small boats) and carabaos are used as main means of transportation, and urgent improvement of transportation facilities is required for the development of the area.

In other two areas, Alcala-Amulung and Iguig, road networks are more developed than in the Aparri area, but road ratio is still so small that efficient farming works cannot be expected (see Appendix F-2).

Provincial roads have 6 meters width and are paved with gravel pavement. Barrio roads have the width ranging from 3 to 5 meters and are not paved. The embankment of these barrio roads is not so high, therefore, the rainfall has turned roads muddy and has made their function lost during wet season in the area.

2-6. Soil and Land Classification

Soil surveys carried out by the Bureau of Soil revealed that most of soils in the Project Area belongs to the alluvium with properties ranging from clay to clay loam, having the thick layers and high fertility. The contents of organic matters and soil nutrients are very high. The average pH of the soil ranges from pH 5.7 to 6.4 and

presents the characteristics of "slightly acidic" or "nearly neutral".

According to the results of land classification, namely, survey for soil suitability to paddy cultivation, 64 per cent of soil in the surveyed area belongs to the category of "highly suitable", and 36 per cent falls on "moderately or marginally suitable", (see Appendix C-1).

For confirmation, it should be noted that the survey by Bureau of Soil only covered 70 per cent of the gross irrigable area in the Project Area, and for the rest 30 per cent of the area, it was presumed that the said area has similar properties to the area surveyed by the Bureau of Soil, based on the results of the field survey.

Soil salinity according to survey results was found approximately 2,000 PPM in the area along the river at Aparri, and approximately 500-800 PPM at Buguey; however, higher salinity was observed in the swamp area. This is caused due to lack of adverse tide facilities around Aparri, thus, allowing the sea water to come up. It is presumed that around Buguey, salinity of water may be diluted by discharge from the Dalaya creek. In completion of CIADP, the irrigation and drainage facilities to be provided would function to dilute the concentrated salinity to the extent not to damage the paddy (see Appendix C-2).

2-7. Present Agriculture

2-7-1. Land Use

10,810 hectares, approximately 70 per cent of the total Project Area of 15,190 hectares, are cultivated for paddy cropping, and a large part of the rest 30 per cent is occupied by undeveloped woods and wild lands, and very small for the public utilities.

500 hectares of the paddy fields, approximately 5 per cent of existing paddy fields, are irrigated by privately owned small-scaled pumping facilities for double cropping of paddy. The rest, 10,310 hectares are rainfed and single paddy cropping is carried out, and a part of rainfed fields is devoted to corn cropping or some other upland cropping after the paddy cropping.

An average hectarage per farm household in the Project Area is about 2.6 hectares, most of which is cultivated for paddy cropping.

As mentioned above, the considerably wide undeveloped wild lands exist in the Project Area. These areas have not provided with the drainage facilities and been turned swampy in wet season. They have remained undeveloped grass-lands. The soil survey, however, revealed that some 3,840 hectares of such undeveloped lands will have potential to be utilized as paddy fields by providing adequate irrigation and drainage facilities because of their favorable soil properties and locatio in reasonable elevation for irrigation farming. These undeveloped lands are scattered in the Project Area, and found much in the Aparri in Lower Cagayan.

2-7-2. Land Tenure System

Since the start of Agrarian Reform in 1972, improvement of land reform has influenced land tenure system to a greater extent. But since 1971, there have been no censuses carried out on agriculture, so that actual status of land tenure system could not be easily grasped.

Judging from progress of land reform after agricultural census in 1971, the land tenure system in Cagayan province would be presumed as shown in the following table:

TABLE 2-4. PRESENT LAND TENURE

	No. of Farm Household	Area (ha)
Full owner	31,076 (59%)	90,353 (44%)
Part owner	15,343 (28%)	44,848 (22%)
Tenant	6,551 (12%)	14,045 (14%)
Manager	57 (0%)	52,587 (25%)
Other form	387 (1%)	1,367 (1%)
Total	53,414	203,200

The above table clarifie that the managers' households occupying less than one per cent of the total number of households possess approximately 25 per cent of total arable lands, and these managers' owned land would be utilized for large-scaled cattle feeding in grass lands. Sixty-six (66%) per cent of arable lands is owned by ordinary owners of 87 per cent of total households.

2-7-3. Present Cropping Pattern

In rainfed areas, paddy is grown in wet season. Planting season starts when enough rain water is available. Sometimes farmers have to wait several months for preparing their field to plant. Usually, seeds are sown in August or September. Transplanting is done as early as September to as late as November due to dependence on rainfall. Most of the farmers plant the native late maturing varieties (5 to 6 months), commonly called "Los Baños" varieties. Paddy is usually ready for harvest in the month of January or February. After harvest of paddy, only 4.8 per cent of rainfed area is planted to corn. In small scale, planting other crops such as peanut and mongo follow after paddy (see Fig. 2-1).

Double cropping of paddy is introduced in about 500 hectares of irrigated area. Irrigation water is taken from creek or well by small scale irrigation pump individually owned by farmers. Generally, early maturing high yield varieties such as IR lines, C4 lines are used in these irrigated areas.

Efficient pumping irrigation, however, is not expected to be carried out due to unstability of water sources, and the cropping pattern has been decided on dependence of rainfall; that is, the first crop is grown during July to October in wet season and the second crop during December to March in wet season.

The above quoted cropping pattern has some problem in harvesting period, which falls on October when typhoons and floods sometimes damage the farming products.

FIGURE 2-1 PRESENT CROPPING PATTERN

Classification		Area(ha)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Irrigated	Rice I + Rice II	500	Rice II: H					S, T		Rice I: H			S, T	
Rainfed	Rice	10,180	H								S, T	Rice		
	Rice + Corn, etc.	500	H	S						H	S, T	Rice		
Total		11,180												

LEGEND: S ; Sowing, T ; Transplanting, H ; Harvesting

2-7-4. Farming Practice

Absence of irrigation and drainage systems has drived farmers to follow the traditional method of farming for growing native varieties. Thus, poor farming prevails in the Project Area. In rainfed areas, inputs like fertilizers or other kinds of chemicals are not applied. The transplanting is carried out at random. Harvesting is done by sickle or by hand. Immediately after harvesting, the paddy is left in the field for sun drying. Threshing is done by foot or by animal. Very few farmers own or hire machinery like small type tractors for land preparation and large capacity threshers and dryer for post-harvest operations. Moreover, there are some farmers who borrow loans from Rural Banks and Philippine National Bank under the Masagana 99. These lending institutions help farmers to procure farm inputs such as fertilizers and other chemicals together with technical guidance. The package deal in lending fund and giving guidance has resulted in fairly good success; however, insufficiency or absence of irrigation/drainage facilities in the area prevents harvests from reaching the national average.

2-7-5. Productivity and Production Cost

1) Productivity

According to the data of paddy field, collected from main municipalities in the Project Area, in the past five years, 1969-1974, the average yield per hectare is 1.3 tons in the rainfed fields. The average yield of the first crop in wet season is 2.0 tons and the second crop in dry season is 2.2 tons in the existing irrigated fields. There is no difference in average yield by main municipalities, and the above average yields are nearly equal to those in the averages of the whole Cagayan province (see Table 2-5).

For further information, the average yields in the Masagana 99 are 2.3 tons in wet season and 2.6 tons during the period from Phase I to Phase IV (May-October, 1973, wet season up to April 1975, dry season), and the result of Masagana 99 was proved very favorable, although some problems remained in insufficient irrigation and drainage system.

TABLE 2-5 FARM AREA AND PRODUCTION OF PADDY IN EACH MUNICIPALITY

MUNICIPALITY	FARM AREA (ha)				PRODUCTION (tons)				UNIT YIELD (t/ha)			
	Irrigated		Rainfed	Total	Irrigated		Rainfed	Total	Irrigated		Rainfed	Total
	1st Crop	2nd Crop			1st Crop	2nd Crop			1st Crop	2nd Crop		
1. Alcala	791	385	3,550	4,726	1,344	915	5,155	7,414	1.7	2.4	1.5	1.6
2. Amulung	781	444	2,428	3,653	1,546	956	3,098	5,600	2.0	2.2	1.3	1.5
3. Aparri	160	47	3,323	3,530	310	99	4,386	4,795	1.9	2.1	1.3	1.4
4. Buguey	1,632	1,274	1,196	4,102	3,447	2,915	1,473	7,835	2.1	2.3	1.2	1.9
5. Camalaniugan	29	18	2,554	2,601	56	38	3,371	3,465	1.9	2.1	1.3	1.3
6. Iguig	331	174	1,923	2,428	641	367	2,285	3,293	1.9	2.1	1.2	1.4
7. Lal-lo	458	307	2,551	3,316	927	675	3,255	4,857	2.0	2.2	1.3	1.5
Total	4,182	2,649	17,525	24,356	8,271	5,965	23,023	37,259	2.0	2.2	1.3	1.5

Data Source: BAEx Region II (excluding upland rice)

2) Production Cost Without Project

At present, most parts of the Project Area are cultivated with paddy under the rainfed condition, while paddy field irrigated by privately owned small pump units in the Project Area is very limited.

Under the rainfed condition, farmers are not willing to cultivate crops with adequate amount of inputs such as fertilizers and chemicals at proper time because of unreliable rainfall.

Table 2-6 indicates the production costs of paddy under the rainfed and irrigated conditions and corn grown after the rainfed paddy.

2-8. Agro-institutional Establishments

2-8-1. Farmers' Cooperative

In 1973, a new cooperative development program was established by efforts of the Bureau of Cooperatives, DLGCD. At present, in Tuguegarao, there is First-Cagayan-Kalinga-Apayao Area Marketing Cooperatives serving to Cagayan province and Kalinga-Apayao province. 29 Samahang Nayon have been registered at the AMC. In the project area, no Samahang Nayon was registered. The AMC has endeavored to strengthen activities along with the guidance of DLGCD. Main services of AMC are recorded as follows:

1) Purchasing of palay
2) Storage of palay
3) Selling of palay and rice
4) Rice processing
5) Selling of agricultural inputs
6) Selling of daily necessities

Whenever AMC wants to purchase palay, serious competition exists among private dealers and NGA. On the contrary, AMC does not have sufficient numbers of direct outlets to consumers in large cities. Though DLGCD has devoted to develop Samahang Nayon, numbers of barrios which have organized Samahang Nayon are few and Samahang Nayon cannot involve all farm households.

TABLE 2-6 PRODUCTION COST WITHOUT PROJECT

(₱/ha)

ITEM	Palay						CORN	
	Rainfed		Irrigated					
			1st Crop		2nd Crop			
	Q'ty	Cost	Q'ty.	Cost	Q'ty.	Cost	Q'ty.	Cost
I. Labor Requirement								
a. With animal (man-day)	19	171	19	171	19	171	9	81
b. Without animal (-do-)	44	264	52	312	52	312	22	132
II. Fertilizer (kg.)								
a. Urea			50	94	50	94		
b. Ammosul			100	112	100	112		
c. 16-20-0			25	38	25	25		
d. 14-14-14			75	107	70	99		
III. Insecticide								
a. Liquid (Qt)			40	92	40	92		
b. Granular (kg)			1.0	3	1.0	3		
IV. Herbicide								
a. Liquid (Qt)			2.0	56	1.6	45		
b. Granular (kg.)			1.0	3	1.0	3		
V. Miscellaneous		10		20		20		10
VI. TOTAL		445		1,008		976		223

Samahang Nayon aims to help member farmers to increase their income through selling the daily necessities and agricultural inputs to the farmers at possible low cost and also procuring the products such as paddy and fishes from the farmers in more advantageous conditions than those offered by middlemen.

For effective operation and efficient function of the organization, some duties are imposed on the members in receiving educations and trainings for better understanding of the organization, and in reserving the Barrio Saving Fund and the Barrio Guarantee Fund. The farmers in the Project Area, however, have not entered the membership yet officially, as they have not reserved the funds required for the members, though completed the pre-membership training (see Appendix H-1).

2-8-2. Marketing

In national level, floor price of palay and ceiling price of rice are decided by the Presidential Decree. For stabilizing prices, NGA purchase palay when price of palay is low and sell rice when price of rice is high. Fixing the ceiling and floor prices can reduce the speculation opportunity by large middlemen than before.

Processing facilities would play an important role in marketing channel to contribute to farmers' profits.

Palay is dried out on concrete floors or roads by sunshine. At present, rice milling for home consumption is made by using 2 or 3 "kiskisan" placed in a barrio. Palay sold to dealers is processed with Cono rice mills with rather high processing capacities, located in trading center like Tuguegarao. Almost all warehouses are privately owned. In Camalaniugan, there is NGA warehouse, which suffers from floodings during wet season every year.

Regarding the transportation of palay, the national roads connecting Manila to Aparri and other municipalities is available, and transport from trading center to consumption center is consolidated. Passing through three areas, Iguig, Alcala-Amulung and Lower Cagayan, the national road serves as main road in the Project Area.

For rice distribution, socio-economic study of farmers in selected towns of Cagayan province, prepared by Special Studies Division Planning Service, DA, 1976, shows the following geographic sources and destination of palay:

TABLE 2-7 GEOGRAPHIC SOURCES AND DESTINATION OF PALAY

Area	Source (%)	Destination (%)
In town	80	52
In other town	20	10
		38
Others	-	0
Total	100	100

(Refer to Appendix H-2).

2-8-3. Agricultural Credit

In May, 1973, a comprehensive national campaign known as Masagana 99 was launched in the Philippines. Until now six phases have been performed.

Loan amount per hectare in Masagana 99, Phase VI, is one thousand and two hundred (₱1,200) pesos as shown in Appendix H-3.

Repayment of loans which were made during Phase I to IV, however, is quite delayed as Appendix H-3.

2-8-4. Agrarian Reform

This program aims to transfer ownership of tenanted paddy and corn fields to tillers. The first stage in the program would replace share-cropping by cash tenancy or leaseholding with regulated land rentals. The next stage would be the purchase of the leaseholders' tilling lands by the government through the Land Bank.

In the final stage, after new owners have paid loans completely, they will become full landowners.

Practical implementations of Agrarian Reform Program are performed by Agrarian Reform Teams, but they have found following difficulties on implementation of agrarian reform:

1. Uncooperative attitudes of some landowners due to vested interests in them.
2. Unsettled cases on ownership of some landholdings covered by operation of land transfer.
3. Lack of logistics in carrying out the agrarian reform program.
4. Some tenants would refuse to accept the program due to their close relationship and financial indebtedness with their landlords.
5. Refusal to leasehold due to inability to establish repayment schedule (from CIADP Report).

Following table indicates the progress of issued certificate of land transfer until January, 1976 in municipalities related to the Project.

TABLE 2-8 LAND TRANSFER

	Issued Certificate of Land Transfer (ha.)	Issued Certificate of Land Transfer per Identification x 100 (%)
100 ha above	614	92
50 - 99.9 ha	91	26
24 - 49.99 ha	306	42
7.01 - 23.99 ha	0	0
Total	1,011	

Situation of leasehold operation in the municipalities in the Project Area is listed below:

Table 2-9. Leasehold

	Area (ha)	No. of Parcel	Tenanted Tiller (household)	Land Holder (household)
Scope	9,561	10,257	8,214	6,140
Accomplishment	342	350	341	215
Accomplishment (%)	4	3	4	4

Accomplishment of each item is quite low.

2-9. Rural Electrification

2-9-1. General Description

Rural electrification is one of the important components involved in CIADP from not only economical viewpoint but social. The electrification scheme in CIADP aims at establishment of electric distribution system covering the municipalities of Aparri, Camalaniugan, Lal-lo, Gattaran and Buguey, and other adjacent areas will hopefully be served with the system expanding through further development program which will be undertaken by CAGELCO-II under NEA.

At present, two municipal government owned and one privately owned electric utilities supply the power to main municipalities in the Project Area, but the existing installations of these utilities are very small on scale and in need of repair and better maintenance.

Regarding present consumption of electricity in the Project Area, the detailed analysis could not be made due to absence of data available for the purpose, but a rough sketch based on a few records was presented in the following table (Table 2-10):

TABLE 2-10. PRESENT POWER CONSUMPTION

Utilities	Aparri Electric Plant	Camalaniugan Municipal Electric	Lal-lo Municipal Electric
1. No. of customers over 20 kwh/mo. less than 20 kwh/mo.	300	140	112 40 72
2. Kwh generated/mo. Kwh sold/mo.	7,000 5,500	6,000	6,240 5,200
3. Kw capacity of diesel generator	350 kw x 2 (one is obsolete)	50 kw x 2	50 kw x 2
4. No. of pole transformers	10 KVA x 1 25 KVA x 13 37.5 KVA x 1		
5. Line voltage	2,400 V	2,400 V	2,400 V
6. Total length of line			
7. Service hours/day	5	4	4
8. Retail rate	Meter rate	Flat ₱10/mo. ₱0.5/kwh	Min. 15 kwh ₱15.00 Over 15 kwh ₱0.7/kwh

2-9-2. CAGELCO-I and CAGELCO-II

With development programs progressed, the Philippine Government has tried to organize the provincial electric cooperatives under the guidance of NEA, so as to meet the requirements by modernization of industries and social life. Under the direction, the Cagayan Electric Cooperative-I (CAGELCO-I) has already been started to cover a southern half of Cagayan province. NEA has a program for establishment of CAGELCO-II as an urgent project to cover the remaining northern half of the province.

The proposed pumping facilities in Iguig and Alcala-Amulung will be energized by CAGELCO-I and Magapit by CAGELCO-II.

It is evident from various aspects that the rural electrification scheme in CIADP will be successfully realized in keeping good harmony with the development of CAGELCO-I and II.

CHAPTER 3. THE PROJECT

3-1. Objectives and Components of the Project

3-1-1. Objectives

13,200 hectares of paddy fields which are the proposed irrigable area in the Project have been provided with very few irrigation and drainage facilities at present. Only a single cropping paddy cultivation has been employed in the wet season throgh the year.

The CIADP is the integrated development project that the double cropping paddy cultivation shall be introduced by providing irrigation and drainage facilities in the said irrigable area and also the improvement of agri-supporting services and rural electrification shall be planned to smoothen processing and distributing the increased products, and to improve the living conditions of inhabitants.

Furthermore, CIADP programs to establish the Pilot Center for advancement of farming techniques and also to stabilize the farm management.

3-1-2. Project Components

The quantities of CIADP construction works are shown in the following Table 3-1.

TABLE 3-1. QUANTITIES OF CONSTRUCTION WORKS

Works	Unit	Iguig	Alcala-Amulung	Lower Cagayan	Remarks
Pumping Station					
Building	m^2	9x12x24	10x27x14	15x35x30	
Pump	set	3	3	4	
Diameter	mm	400	600	1,500	
Power	kw	225	750	4,800	
Irrigation Canal					Total
Main canal	km	6.4	7.6	30.2	44.2
Laterial canal	km	12.5	27.7	91.2	131.4
Farm ditch	km	34.5	79.7	639.5	753.5
Drainage canal					
Main canal (Inter cepting canal)	km	-	-	18.2	18.2
Main canal (For low land)	km	-	9.9	31.8	41.7
Lateral canal	km	6.6	7.8	54.6	69.0
Farm drain	km	12.9	30.1	240.8	283.8
Flood Control	km	-	-	1.1	1.1
Gate Construction					
Main drainage canal	portion	-	-	4	4
Road Construction (same as roads for O&M of Canals)					
Trunk road	km	-	-	27.2	27.2
Farm road	km	25.7	64.4	329.4	422.5
Supple. farm road	km	10.4	24.2	193.2	227.8
Land formation	ha	-	140	240	380
Electrification					
Pole	pcs	-	-	930	930
High Voltage line(12.2KV)	km	-	-	70	70
Low voltage line (220 V)	"	-	-	25	25
Transformer	pcs.	-	-	250	250
Insulator	pcs.	-	-	3,450	3,450
Watthour meter	pcs.	-	-	6,000	6,000

3-2. Proposed Agricultural Development

3-2-1. Proposed Land Use and Cropping Pattern

1) Proposed land use

An area of 15,190 hectares was decided as the Project Area, where 13,200 hectares are paddy fields, and the remaining 1,990 hectares contains areas occupied by irrigation/drainage canals, national and provincial roads, and residential lots. 97 per cent of 13,200 hectares paddy fields (about 12,790 hectares) will be developed to the double cropping paddy fields in providing new irrigation and drainage facilities, and 3 per cent 410 hectares to the single cropping paddy fields, where even drainage improvement will not be able to prevent from excess water.

1,990 hectares of the remaining area comprises 170 hectares of low-lying lands under the mean sea level (E L nearly 0 meter), suffering from excess standing water, 370 hectares of existing residential lots and roads and canals, and other 1,450 hectares to be occupied for proposed roads, and canals and residential lots for new settlers who will be immigrated after completion of the Project.

The low-lying area of 170 hectares will be able to be utilized as fishponds.

The following Table 3-2 shows the details of benefitted areas in CIADP.

TABLE 3-2. DEFINITION OF THE AREA

Area	Project Area[1/]	Gross Irrigable Area[2/]	Net Irrigable Area[3/]	Remarks
Iguig	710	690	600	
Alcala-Amulung	1,660	1,570	1,400	
Lower Cagayan				
Aparri	11,500	11,100	10,000	
Lal-lo	1,320	1,290	1,200	
Sub-total	12,820	12,390	11,200	
Total	15,190	14,650	13,200	

Note: 1/ Project Area: whole area covered by the project boundary

2/ Gross Irrigable Area: Project Area less residential area, national road, provincial road and swamp to be unarable land in future.

3/ Net Irrigable Area: Gross Irrigable Area less proposed canals and roads.

Source: Based on topo-map prepared by NIA, 1976

2) Proposed cropping pattern

Selection of non-photosensitive high yielding varieties is essential for introducing double cropping paddy cultivation. The most of best suited variety to the area will have maturing period in a range between 100 and 125 days. (see Appendix C-4).

The Project Area has been frequently attacked by strong wind at velocity more than 18 m/s or typhoons in a period from June to November, and furthermore, floodings caused by heavy rainfall and typhoons in October and November have damaged the area. The floodings take place once every three or four years and concentratedly in above two months.

The first crop, therefore, will be scheduled to be sowed in May, transplanted in June and harvested in September so that the crops may

escape from the flooding damages; and the second crop be sowed in November, transplanted in December and harvested in March or April, accordingly.

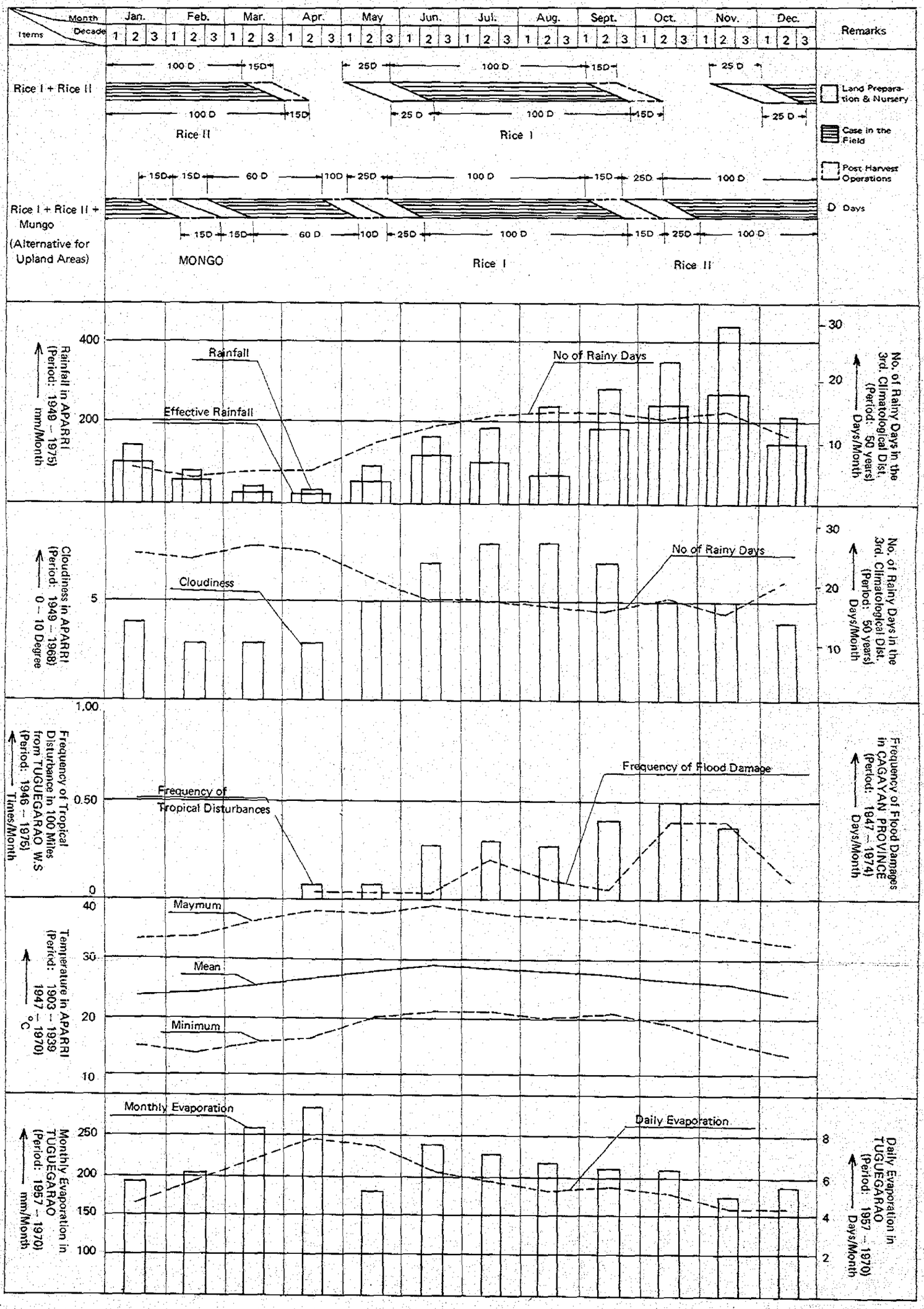
For double cropping paddy cultivation, adequately scheduled cultivation, which shall have well-arranged irrigation water and proper application of fertilizers and chemicals, will raise up the productivity to a greater extent.

The harvest season of the first crop will fall in September, the wet season, and a special care should be exercised in drying harvested paddy. Contrarily, the second crop will not encounter any technical difficulties during its growing period, if smooth and sufficient irrigation can be carried out, and much more harvest of the second crop can be expected than that of the first crop because of little suffers from pests in the season.

In future, flood control system provided in the Cagayan river basin will reduce the damages by floodings and mechanized farming introduced positively in the Project Area will allow the cultivation to be available for three crops through the year, double cropping paddy and single cropping mongo beans. The mongo beans, especially early maturing variety, can be grown as a secondary crop with dual purpose of retaining soil fertility and increasing farmers income.

The proposed cropping pattern is shown in Fig. 3-1.

FIGURE 3–1 PROPOSED CROPPING PATTERN FOR AREAS TO BE IRRIGATED



3-2-2. Proposed Farming Practices and Inputs to be Required

1) Proposed farming practices and inputs to be required

After completion of irrigation facilities, the high yielding varieties with average 125 days of maturing period shall be introduced and the rationalized paddy cultivation shall be conducted with adequate amount of inputs such as fertilizers, insecticides, and pesticides, while new seeds shall be supplied at every 3 - 4 years. The necessary quantity of fertilizers, mainly nitrogen, will be applied at 50 kg/ha for first crop cultivation and 60 kg/ha for second crop, and furthermore, insecticides, pesticides and other chemicals like weed controller shall be put in for harvesting the proposed target yield.
(see Appendix C-5)

As well-known, retention of soil fertility is one of the vitally important factor to keep double cropping in good harvest for a considerable long period. Various chemicals and other materials will have to be put in for the purpose. In this connection, the paddy straws after threshing shall be utilized as manure for the purpose of their restoration to the soil.

2) Water Management on Farm

Possibly effective and economical supply of irrigation water is quite essential to execute irrigation project successfully. The Project, which employs pump-up irrigation system requires more reasonable utilization of irrigation water, and the total amount of irrigation water was determined from the above viewpoint. Each field should make the best use of water under the rotational irrigation method. The proper irrigation and drainage for each stage of paddy growing should be conducted.
(see Appendix C-6)

3-2-3. Labour Requirement and Farm Mechanization

1) Demand and supply balance of labour

The present single cropping pattern of paddy in the rainfed area

allowed the farmers to apply comparatively little labour power; however, the double cropping pattern will require labour power more than twice as much as at present. Especially, a certain period in peak of farming works will require concentration of the labour together with improved farming practices. In order to escape from such pressure of the works at preak time, man-power rotary weeders and pedaling threshers should be introduced after the project completion. These simply operated equipment will be easily employed in harmoney with animal power, carabao, as carried out in other places in the Philippines.

Under the present situation, total working hours required for one cropping per hectare consist of 63 man-days and 19 animal-days, and contrarily, after completion of the Project, these figures will increase to 115 man-days and 22 animal-days, respectively. So, the well-balanced labour arrangement should be made for each month in the course of cultivation, in taking account the computed results of the on-farm labour balance. (see Appendix C-7)

2) Farm mechanization

CIADP with sufficient supply of irrigation water and well-arranged drainage system will require more efficient and accelerated farming works. In future when the economy of farming households grows, there will be a need to apply the multiple farming which will be operated by mechanized system. Hand-tractors will be introduced at the first stage of farm mechanization. However, large-size machinery would be employed to the fields which provide accessibility and conditions suitable to large-size machinery. For introducing such machinery, as a general rule, there should be provided the conditions that the fields have sufficient areas in rectangular shape for efficient operation of machinery.

But Carabaos will have to be employed for farming works until the growth of farmers economy permits a full scale of farm mechanization. The farm mechanization is expected to be increasingly introduced with reductions of machinery costs.

3-2-4. Productivity and Production Cost

1) Productivity

The experiment results by IRRI and the Philippine National Experiment Sation proves that approximately 60 kg/ha of nitrogen is most effective input amount for new high yielding variety to be introduced to CIADP, and the yield with above amount of nitrogen input is approximately 6 t/ha in dry season and 4 t/ha in wet season. It is learned from the fact mentioned above that the new variety has a rather high productivity in reacting to the input of 60 kg/ha of nitrogen and the other favourable farming environment to paddy cultivation.
(See Appendix C-8)

On the other hand, it is reported that some large-scaled irrigation projects in the Philippines have been producing about 4 t/ha of gross palay yieldings, and the latest information from Masagana 99, Phase V (April - October, 1975) presents the result of palay yielding from irrigated fields as approximately 4 t on a national average.
(see Appendix C-8)

After consideration of the many aforesaid factors, it was estimated that even in CIADP the proper application of fertilizers, insecticides and pesticides, and improvement of farm management would allow the farmers to produce 3.5 t/ha of palay in wet season, and 4.0 t/ha in dry season.

Thus, it was estimated that CIADP would bring about some 82,000 tons of increased paddy yielding as compared with the present paddy yields.

2) Production cost with project

In order to attain the target yields of paddy, it will be fundamental for farmers to introduce an intensified farming practices with assistance of fully controlled irrigation water. Such farming practices will be experimented and transfered to the farmers in the Pilot Center as well as the Leading Extension Farms.

The items of production cost calculated in economic evaluation consist of such labor, seeds, fertilizers, insecticides, herbicide and miscellaneous as shown in Table 3-3.

As stated in the previous Chapter 1, serious unemployment and/or underemployment was not observed in the 1970's census, so that cost of farm labor is evaluated at the prevailing rate in the area.

TABLE 3-3. PRODUCTION COST OF PALAY WITH PROJECT

(Unit: ₱/ha)

	Unit	Wet Q'ty	Wet Cost	Dry Q'ty	Dry Cost
I. Labor Requirement					
a. With Animal	man-day	22	198₱	22	198₱
b. Without Animal	man-day	92	552	92	552
II. Seed	kg	44	58	44	58
III. Fertilizer					
a. Urea	kg	56	105	67	126
b. Ammosul	kg	119	133	143	160
c. Superphosphate of line	kg	177	269	177	269
IV. Insecticides					
a. Carbofuran, G	kg	2.3	14	2.3	14
b. Cloroimeforn, G	kg	17	82	17	82
c. Diazinon, G	kg	14	124	14	124
d. Diphacinone, P	g	250	12	250	12
V. Herbicide					
a. 2-4-D Ethyester	kg	25	70	25	70
VI. Miscellaneous			30		30
VII. Total Cost			1,647		1,695

Remarks:

Unit Price

Labor

With Animal	₱ 9/day
Without Animal	₱ 6/day

Fertilizer

Urea	₱94/50kg
Ammosul	₱56/50kg
Superphosphate of lime	=₱76/50kg

Herbicide

2-4-D Ethylester	₱2.8/kg

Insecticide

Carbofuran, G	₱ 6.2/kg
Cloroimeforn, G	₱ 4.8/kg
Diazinon, G	₱ 8.9/kg
Diphacinone, P	₱48.0/kg

Note: G - Granula P - Powder Qt - Quart = 0.946ℓ

3-3. Proposed Irrigation Scheme

3-3-1. Water Sources

It is natural that water sources for CIADP should depend totally on the Cagayan river. In the Pre-feasibility Study, irrigation water to be supplied to the Alcala-Amulung area was expected to be pumped up from the Pared river, one of the tributaries of the Cagayan river. The pumping site, however, has to be relocated to the site along the main stream of the Cagayan river from the Pared river site due to foreseeable decrease of discharge by influence from Bagao Irrigation Project, which is now being undertaken by NIA.

Two other sites, Iguig and Lower Cagayan are available for taking water from the Cagayan main stream as originally planned; subsequently, the whole irrigable area in the Project will be covered by the water to be taken from the Cagayan main stream. (see Appendix D-1-1)

3-3-2. Water Requirements

In CIADP, water requirements were determined with reference to actual results taken up in the existing other projects by NIA, in taking into account the proposed cropping pattern and soil conditions.

1) Essential factors for estimate of water requirements

In the estimate of water requirements, essential factors considered are cropping pattern, evapo-transpiration, percolation, and necessary amount of water for land preparation, and the result of estimate is shown below.

Land Soaking	130 mm
Plowing and Harrowing	130 mm
Evapo-transpiration	6.4 mm/day
Percolation	2.0 mm/day

The above water requirements includes only the necessary water amount on farm level, and then, the related irrigation facilities were designed on the basis of the total water amount of the said water

requirements plus amount of water conveyance losses on the canals and ditches. The water conveyance losses are shown as follows.

On-farm losse	20%
Conveyance loss in Lateral Canal	15%
Conveyance loss in Main Canal	20%
Total losses	54.4%

Based on all the above quoted factors, the on-farm water requirements was determined as 1 l/sec/ha. Consequently, the necessary water to be conveyed from pumping station to terminal fields was determined as 1.84 l/sec/ha, which include estimated water losses and irrigation water requirements on farm. (see Appendix D-1-2)

2) Rotational irrigation

CIADP adopts the rotational irrigation method for the purpose of preserving sufficient irrigation water. There are three levels in carrying out rotational irrigation; on farm ditches, on lateral canals and on main canals. In CIADP, rotational irrigation shall be carried out on farm ditch level. Close attention should be paid to water management in the pumping irrigation due to comparatively high cost for operation and maintenance as compared with that of the gravity irrigation.

The unit area to be irrigated by rotational irrigation on farm ditch level was determined at 50 hectares on an average, and furthermore, the said unit was designed to be divided into 5 hectares sub-unit so as to carry out the effective rotational irrigatin in better combination of the terminal fields. (see Appendix D-1-3)

3-3-3. Irrigation canals

1) Canal Layout

Main and lateral canal alignments were determined based on the topomap prepared by NIA, taking into account the results of fields survey and the drainage scheme. On main canal alignment between Lal-lo and Aparri in Lower Cagayan, alternative plans were taken up and alignment

was decided after comparative studies in respect to easiness of construction works and economy; the one is to lay the canal running through the hilly lands, and the other running along the national road. The studies revealed that in the former plan, most part of the canals would be the open earth canal, excepting some 460 meters of tunnel portion, but in the latter there would be 1,650 meters siphon, approximately 500 meters culvert in residential area to be constructed, and consequently difficulty for land acquisition and cost problem are anticipated. According to the above studies, the alignment running through the low hilly lands was considered advantageous.

In two other areas, the national roads are traversing through the areas, and yet the topography presents particular features to form a basin-like shape, namely, central lower area surrounded by high elevation lands; so the main canals shall be inevitably laid along peripheral high elevation areas.

2) Type and scale of canals

With due consideration of topography of the area, longitudinal slope of canals was determined so that the water head might be allocated most economically. As a result, the slope of canals over the area was estimated at 1:3,000 on an average, but the structures were designed with rather steep longitudinal slope (e.g. 1/2,200 in the tunnel in Lower Cagayan), which would make the cross-section smaller. The water levels at respective starting points of the canals were determined as follows, based on the terminal water levels required and the longitudinal slopes; 19 meters at Iguig, 22.5 meters at Alcala-Amulung, and 15 meters at Lower Cagayan. The total length of main canals is 44.1 kilometers (3.0 m/ha) and design discharge ranges from 20.6 cu.m/s to 0.3 cu.m/s. The total length of lateral canals is 131.4 kilometers (10.0 m/ha) and design discharge ranges from 2.6 cu.m/s to 0.1 cu.m/s.

The earth canal was selected as the most economical type after careful examination of the existing canals adopted in various projects undertaken by NIA. The crossings of canals with national roads or

provincial roads, however, were designed with siphon or closed conduit.

3) Canal structures

Diversion works will be constructed to supply water in required quantity for a given irrigation area and function efficiently to divert water from main canals to lateral canals. The diversion works to be provided for water supply from lateral canals to firm ditches shall be constructed to meet hydraulic conditions of the canals and the mode of water utilization together with serving the purpose of measuring the dishcarge. In CIADP, the double orifice gate was designed to be used for discharge below 0.85 cu.m/s, and the gate, for discharge more than 0.85 cu m/s and the water shall be conveyed through Parshal flume.

Movable check gate shall be installed to keep the necessary water level for taking the required irrigation water. The steel gate shall be adopted for the main canal and wooden one for the lateral canals. (see Appendix D-1-4)

3-3-4. Model Area

The model area for designing of terminal facilities was selected at Barrio Afunan, Camalaniugan, Cagayan Province. The said model area, comprising 80 hectares paddy fields, extends along the lateral canal F and the national road connecting Camalaniugan with St. Teresita. For carring out the water management in the said model area, 4,570 meters of main and supplemental farm ditches and 1,720 meters of farm drain ditches are to be provided. Density of the said ditches is estimated at 57.1 m/ha for irrigation ditches and 21.5 m/ha for drain ditches. (see Appendix D-1-5)

3-3-5. Pumping Stations

1) Iguig pumping station

The Iguig pumping station was designed to provide the pumping capacity at 1.10 cu.m/s from the Cagayan river to serve the area of 600 hectares in the Iguig area.

The location was selected at the upstream portion of the irrigable area in Barrio Minaga Sur, in taking into account the various conditions such as the Cagayan river, confluence with creeks, layout of canals, and arrangement of houses in the village.

The water level of the Cagayan river fluctuates in a range of more than 15 meters in the drought and the floods. The design of pumping facilities, type of intake, and buildings was made as shown in Fig. 3-2, in due consideration of the factors such as availability for pumping-up even in the drought, and sediment prevention and non submersible structures in the floodings.

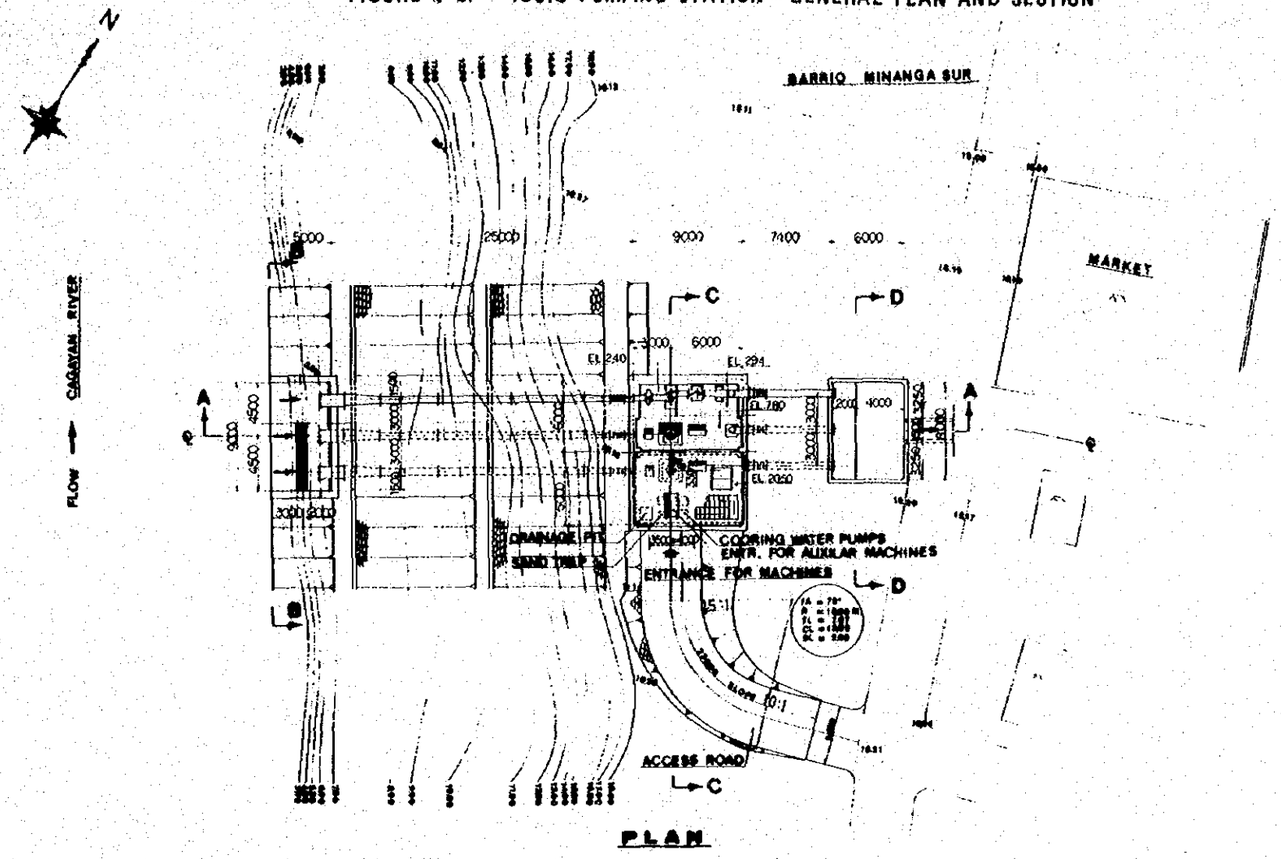
The designed dimensions of the pumps are 1.10 cu.m/s for water requirements, 22 meters for designed lift, and three sets of 400 millimeter diameter vertical volute pumps with 75 kilowatt power motor.

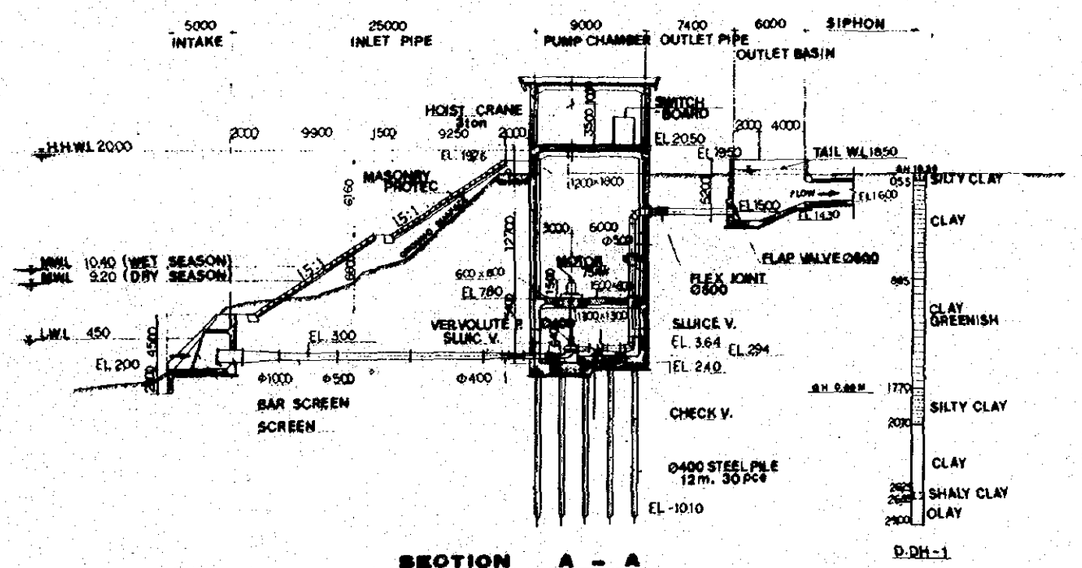
As a result of comparative study of electric motor with diesel engine, operating cost of motors was estimated at about 33 per cent lower than that of diesel engine, in case that the electric power supply would be available from the utilities provided in CAGELCO-1; consequently, the electric motors should be adopted as prime mover in this scheme.

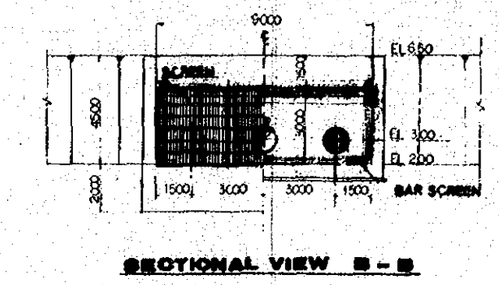
The bearing capacity of the foundation is not sufficient on the site where the clay layer distributes thickly. Therefore, the pile foundation will be inevitably required for securing the necessary bearing capacity.

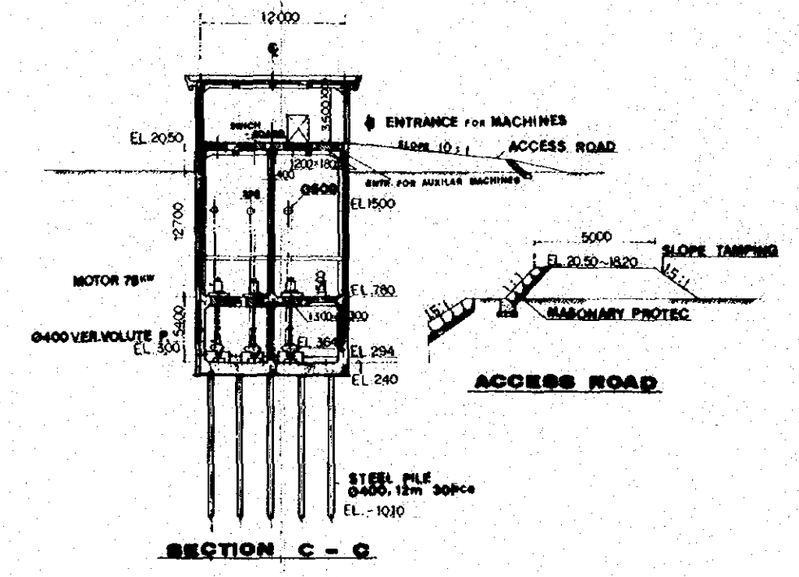
Furthermore, for the area of 125 hectares extending in high-elevated land at eastern part from Barrio Capitan, two sets of booster pumps shall be provided at Barrio Capitan for supplying waters (0.23 cu m/s for designed intake capacity, 10 meters for designed lift, 250 millimeters in diameter horizontal mixed low volute pump with 18.5 kilowatt power motor.) Fig. 3-3 shows the details of the pump (see Appendix D-2)

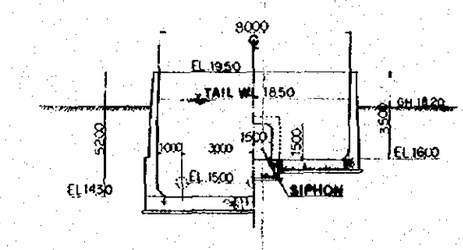
FIGURE 3-2. IGUIG PUMPING STATION – GENERAL PLAN AND SECTION





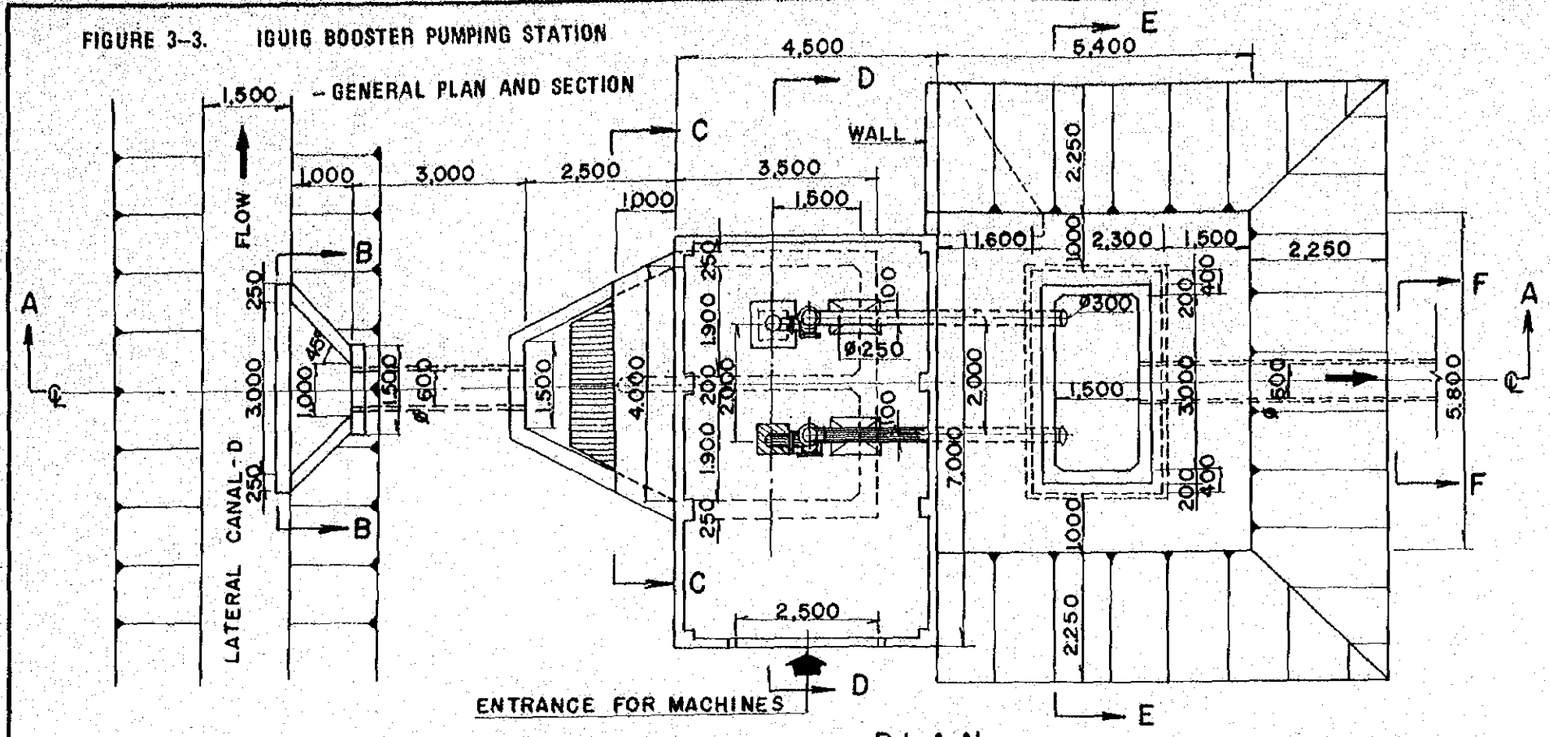






CIADP	CAGAYAN PHILIPPINE
IGUIG PUMPING STATION GENERAL PLAN AND SECTION	
JAPAN INTERNATIONAL COOPERATION AGENCY	

FIGURE 3-3. IGUIG BOOSTER PUMPING STATION - GENERAL PLAN AND SECTION



CIADP	CAGAYAN PHILIPPINE
IGUIG BOOSTER PUMPING STATION	
GENERAL PLAN AND SECTION	
JAPAN INTERNATIONAL COOPERATION AGENCY	

2) Amulung pumping station

The Amulung pumping station was designed to provide the pumping capacity at 2.6 cu.m/s from the Cagayan river to serve the paddy field of 1,400 hectares in the Alcala-Amulung area.

The location was selected at the western part of Barrio Baculud which is situated nearly in the center of the irrigable area extending along the Cagayan river, in taking into account various conditions such as river condition, canals, and arrangement of houses in the village.

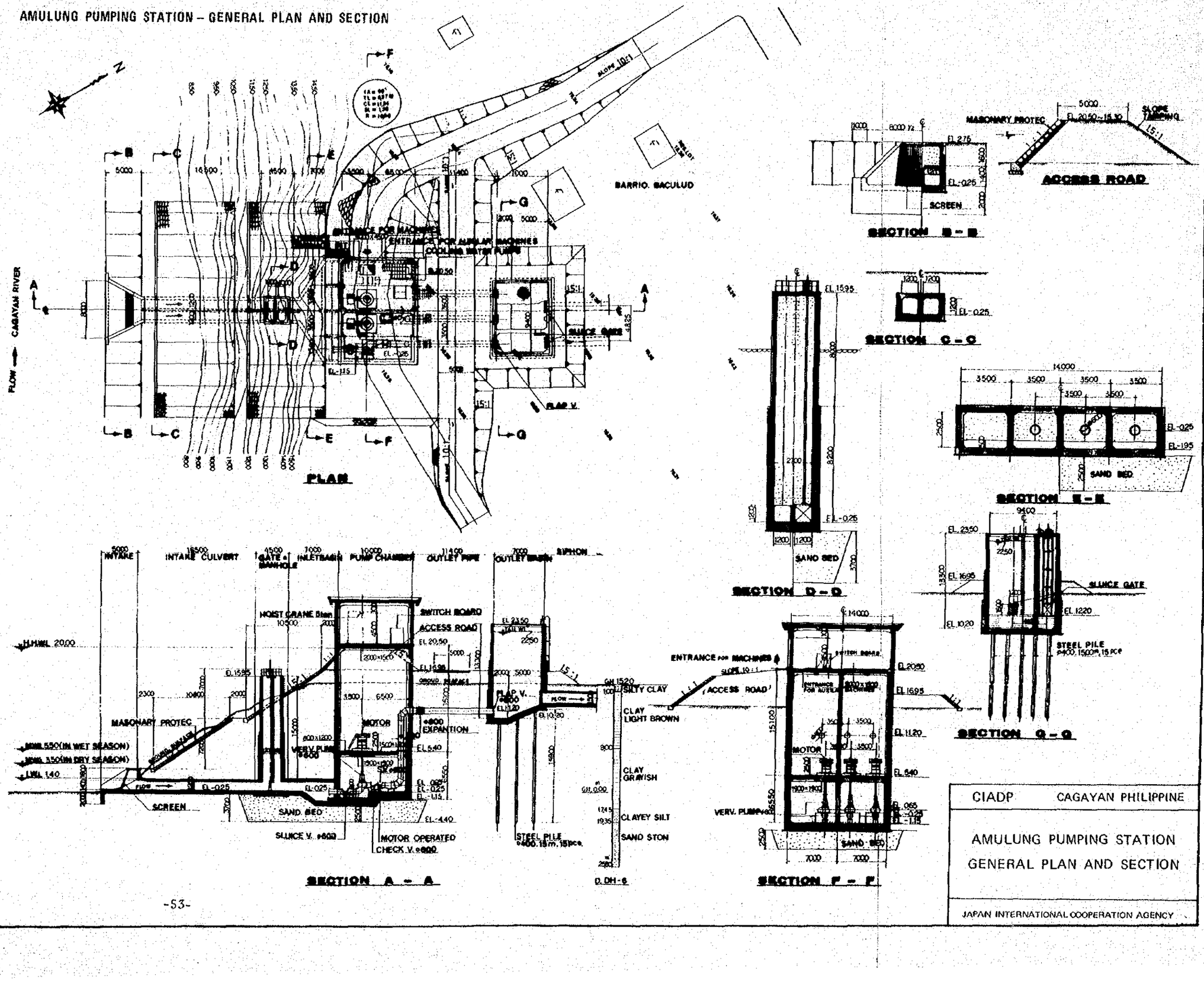
The river conditions around the pumping site present almost the same features as the Iguig case, and the facilities, type of intake, and the building were designed in due consideration of the factors such as availability for pumping-up in the drought, and sediment prevention and non-submersible structures in the floodings. The details are shown in Fig. 3-4. The designed dimensions of the pumps are 2.6 cu.m/s for water requirements, and three sets of 600 millimeters in diamter vertical volute pumps with 250 kilowatt power motor. The designed lift of the pumps is 22meters, and two outlet basins shall be provided, namely, the one for high lift and the other for low lift (17 meters). The outlet basin for low lift shall serve the purpose of irrigation to the comparatively low lands 1,500 hectares, lying around the said pumping station for saving the running cost.

Around the site, it was presumed that the sand-stone would be encountered 2 meters below the bottom of the structures, and therefore, the foundation treatment should be made by displacing method of sand-stone with sandbed. (see Appendix D-2).

3) Magapit pumping station

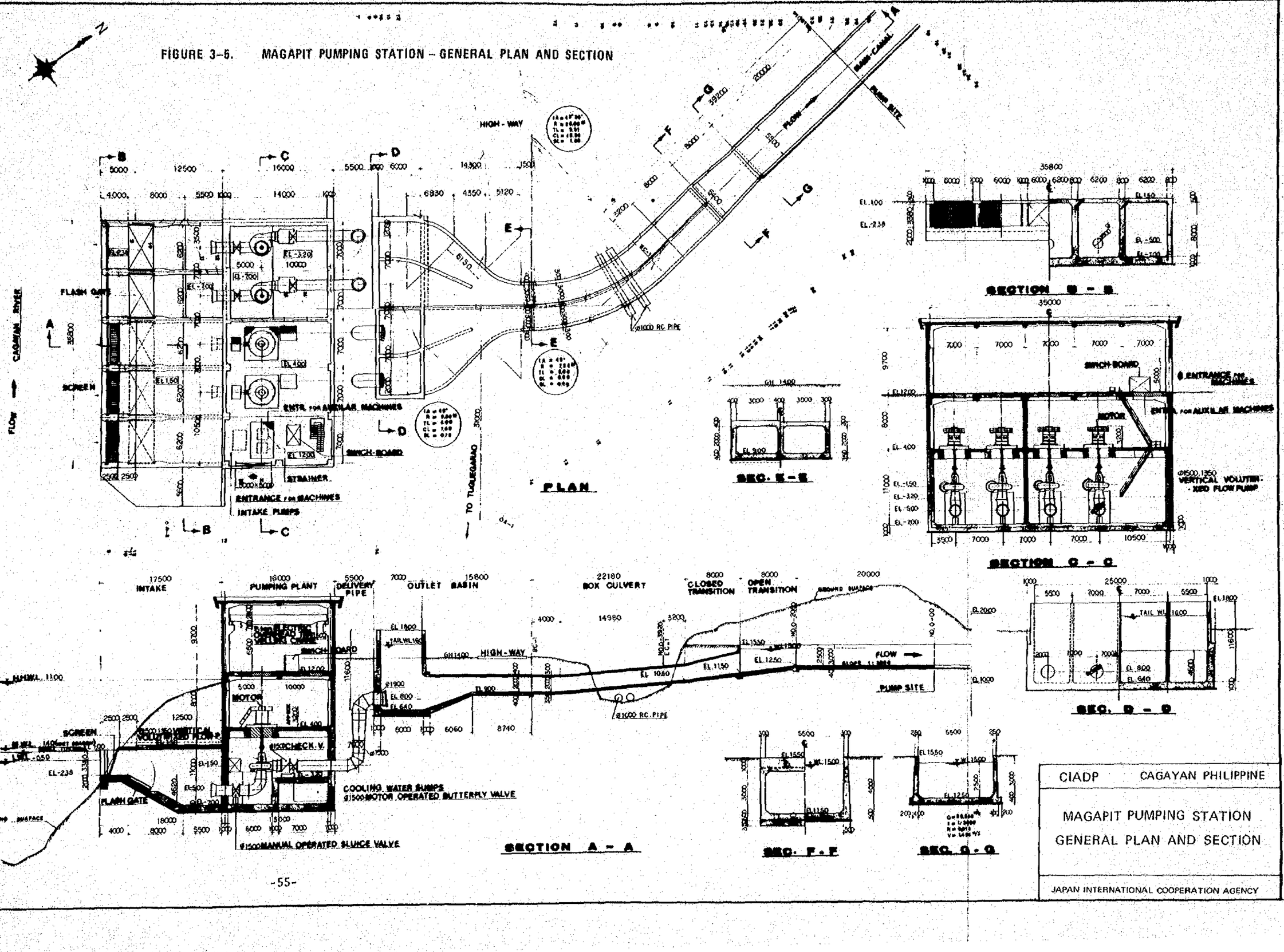
The Magapit pumping station was designed to provide the pumping capacity at 20.6 cu.m/s from the Cagayan river to serve the paddy fields of 11,200 hectares (Aparri 10,000 hectares, Lal-lo 1,200 hectares) in the Lower Cagayan area.

FIGURE 3-4. AMULUNG PUMPING STATION – GENERAL PLAN AND SECTION



CIADP	CAGAYAN PHILIPPINE
AMULUNG PUMPING STATION GENERAL PLAN AND SECTION	
JAPAN INTERNATIONAL COOPERATION AGENCY	

FIGURE 3-5. MAGAPIT PUMPING STATION – GENERAL PLAN AND SECTION



CIADP	CAGAYAN PHILIPPINE
MAGAPIT PUMPING STATION GENERAL PLAN AND SECTION	
JAPAN INTERNATIONAL COOPERATION AGENCY	

The location was selected at the point 150 meters upstream of the Magapit bridge, in taking into account the topographical restrictions, prevention of sediments in the floodings, and adverse flow of saline water under the abnormal drought. Under the situations, it is deemed suitable to adopt the gate system which keeps the intake capacity stable to meet the water requirements corresponding to fluctuation of the water level. Compact type structures were designed for this station because of restricted site conditions such as foundation consisting of Magapit-rock and construction space blocked by national road and creek.

The designed dimensions are 20.6 cu m/s for water requirements, 18.0 meters for the designed lift and four sets of 1,500 millimeters in diameter vertical volute pumps with 1,200 kilowatt motor power. The details are shown in Fig. 3-5.

It is anticipated that the supply source of the power for total output of 4,800 kilowatt would be available by CAGELCO-II. Regarding the running cost of the pumps, the electric motor is about 28 per cent lower than the case of diesel engines, just like the case in Iguig which will receive the power supply from CAGELCO-I. Consequently, the electric motors should be adopted as the prime mover (see Appendix D-2).

4) Operation method of pumps

It is essentialy required to operate pumps at their maximum point of efficiency for minimizing the running costs. Consequently, the pumps should be operated by way of controling number of pumps to be driven and their operation hours, so as to meet the seasonal change of water requirements. This method is considered most suitable and economical in this Project, the main crop of which is paddy.

Furthermore, it is required to operate pumps in corresponding to the water management under rotational irrigation to systematized on-farm blocks.

Regarding the operation hours, it was estimated that the necessary daily running hours would be about 10 hours (42-43 per cent) in first crop for each station, and about 18 hours (61 per cent) for Iguig and Amulung, 13 hours (43 per cent) for Magapit in second crop, but excepting the month of May when full operation, 24 hours running required. The yearly average of running hours are in a range from 10 - 12 hours (43-51 per cent), and subsequently the two-shift operation system would serve the purpose. (see Appendix D-2)

3-4. Proposed Drainage Scheme

Rearrangement and improvement of drainage canals in the Project Area (including river improvement and new canal construction) shall be carried out aiming at formation of paddy fields suitable for double cropping throughout the year for existing paddy fields and possible reclamation for the swamp area.

3-4-1. Design Rainfall and Run-off

Based on the rainfall data recorded at both observation stations in Aparri and Tuguegarao, for the past 25 years, design rainfall was determined as the probable rainfall at 1/5 from the viewpoints of economy and rainfall frequency.

As well-known, however, the relevant rainfall is of particular characteritics with concentrated rainfall with high local intensity, and consequently, such spot rainfall was converted into areal rainfall by applying Horton's equation to obtain the design rainfall in the area.

For paddy fields, the design rainfall was determined in a range from 239 millimeter to 261 millimeter based on 3-consecutive days in taking into account the field surface storage and standing water; and for the mountainous area, in a range from 173 millimeter to 183 millimeter based on daily rainfall in taking in account the vegetation and non-effect of surface storage. (see Appendix E-2)

Due to absence of observation data, coefficient of run-off from the mountainous area was determined as 0.4 on an average in applying the run-off coefficient in the data of the Texas Highway Department, USA, together with consideration of the actualities of the catchment in the Project Area. The coefficient of run-off from the paddy fields was obtained by unit hydrograph derived from Dr. Mononobe's graphic analysis which was developed graphically from Ekhal's analysis.

Based on the above-mentioned various factors, the respective unit run-off was obtained as 6.4 cu.m/s per plain area and 8.4 cu.m/s for mountainous area on an average.

The total run-off for respective areas was estimated at approximately 150 cu.m/s in Aparri, 70 cu.m/s in Lal-lo, both in Lower Cagayan, 40 cu.m/s in Alcala-Amulung, 10 cu.m/s in Iguig. (see Appendix E-3)

3-4-2. Canal Alignment and Drainage Facilities

Layout of drainage canals was made based on topo-map prepared by NIA taking into account the slopes of topography and layout of irrigation canals. Particularly, the canal alignment in Aparri area of Lower Cagayan was carefully decided having regard to improvement of swamp area which extends in the center of the vast low-lying flat of Aparri. Consequently, 44 square kilometers of the mountain side catchment of the Dalaya Creek will be transposed to the Agguigang Creek so that the run-off to the relevant area may be shut out. Furthermore, the run-off from the mountain side catchment, 52 square kilometers shall rapidly flow out of the said area through the intercepting canal to be provided along the national road.

In the low-lying flat land, the main drainage canal shall be constructed along the sea shore so that discharge from every lateral canal may rapidly flow out of the said area. At the downstream portion of the main canal, two adverse tide gates shall be constructed to protect the said area from adverse tide. As a result of the study on water balance between the inflow water and outer water level, even these gates to be

provided cannot prevent excess standing water completely in the wet season and approximately, 410 hectares will suffer ponding with water more than permissible depth. It is expected, however, that the completely mechanized drainage facilities, which could be provided in the future with the increase of farmer's income, will improve the total swampy area into paddy fields suitable to double cropping cultivation throughout the year. (see Appendix E-4)

The total length of canal facilities is 410 kilometers (main canal 60 kilometers, lateral canal 70 kilometers and farm drains 280 kilometers).

Density of canals was estimated at 31 m/ha

The total length of existing main and lateral canals requiring rehabilitation amounts to approximately 75 kilometers, equivalent to 60 per cent of 130 kilometers. Total excavation volume was estimated at approximately 3.3 million cubic meters.

All canals shall be of earth type and the side slope of canals was determined as 1.5 : 1, in due consideration of clay loam soil features, excavation depth ranging from 2 - 1 meters and protection of the side slope from collapsing.

The 4 meters width farm roads shall be constructed on one side of the canal banks for serving dual purpose of access roads of machinery for operation and maintenance (i.e. back-hoe, etc.) and farm roads. The other side of the bank shall be provided with 2 meters width farm roads for their exclusive use.

If the bottom width of the canals is more than 15 meters, the 4 meters width road shall be constructed on both banks to serve operation and maintenance of these canals.

As for the 15.8 kilometers portion of main canal running along the seashore, a dike shall be constructed to function with triple purpose of protection against adverse tide, trunk road between Aparri and Buguey, and operation/maintenance road. For main structures, two adverse tide gates with 15 meters effective width shall be installed on the main drainage canals passing through the low-lying land. Furthermore, short-cut structures shall be installed at the conjunction of the Agguigang and the Dalaya creek to carryout separation of catchment basin. A dike with 2 meters embankment height and 6 meters crest width shall be constructed at 11 kilometers downstream point from the national road to serve dual purpose for traffic and flood protection. (see Appendix E-5)

3-5. Road Networks

In the Project Area, arrangement and improvement of farm roads as well as national and provincial roads are essential for mass transportation of agricultural inputs and products brought about by mechanized intensified farming and betterment of farmers living environment. Especially, completion of drainage system in Aparri area in Lower Cagayan will cause the existing swamp areas to be decreased and the water level of the creeks to be lowered, and thus the transportation by water will be switched to that by land due to inability of navigation by Banca, (small boats) through creeks.

3-5-1. Kinds and Layout of Roads

The roads are classified as trunk road, farm road and its supplements by their layout and purpose to serve. Trunk roads will serve not only the farming activities and distribution of its products, but also the general traffics. Two trunk roads were designed to be provided along the Babuyan channel in connecting Aparri with Buguey in the Aparri area, where the national road is running one-sided, and traversing in the center of the area in connecting with provincial road.

Farm roads shall be constructed along every irrigation and drainage

canals, serving dual purpose of farming works and operation/maintenance services for the canals.

Supplementary farm roads shall be constructed along the main farm ditches, serving the purpose of facilitating the operation and maintenance of the terminal facilities for smooth rotational irrigation.

3-5-2, Width and Total Length of Roads

The trunk roads shall have the total width of 6 meters, effective width 5 meters, so that jeepenys, trucks and tractors (with 10 horse powers) may pass each other. The said roads were designed in the Aparri area with total length about 27.2 kilometers (2 m/ha). The width of the farm roads depends on the kinds of canals, on the banks of which the said farm roads are to be provided. The width of farm roads along the irrigation canals was determined based on the NIA criteria; that is,

In case of canal discharge is,

more than 5 cu.m/s, the total width of the road is 5 meters and effective width 4.5 meters

less than 5 cu.m/s, the total width of the road is 3.5 meters and effective width 3.0 meters

The farm roads along the drainage canals shall be generally constructed on one side of the canal banks with width 4 meters, effective width 3.5 meters in taking into account the accessibility of machinery for maintenance of the drainage canals, which was designed with comparatively wide bottom width. In case that the drainage canals have the bottom width more than 15 meters, the farm road shall be constructed on both banks. The designed total length of the farm road is about 422.5 kilometers (32 m/ha).

The supplementary farm roads shall have the width of 2 meters, effective width 1.5 meters, for accessibility of animal carts or power tillers (10 horse powers). The designed total length of supplementary farm roads is 228.4 kilometers (17 m/ha).

Consequently, the designed total length of all roads is 678.1 kilometers (51 m/ha), and adding the existing road length of 81 kilometers (6 m/ha), the sum total of the road length in the Project Area amounts to 759.1 kilometers (57 m/ha). (see Appendix F-3)

3-5-3. Road Construction and Structures

The proposed roads were designed to be constructed mostly in the plain lands and then, the earth embankment type was adopted. The earth materials required for embankment will be available with residual earth by canal excavation and construction. Such earth materials in the Project Area, however, are mostly clayey soil, which will turn into mud in a wet season. Therefore, earth materials taken from borrow pits around the sites should be banked with 20 centimeters thickness on the road surface and furthermore, gravel pavement should be made with 15 centimeters thickness for finishing.

With improvement of road networks bridges over canals, mainly drainage canals, are necessarily required as road structures. These bridges shall be constructed at approximately every 5 kilometer to the total road length with structure of 4 meters floor slabs placed on abutments with steel pile. About 30 bridges were designed in the whole Project Area. (see Appendix F-4)

3-6. Rural Electrification

3-6-1. Purpose and Scope of the Electrification Scheme

The rural electrification aims to upgrade the living standard of the inhabitants by utilization of electricity supplied at low cost in good quality. The scheme will cover five municipalities along the national road from Gattaran to Aparri and Buguey.

3-6-2. Load Forecast

Since the data collection for load forecast in the objective area

was considerably difficult, the study was carried out based on the demographical distribution data. Brief Socio-Economic profile, Province of Cagayan, November, 1975, revealed that population growth rate in the Cagayan river mouth area was 2.3 per cent per anum. In the study, this growth rate was regarded as fixed one for coming 10 years or so to estimate the demography by years from 1979 to 1988, and the results was presented in Table 3-4.

Based on the projected population and NEA's Project Assumption (Form NEA/FS-3.2) yearly consumption and load forecast were made for 10 years from 1979 to 1988 and the results were shown in Table 3-5. Yearly load, kw, was shown in Fig. 3-6 as the result obtained from proportionating the respective kw levels to each municipalities by their corresponding yearly population.

3-6-3. Physical Planning

In planning the system, emphasis was placed on the followings.

1. Span length of wood poles:
   An average span of 50 meters for densely populated areas and a standard span of 100 meters for sparsely populated areas.

2. Guywire:
   For transversal, two guywires for every five poles, and for longitudinal, one guywire for every five poles.

3. Crossarm:
   Hot dipped galvanized steel, double crossarm on one pole for every five poles.

4. Insulator:
   In Aparri and Buguey areas, insulators of salt-proof type will be used within 5 kilometers range from seaside.

TABLE 3 — 4 POPULATION PROJECTION

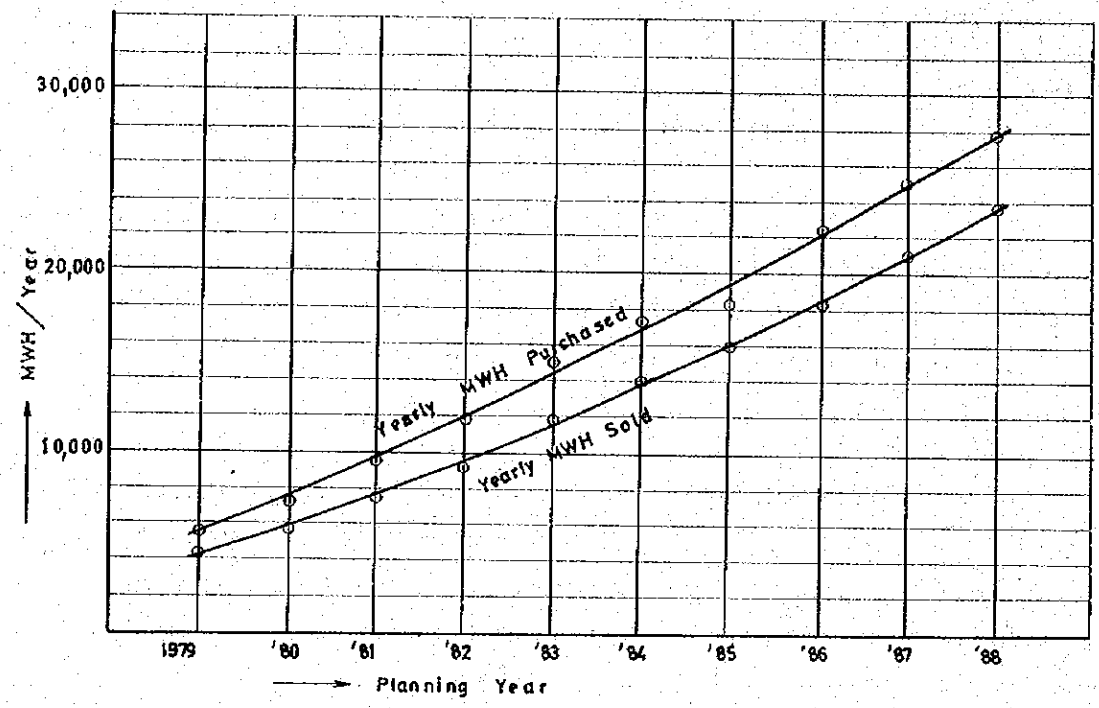
(AVAILABLE FOR SERVICE CONNECTION)

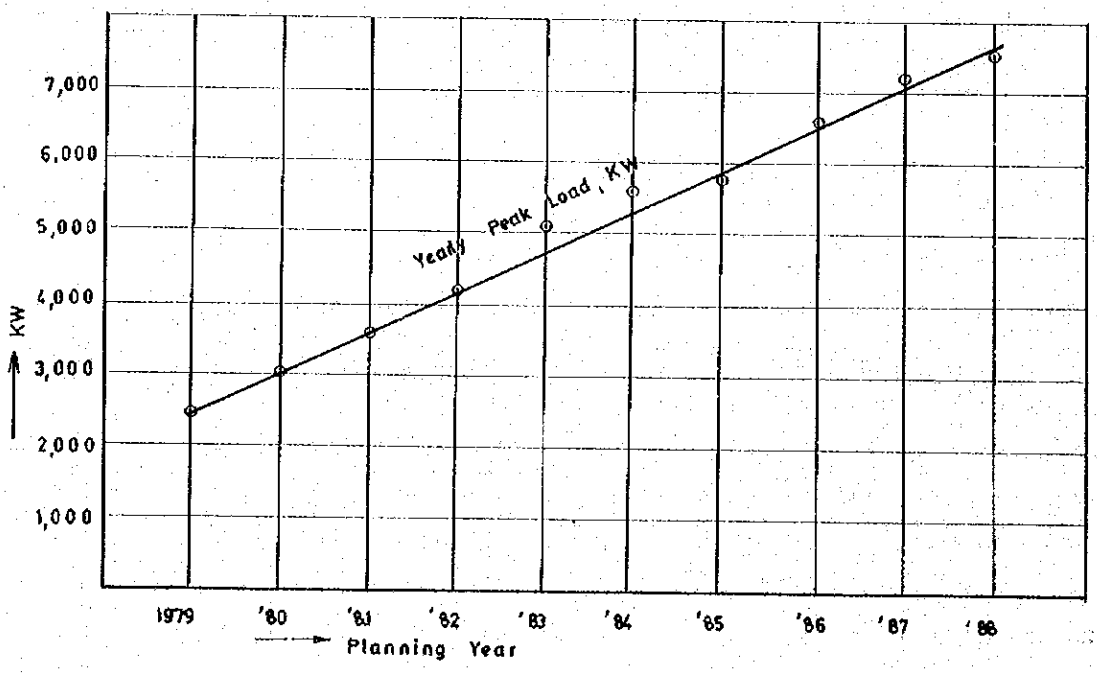
	Planning Year									
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Poblaciones	26,790	27,441	28,045	28,695	29,360	30,040	30,735	31,448	32,176	32,921
Barrios	121,985	124,810	127,701	130,659	133,685	136,781	139,949	1,431,191	146,508	149,901
% to be Served	25	10	8	8	7	6	6	5	5	5
No. Availabe	30,496	12,481	10,216	10,453	9,358	8,207	8,379	7,160	7,325	7,495

TABLE 3 — 5 PROJECT ASSUMPTIONS

Planning Year		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Population Growth Rate		0.023 for both of Poblaciones & Barrios									
No. of People per House		6 for both of Poblaciones & Barrios									
Load Factor		0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.46	0.48	0.50
System Loss in %		24	23	22	21	20	19	18	17	16	15
Peaking Factor		1.2									
Connection Level in %	Houses — Poblaciones	50	55	60	65	70	75	80	85	90	95
	Houses — Barrios	35	40	45	50	55	60	65	70	75	80
	Small Commercials as % of H/H	5.75	5.70	5.65	5.60	5.55	5.50	5.45	5.40	5.35	5.30
	Security Light as % of H/H	3.00	2.95	2.90	2.85	2.80	2.75	2.70	2.65	2.60	2.55
	Public Buildings as % of H/H	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6
Consumption Rate in KWH/Month	Houses — Poblaciones	40	45	50	55	60	63	66	69	72	75
	Houses — Barrios	33	36	39	42	45	47	49	51	53	55
	Small Commercials	90	100	110	120	130	140	150	160	170	180
	Public Buildings	40	45	50	55	60	65	70	75	80	85
	Security Lights	55									

FIGURE 3 — 6 YEARLY LOAD FORECAST (MWH, KW)





5. Conductor size:

To be carefully selected in anticipation of future expansion of the system, and to keep voltage drop within 10 per cent at customers' level when fully loaded.

6. Equipments:

To be interchangeable between Cooperatives.

According to NEA, National Power Corporation has a plan to complete the transmission line with 69 kv for the Cagayan Valley and sub-station in Camalaniugan by April, 1979, and CAGELCO-II can receive power supply from the said scheme. Subsequently, no power generation scheme was made in this program.

The distribution backbone system will be served by means of two units of four circuits of 7.62/13.2 kv switch-gears emanating from a 15,000 kva step-down transformer installed in the NPC's sub-station. The remaining two circuits of switchgears are allocated to supply the pumping station in Magapit.

The skeleton diagrams of the backbone system and system voltage are shown in Fig. 3-7 and 3-8 respectively.

3-7. Extension Services

Extension services in the Project Area will be carried out in accordance with "Agriculture Program" which is one of main program in CIADP. (see Appendix C-9) CIADP Agriculture Program comprises three kinds of programs, namely Agricultural Pilot Center (APCTR) Program, Leading Extension Program and Extension Service Program. These programs will be implemented by the APCTR which will be established under the technical assistance of the Japanese Government, and present organizations concerned with extention and seed-expansion service, especially Bureau of Extension (BAEx) and Bureau of Plant Industry (BPI) respectively.

FIGURE 3 – 7 BACK-BONE DISTRIBUTION SYSTEM

(13.2 KV, 3ϕ, 4W)

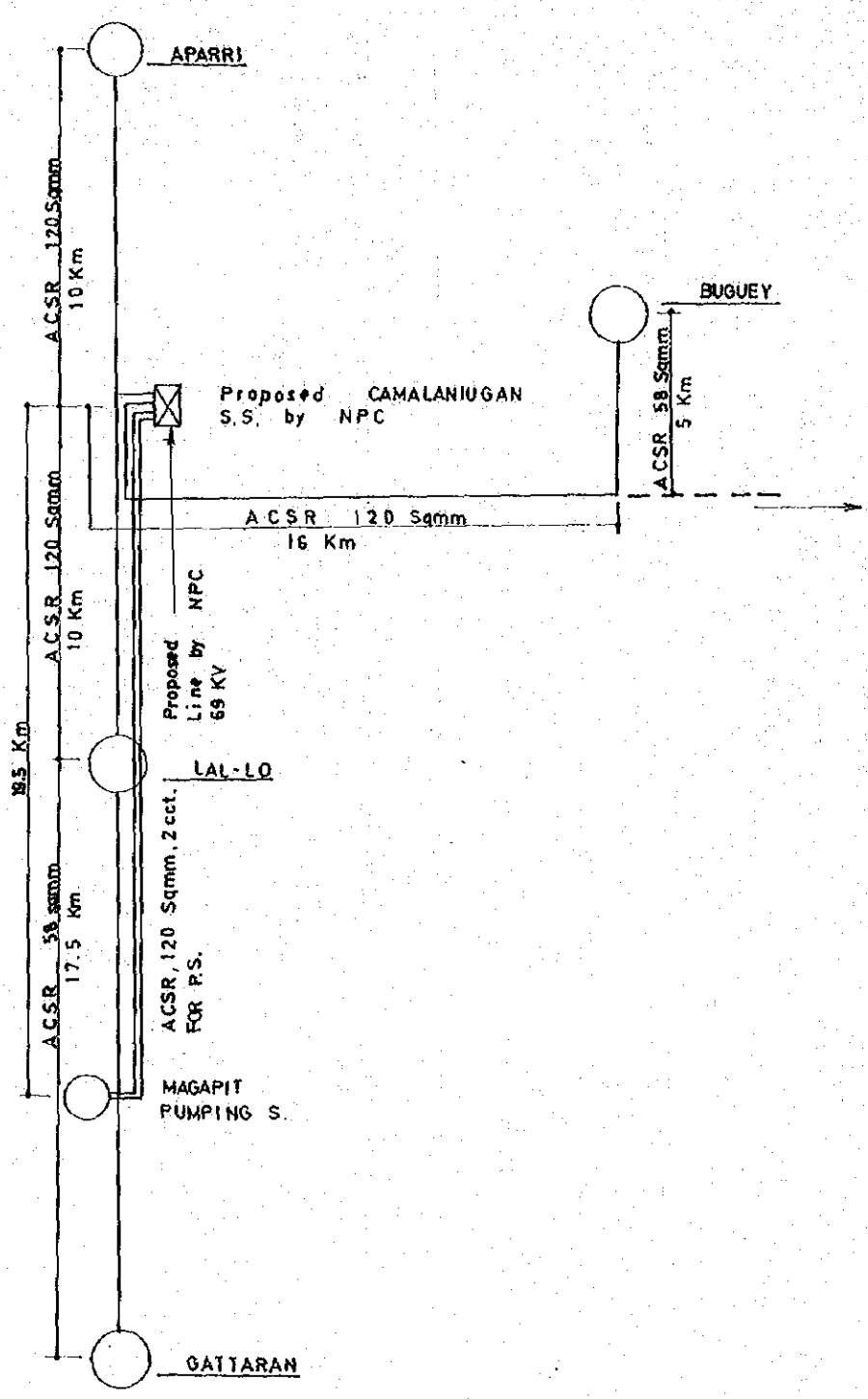
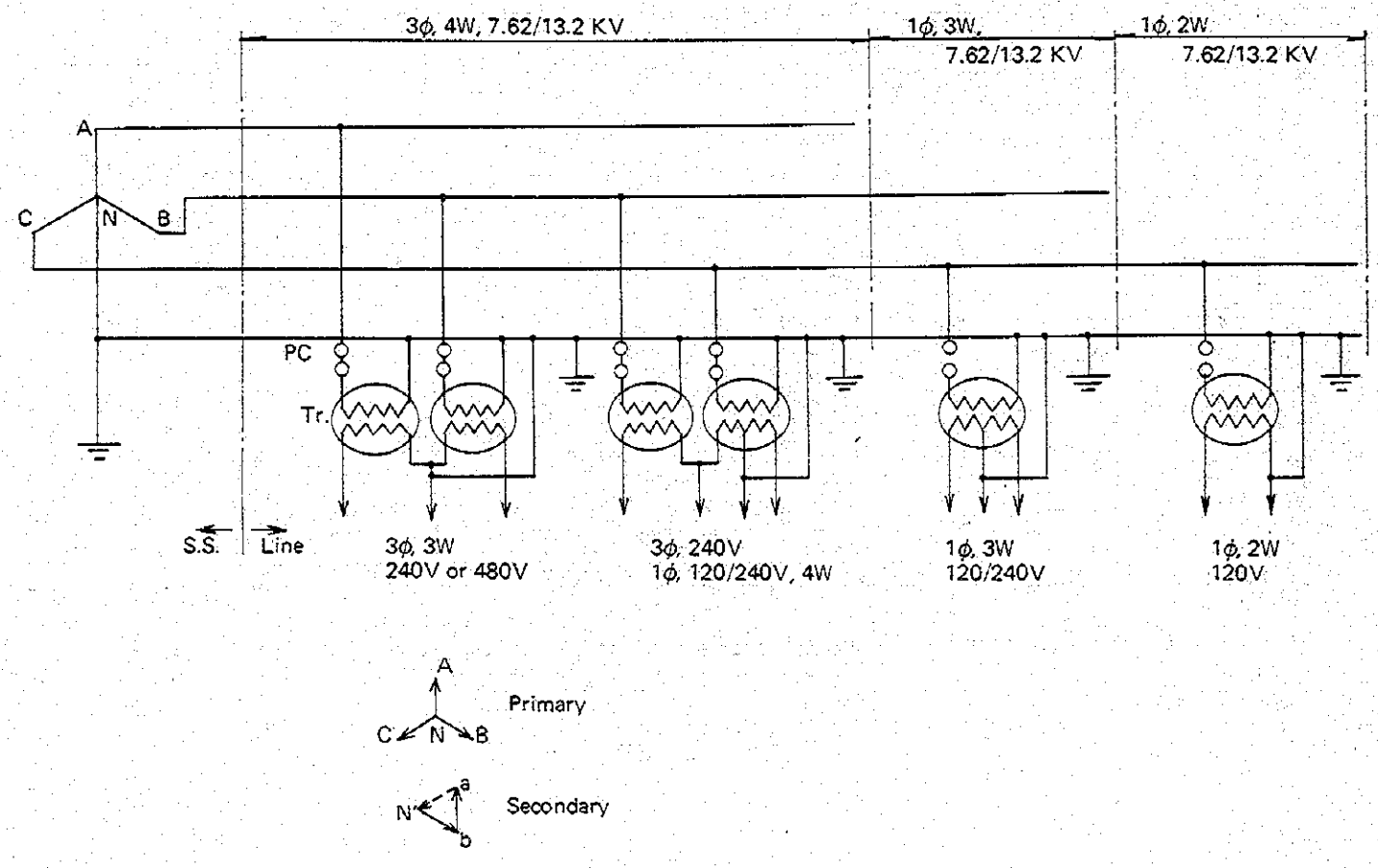


FIGURE 3 — 8 **DISTRIBUTION SYSTEM**

7.62/13.2 KV, 3φ, 4W, COMMON NEUTRAL
MULTIPLE - GROUNDED



1) APCTR

APCTR will be located in Iguig in consideration of accessibility and its scale, facilities to be provided, and the functions are as follows.

APCTR will have 6 hectares of consolidated field with pumping irrigation and drainage facilities, comprising trial farm, seeds and extension farms and training farm. And also APCTR will set up two "Leading Extension Areas" in the Project Area, namely in Iguig Area and Alcala-Amulung Area. The plan of APCTR is shown in APPENDIX C-9.

According to the APCTR Program involved in CIADP Agriculture Program, APCTR will function to implement three sub-programs of APCTR Program as follows.

a) Development, improvement, and data arrangement of farming techniques to be applied to the farming in the CIADP area (Trial Program),

b) Attempts to introduce and stabilize the new high yielding varieties to the irrigated fields (Seed Expansion Program),

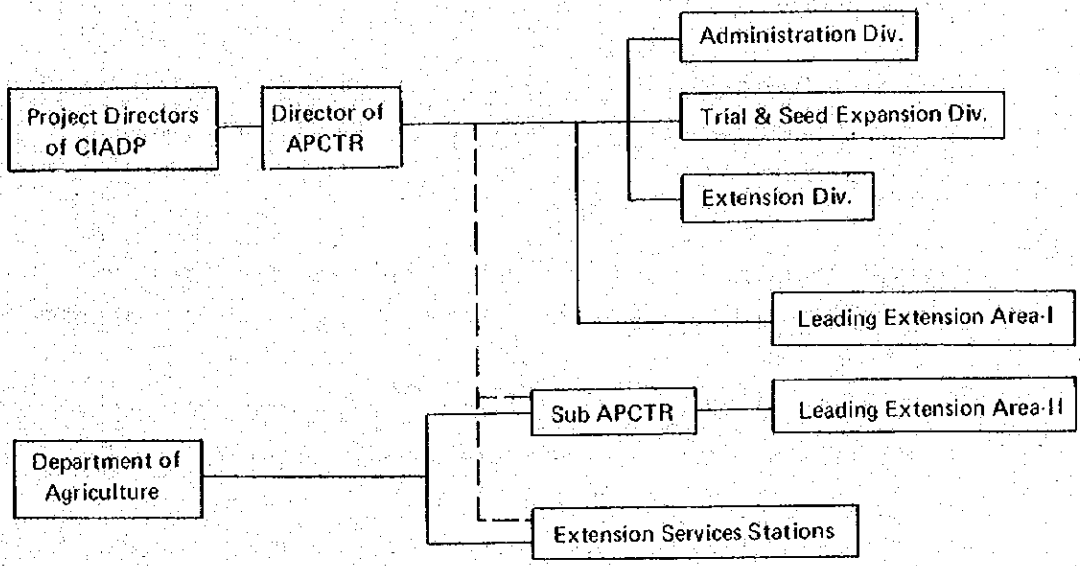
c) Trainning of extension workers and core farmers in the Project Area and giving guidance and information about new techniques developed in APCTR (Extension Program).

According to the so-called, "Leading Extension Program" involved in the CIADP Agriculture Program the APCTR staff will give a guidance to the farmers in the "Leading Extension Areas" on the new intensified farming techniques and demonstrate practical farming works by the farmers themselves in the fields with similar conditions to the actual paddy fields in the Project Area. The staff also will try to encourage the farmers to organize the bodies for water and farm management and to make extension services in establishing water control system, introducing new farming techniques, and improving old-fashioned farming practices. The irreducible minimum scale of farm mechanization shall be introduced to

the Leading Extension Area by leasing machines and granting agricultural materials at reasonable costs, which will be one of the means to bring about the impact at minimum.

APCTR will be managed and operated under the organization as shown Figure 3-9.

FIGURE 3-9. ORGANIZATION CHART OF APCTR



The chief of APCTR will supervise "Leading Extension Area-I". The Department of Agriculture will control the "Sub APCTR", the "Leading Extension Area-II" and extension workers offices in each municipality, involving in the existing Departmental organization. These last three organizations shall function in organical coordination with APCTR.

The required staff for operation of APCTR, such irrigation engineers, agronomists and water management expert will be dispatched from both the parties, governments of the Philippines and Japan. The operation of APCTR will be carried out by the Philippine authorities concerned under the closest cooperation with BAEx and BPI.

Extension services are one of the most important programs involved in CIADP Agriculture Program as "Extension Service Program". Implementation of the program will be made by the government of the Philippines with the existing extension workers offices available, which shall be supplemented to strengthen their power.

Actually, they will serve in the following fields.

2) BAEx

BAEx belongs to DA and has responsibility for extension service. The Project Area is covered by BAEx region II which shall support the agricultural development of this Project Area. There are 79 of farm management technicians who are in charge of the services in Cagayan Province. And in the Masagana 99 program from Phase I to IV, the 170 hectares were covered by one farm management technician in the province.

Farmers in the project area have to be provided for intensified extension service with sufficient numbers of well-trained farm management technicians. APCTR will give chance to train farm management technicians to meet the project requirements.

It is desirable for Masagana 99 program, which can supply farming inputs together with technical guidance as a package deal, to be concentratedly employed to the Project Area so that more effective services may be carried out.

3) BPI

BPI which is also one of the bureau in DA is responsible for seed production. Supply of high yielding varieties on schedule to irrigated area is one of the key points in the process of changing paddy fields from rainfed to irrigated. BPI Region II which is covering Project Area has been already undertaking to expand seed production facilities with assistance of Japanese specialists, so as to make sufficient and timely supply of the seed to the farmers in the Project Area.

Besides the above services, BPI is in charge of research of countermeasures for insects and pests together with other experimental works. These services made for the Project Area shall be carried out in close cooperation with APCTR.

3-8. Agro-institutional Establishment

3-8-1. Organizations for Water Management and Farm Management

The pumping irrigation system shall be provided in CIADP. It is natural that the operation and maintenance costs for pumping irrigation is higher than that for gravity irrigation. The operation and maintenance costs for CIADP are estimated at about ₱360 per hectare on a yearly average, while those for gravity irrigation of existing projects in the Philippines are about ₱250.

The pumping irrigation has limit of taking water within a range of its designed capacity for pumping and so the areas located downstream of irrigation canals may suffer from water shortage if the water is over taken in the upstream of the canal. Taking into account the above factors, proper and systematical water distribution is quite essential so that the effective irrigation may be carried out with limited amount of water at comparatively high cost. The systematic water utilization only can serve the purpose of securing the effective pumping irrigation.

Terminal blocks with 50 hectares will be a basic unit for the farm management. The organization for operation and maintenance of the system will be established by NIA. One ditch-tender for terminal 50 hectares and one gate keeper for 600 hectares shall be positioned to play important roles in water distribution, and operation and maintenance of the terminal facilities. These personnels also are responsible to operate the facilities for more effective irrigation to the terminal unit of 50 hectares and to make coordination with other units for avoiding water dispute among them. Agronomists will be suitable to be assigned to these positions of water management because the positions will have to be in charge

of not only water distribution but also effective water utilization for growing crops. (see Appendix H-4)

The above mentioned terminal unit of 50 hectares will be similar to Sitio in its acreage, which composes Barrio. And one farmers' leader and two sub-leaders shall be selected to form a farmers' group, which will play a role of arranging all farming works as an elemental organization and will transmit the farmers' requests to related agencies such as Samahang Nayon (Cooperatives), NIA (Water Management Organization), and Barrio (Administration).

The relationship between farming groups and their related organizations is shown in Appendix H-5. The farmers' groups will be, in every respect, fundamental organizations in the areas after completion of the Project. Furthermore, the establishment of wireless radio communication system will give the farmers the latest information and smoothen communication between organization and CIADP main office or branch offices.

3-8-2. Proposed Marketing System

CIADP aims at completion of arrangement of the infrastructures by 1981, and 5 years later on, will hit the production target. The following should be taken into account to meet such situations.

1) selling, processing, and storing large amount of palay harvested by double cropping (from average 30 cavans/ha "without Project" to average 85 cavans/ha "with Project"); 2) establishment of moasures for drying and storing palay during a wet season; 3) securing purchase channel of inputs like fertilizers and other farming chemicals for harvesting higher yields; 4) taking countermeasures against unexpected matters caused from new water management system under pumping irrigation, introduction of new farming techniques for high yielding, and other problems.

In response to these problems, establishment of Agricultural Cooperatives is essentially needed for making farmers display their potential

ability with self-reliance. It is opportune that DLGCD, which has learned much about unsuccessful results of PaCoMa case, is now trying to re-organize the agricultural cooperatives. At the opportunity, therefore, it is proposed to improve the marketing system (see Appendix H-6), which will be established through organization of the agricultural cooperatives, and the related physical planning and organization are shown as follows.

a) Physical Planning

i) Processing facilities

° Threshers & Selectors — To be procured by farmers because of their comparatively low costs.

° Dryers — Necessary for wet season harvest; to be procured by Project, but Philippine-made available.

° Rice Mill — Necessary for reducing transportation costs and eliminating middlemen's control, but Philippine-made available

ii) Warehouse — Necessary for controlling shipment in corresponding to market price fluctuation.

b) Transportation facilities

i) Road networks — To be improved by CIADP.

ii) Trucks — 10 tons loading trucks operated for transportation of goods between Project Area and consumers areas; 6 tons loading trucks operated within the Project Area.

c) Organization — Barrio groups to be formed with 600 hectares of commanding area, based on Samahang Nayon, and new AMC branches to be established for making services.

d) Communication System — To give information through wireless radio communication system by CIADP for forming proper system to take reaction for market trends.

DLCCD shall be fully responsible for operation and maintenance of the facilities to be introduced as mentioned above. The realization of the physical planning will require about 11.6 millions Pesos funds. (see Appendix H-7)

Spirit of independence and positive attitude of farmers and devotion of cooperative staff will allow the Project, which will provide modern facilities, to be a model area of the rice marketing system improvement projects in the Philippines.

On the other hand, several discussion meetings about the accommodation and mode of repayment of the necessary fund concluded that apparently, improvement of the marketing facilities for agricultural products is essentially needed, but establishment of its supporting organization and effective operation will take a rather long time to accomplish; therefore, this feasibility study shall cover the problem as an alternative plan.

In this connection, the Government of the Philippines will have a study to take up any one of two for preparation of the necessary implementation plan, and further study and discussion will be made to conclude the Loan Agreement between the Government of the Philippines and the Government of Japan.

3-8-3. Agricultural Credit

Credit is one of the most important factors for modernization of agriculture. To give credit will eliminate the financial barrier and will enhance farmers' desire to learn the new farming techniques. Also, credit will take important part on the course of development of the rural economy. Even credit at the minimum rate of interest, however, cannot be a universal remedy for abrupt increase of agricultural productivity or

rapid growth of poor farmers' economy. That is because the successful performance of credit is always supported by packaged extension services, purchase availability of inputs, proper crediting channel with well-managed agencies, and other factors.

The criteria for credit capacity of applicant farmers are their independency and repayment capacity. Most of the small scaled farmers in the Project Area will not be able to enjoy such institutional credits in employment of above mentioned criteria.

With the Project completed, it is expected that increase of farmers' disposal income, which will be brought about by higher yielding based on well-provided infrastructures, will give them potential credit capacity. In CIADP, the farmers will be able to repay the given credit and pay the operation and maintenance costs out of the palay sales costs collected through Samahang Nayon.

Samahang Nayon gives the farmers an education on purpose and meaning of agricultural credit as well as mode of credit; furthermore Samahang Nayon will make good coordination services among related agencies with effort to simplifying the application formalities of short term credit for producers of Masagana 99 in the Project Area.

Thus, these factors of agricultural credit will eliminate the exclusive use of the credit by limited numbers of large and medium scaled farmers who are all commercially independent already, and give small scaled farmers, who badly need such credit, an opportunity to establish their production target on the firm background of the Project.

The CIADP staff in charge of agricultural credit shall formulate a plan for the necessary loan amount and estimate required credit fund; furthermore, they shall make a program for loan and repayment to each farmer in trying to organize the system available to make the credit served fairly to every farmer. The reservation of fair amount of capital fund by Samahang Nayon will allow cooperatives themselves to establish

their own credit system and enable the farmers in the Project Area to receive the credit, in long term or short, to purchase agricultural machinery and so forth.

Agricultural credit is operated based man-to-man or man-to-agency reliance, and it will be impossible to establish the real agricultural credit system only by introducing modern system one-sidedly. On the other hand, repayment by the farmers is quite essential to efficient operation of the credit services, and the AMC staff must have a fair knowledge of fundamental idea of the credit services.

It is required to build up the modern rationalized human relationship developed from original 'Pakikisam' (smooth human relationship or cooperative relationship), and to make the farmers learned completely that repayment is the first of all for credit based on the above rationalized human relationship.

3-8-4. New Community Development Scheme in Area to be Reclaimed

CIADP will convert approximately 3,000 hectares of the existing swamp area in Lower Cagayan into new arable lands.

For making new community in the said area, the housing lots shall be selected closely to those reclaimed arable lands, so that the farmers may carry out modernized farming in the said developed fields. It is evidently required to formulate a plan for new community development, when increase of agricultural inputs, extension of farming techniques, securing the modernized living standard, and transportation of farm products are taking into consideration.

Since the plan formulation of this new community development involves not only technical aspect but also political aspect in the Philippines, it is desirable for the Philippine counterparts to make the further detailed studies in every respect.

As one of the essential approach to the development scheme, the following matters should be taken into account.

1) In case that maximum 3 hectares of lands should be alloted to the settlers, some basic living accommodations and farming facilities should be provided by assistance of the Government.

2) Facilities related to newly developed community should be constructed at the site with comparatively higher elevation around the existing swamp area, namely future arable lands, and along the proposed farm roads.

3) The infrastructures required for the new community are shown as follows.

a) Road networks in the proposed Barrio.
b) Wells for public use or any other water treatment facilities.
c) Residential lots and houses.
d) Community center
e) Buildings for Agricultural Cooperatives
f) Warehouses, Rice proce-sing facilities, Farming machinery center
g) School buildings, Office buildings for governmental agencies, etc.

Actually the resettlement project, in taking into account the similar conditions, is now under way in the Philippines. This project was formulated by DAR and detailed in Appendix H-8 and H-9 as an example.

3-8-5. Impact of the Project

1) General

As CIADP is the integrated rural development project, complex components comprised will act among each other. As a result, impacts brought about by such mutual actions of components may sometimes be multiplied to have more effects than expected, or other, no impact may be brought about in the case that only one of many components can be in its realization.

The Project Area stands behind the progress of culture and welfare as compared with other provinces. In an integrated development project involving improvement of infrastructures, the related organization and authorities concerned should pay the closest attention to the better communication for mutual understanding to aim at successful accomplishment of the projects.

To make the impact act as effectively as possible, it is essential to forecast how the impact acts upon the others and necessary measures must be taken according to circumstances, before or even on the course of implementation of the projects.

CCC was established to make the impacts utilized as much as possible and the CIADP is positioned as one of the integrated rural development project under CCC. Thus, it seems that from the viewpoint of organization, all preparatory works in inter-department coordination were already arranged. Only passion and devotion of staff to be assigned to the project will allow the organization to secure the impact as expected.

2) Expected impacts from CIADP

As a result of the CIADP, the most important impact will be brought about from increase of paddy production per hectare which can be realized by double cropping with improvement of infrastructures in the area.

Higher productivity of paddy will enable farmers to earn much more income and to outgrow self-sufficient and self-satisfactory economy, and also the further development of this area is expected to bring the locally confined economy a positive mercantile activities in trading with other areas in the country.

Furthermore, the impact is expected for cottage industries to be brought about by electrification of the area, and other impacts from increase of schools, hospitals and so forth. On the course of the transition of economic system as mentioned above, a special care shall be exercised in eliminating negative effects to be brought about.

It can be presumed, however, that chain-reaction caused by Project impacts will spread over not only production process in human life, but consumption process, learning process, protection process and interaction process. And the expected impacts by the Project can be forecasted in due consideration of the above processes and their respective combinations, the flow chart on which is presented in Appendix H-10.

It is essentially required that the staff and related members of CIADP should make every effort to taking the initiative to make the best use of diversified impacts of the Project to the welfare of the people.

CHAPTER 4. CONSTRUCTION PLANNING

4-1. General

The Project Area is located in the northeastern part of Luzon Island, the Philippines, which has been frequently attacked by typhoons every year, especially concentrated in the months of October and November in a wet season. And the rainfall in the area presents typical tropical pattern with high local intensity. Then, only a good care in drainage will facilitate construction works to some extent. The construction works mainly comprise 5.6 million cubic meters of stripping and excavation, 2.7 million cubic meters of embankment, and 15 thousand cubic meters of concrete placing, all in approximate volume. And no other difficult works will be included in the program. Only consttuction works of three pumping station and tunnel works (L = 460 meters), if any, would require technical care in their implementation. The transportation of various large-size construction machinery to be required for earth moving works sometimes be a bottleneck of executing the works; however, since the Project Area is desirably located along the Philippines-Japan Friendship Highway, no troubles are anticipated for delivery of those machinery to the site. Furthermore, the tropical high local intensity rainfall, though comparatively heavy, will avail to expect sufficient number of working days, which were estimated at 21 days in Lower Cagayan, and 23 days in Alcala-Amulung and Iguig, respectively all on monthly average. (see Appendix I-1)

4-2. Construction Period

The construction period was estimated at approximately 4 years, taking into account the kinds and volume of works and site conditions, and total five and a half years, including one and a half years for preparatory stage of final design and other arrangement, will be consumed to its completion; that is, starting from the middle of 1976, the Project will be completed in the end of 1981. The paddy fields in CIADP

shall be irrigated with water to be supplied by pumping, the power source of which will depend on electricity. In the electrification scheme involving CAGELCO I and II, CAGELCO-I will be completed in 1977 and CAGELCO-II in 1979. Under the situation, it was taken into account that not only construction works of pumping station should be concurrent with the above electrification scheme, but also canals and their structures should be accelerated so as to allow the proposed pumps to be operated for partial irrigation available at the same time. As a result, it is expected that nearly most of the fields in both Iguig and Alcala-Amulung is irrigated in 1979, and a large part in Lower Cagayan in 1980. The general construction schedule is presented in Fig. 4-1.

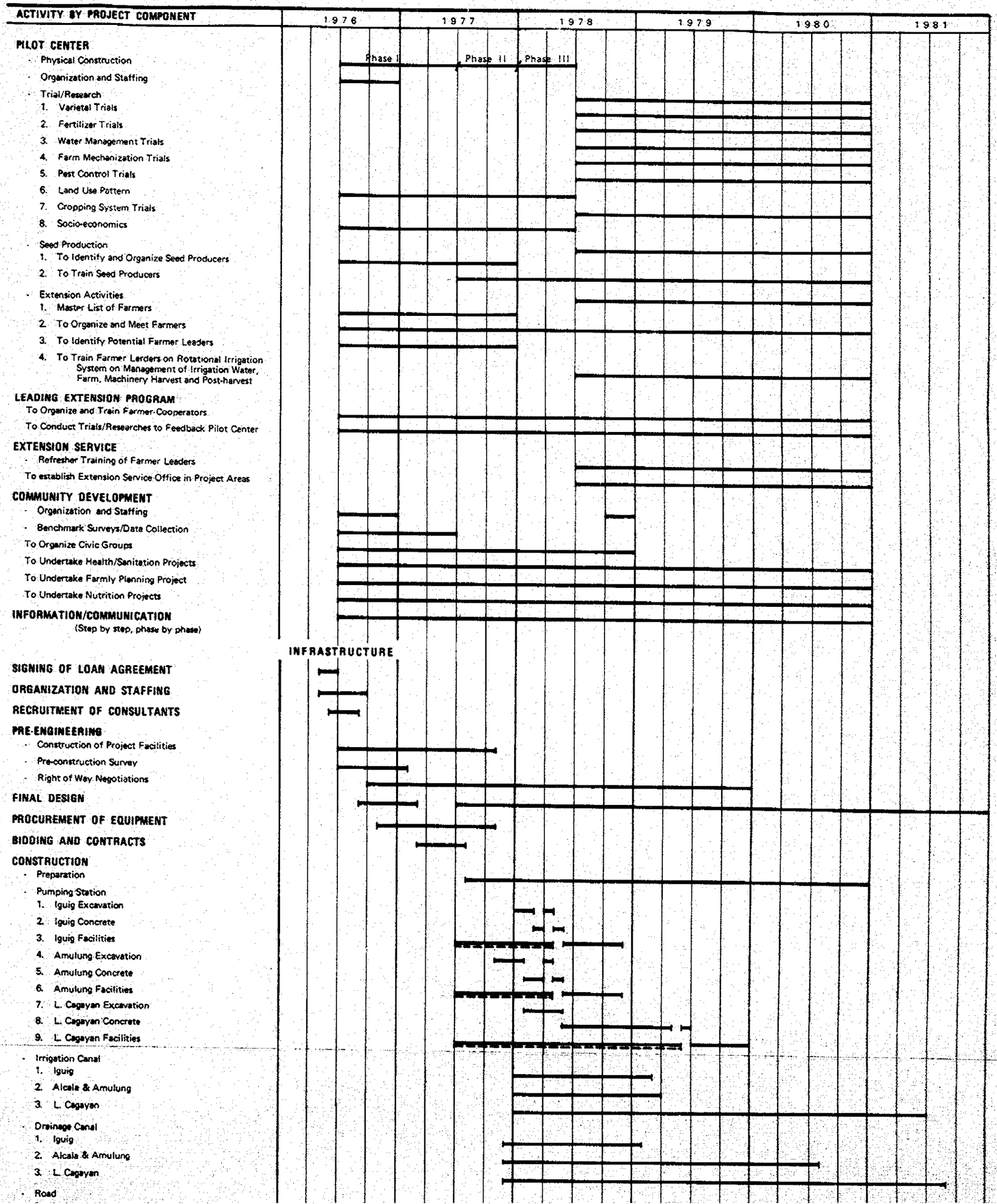
4-3. Construction Method

In the construct works, excavation shall be made by combination employment of bulldozer and shovel (backhoe, dragline), and the excavated earth sha-l be appropriated as much as possible to embankment works; but in case that such appropriation will cost very much with transportation charge, the excavated earth will not be applied in that manner.

Embankment of irrigation canals shall be compacted by tire-roller and that of drainage canals by bulldozer. The residual earth shall be transported to fill up swamps or disused drainage canals around the sites. Concrete mixer plants with capacity of 1 cubic meter or 0.5 cubic meter shall be provided for concrete works in pumping stations and tunnel, and pot mixers shall be provided for small quantity of concrete required for structures. Detailed construction method for each work is shown in Appendix I-2.

FIGURE 4–1. SCHEMATIC FLOW CHART AND SCHEDULE OF WORK OF CIADP

AGRICULTURAL RURAL DEVELOPMENT



- Extension Activities
  1. Master List of Farmers
  2. To Organize and Meet Farmers
  3. To Identify Potential Farmer Leaders
  4. To Train Farmer Lerders on Rotational Irrigation System on Management of Irrigation Water, Farm, Machinery Harvest and Post-harvest

LEADING EXTENSION PROGRAM

To Organize and Train Farmer-Cooperators

To Conduct Trials/Researches to Feedback Pilot Center

EXTENSION SERVICE

- Refresher Training of Farmer Leaders

To establish Extension Service Office in Project Areas

COMMUNITY DEVELOPMENT

- Organization and Staffing
- Benchmark Surveys/Data Collection

To Organize Civic Groups

To Undertake Health/Sanitation Projects

To Undertake Farmly Planning Project

To Undertake Nutrition Projects

INFORMATION/COMMUNICATION
(Step by step, phase by phase)

INFRASTRUCTURE

SIGNING OF LOAN AGREEMENT

ORGANIZATION AND STAFFING

RECRUITMENT OF CONSULTANTS

PRE-ENGINEERING

- Construction of Project Facilities
- Pre-construction Survey
- Right of Way Negotiations

FINAL DESIGN

PROCUREMENT OF EQUIPMENT

BIDDING AND CONTRACTS

CONSTRUCTION

- Preparation
- Pumping Station
  1. Iguig Excavation
  2. Iguig Concrete
  3. Iguig Facilities
  4. Amulung Excavation
  5. Amulung Concrete
  6. Amulung Facilities
  7. L. Cagayan Excavation
  8. L. Cagayan Concrete
  9. L. Cagayan Facilities
- Irrigation Canal
  1. Iguig
  2. Alcala & Amulung
  3. L. Cagayan
- Drainage Canal
  1. Iguig
  2. Alcala & Amulung
  3. L. Cagayan
- Road
  1. Iguig
  2. Alcala & Amulung
  3. L. Cagayan
- Terminal Facilities
  1. Iguig
  2. Alcala & Amulung
  3. L. Cagayan

OPERATION AND MAINTENANCE

ELECTRIFICATION

- Arrangement for Consultant
- Organization and Staffing
- Arrival of Consultant
- Detailed Design
- Organization of Cooperatives
- Award of Contract
- Arrival of Materials
- Construction Works
  1. Backbone
  2. Laterals and Secondary Lines

INFORMATION/COMMUNICATION
(Sept by step, phase by phase)

CHAPTER 5. ESTIMATE OF CONSTRUCTION COST

5-1. General

Necessary data for cost estimate such as labor, materials and equipment are derived from actual results of the Solana-Tuguegarao Irrigation Project and Mission Communal Irrigation Project which are presently being undertaken at Tuguegarao, and those data/unit cost of labor and materials have been counter-checked by NIA counterparts. Regarding necessary equipment, the cost was estimated through careful study on the current prices as of 1976 in on-going projects such as the Pulangui River Project, Magat Multi-purpose River Project and Chico River Project. Among these materials, 50 per cent of the cost for cement steel bar, fuel and oil would be shouldered by foreign currency component.

5-2. Construction Cost

Based on the construction planning as stated in the previous paragraphs, the total construction cost was estimated at ₱232,377,000 (including Foreign Currency portion ₱138,652,000 equivalent, and Local currency portion ₱93,275,000), which does not allow cost escalation in future.

CHAPTER 6. PROJECT IMPLEMENTATION AND OPERATION

6-1. Executing Body and Coordination

Implementation of CIADP comprises two stages, preparation stage and implementation stage. The project components of CIADP consist of irrigation and drainage, electrification and arrangement of marketing facilities though some time considering lagging in its implementation. A structural organization is required for effective and efficient implementation of these three (3) components.

In the Philippines, there has already been several integrated rural development projects (IRDP) implementation in Bicol, Mindoro and others and functional organizations have been established in response to the requirements therefrom.

In the consideration of these facts, it is recomended to establish a similar organization to other cases for a smooth and efficient implementation of CIADP.

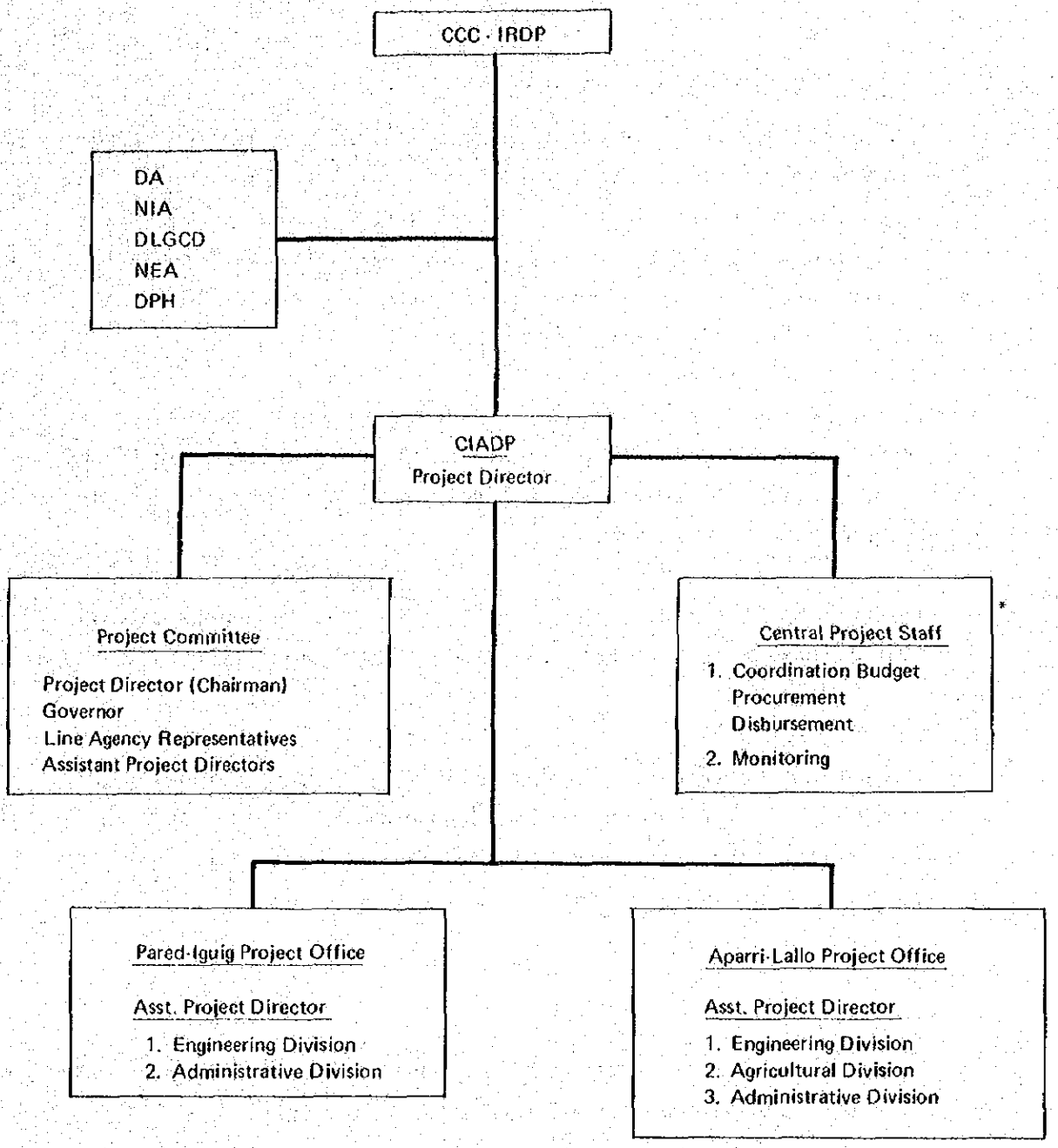
The Cabinet Coordinating Committee (CCC) will take a leading role in implementation of CIADP under close cooperation with NIA and other Authorities concerned. The relevant organization charts are shown in the following Figure 6-1.

6-2. Operation and Maintainance

The component of irrigation and drainage will be taken up by NIA and relevant organization is explained in 3-7-1, Chapter 3.

The component of electrification will be taken up by CAGELCO, which will be in charge of operation and maintenance of the electric distribution system under supervision and creditting by NEA.

FIGURE 6-1 PROPOSED ORGANIZATION CHART



Note: * Japanese senior asst. may join.

The component of roads comprises two kinds of roads, the trunk roads with dual purpose of genoral traffic and farming works, and the roads for operation and maintenance of canals. The former ones are controlled by the Department of Public Highway (DPH), and the latter ones by NIA.

DA will be in charge of operation and maintenance of the pilot center.

In order to maintain the project facilities at full efficiency throughout the project life of 50 years including construction period, operation/maintenance and replacement costs will be required. The operation and maintenance costs will be needed annually after completion of the construction works, while the replacement cost for the pumping facilitie will be accounted at the 25th yeai after commencement of the project.

These costs required for the project operation and maintenance were estimated at approximately ₱5,000,000 annually and the replacement cost of pumping facilities was worked at at ₱15,217,000, equivalent to 60 per cent of the initial installation cost.

CHAPTER 7. PROJECT EVALUATION

7-1. General

Though the proposed project involves many aspects such as irrigation, drainage, road construction, electrification, agricultural supporting services and so on, the economic evaluation would be analyzed on the basis of direct benefit arising from the irrigation aspect. Because it is quite difficult to estimate those benefits except irrigation in monetary terms.

The project has been economically evaluated by means of an economic rate of return (EIRR) with sensitivity analysis and financially appraised by farm budget study, in this Chapter 7.

7-2. Method of Economic Evaluation

The measurable economic benefits and costs are expressed in monetary terms and both streams of benefits and costs in annual forms over the evaluation period are converted to those respective present worth values by applying the discount rate of 10, 12.5 and 15 per cent. Under the present evaluation criteria, a project life of 50 years may be well justified and the year 1976 has been taken as the project year 1 when the final design would be started.

From an economic point of view, the project is defined as a difference between the development envisaged if the proposed measures are executed, viz., the "with the project" case and the development if no such measures are applied, viz., the "without the project" case. Thus, the project evaluation deals with incremental benefits and costs.

7-3. Economic Prices

Since the project concerns with an allocation of the limited natural resources, the evaluation is carried out from a national economic point of view. This means that inputs and outputs are assessed according to their real value to national economy. Thereby, the transfer payment such as custom duties, taxes, subsidies and so forth, should be

eliminated in the economic evaluation as far as possible.

Constant prices at the beginning in 1976 are used to estimate both the economic costs and benefits.

A foreign exchange rate of US$1.00 to ₱7.50 would be appropriate at 1975's year-end based on the information furnished by Central Bank of the Philippines.

Reference price of rice is US$250 per ton C.I.F. Manila, which is based on IBRD projected price 1985, in case of 25 per cent of rice broken, including the transportation cost from Bangkok. After adjusting handling charges and transportation cost, farm gate price of paddy palay in the project area has been calculated at ₱1,127 per ton.

The price of corn applied for this analysis is ₱0.80/kg. which is the prevailing farm gate price in the area considering the weight of corn production is quite minor.

The prevailing wages of ₱6.00 per man-day without draft animal and ₱9.00 with animal are used for the cost of family labor as well as hired labor in the agricultural sector, because no serious unemployment or underemployment is observed in the area.

7-4. Project Cost

Components of the initial costs (financial) consist of preparation works, major construction works including materials, land acquisition, engineering, government administration, equipment, contingency and price escalation. Table 7-1 shows the summary of the project cost. A nominal rate of 5 per cent of the local currency portion in construction cost including land acquisition and engineering as well as the indirect foreign currency cost has been accounted as government administration costs. 15 per cent of total cost excluding equipment costs is accounted as contingency.

Price escalation has been enumerated by computing the estimated rate (8 per cent per annum for both the foreign and local currency) of price increase in prior year and one half of the rate of increase in the year concerned.

TABLE 7-1 SUMMARY OF PROJECT COST

(Unit: thousand pesos)

	Lower Cagayan			Alcala-Amulung			Iguig			Total		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
I. Preparation Works	-	4,879	4,879	-	610	610	-	261	261	-	5,750	5,750
II. Construction Works												
a. Pumping Facility	25,456	4,752	30,208	4,921	1,382	6,303	3,309	1,107	4,416	33,686	7,241	40,927
b. Canal	9,002	26,218	35,220	2,033	6,125	8,158	480	1,531	2,011	11,515	33,874	45,389
c. Road	1,843	7,477	9,320	137	1,009	1,146	56	475	531	2,036	8,961	10,997
d. Terminal Facilities	876	9,299	10,175	308	2,015	2,323	24	400	424	1,208	11,714	12,922
e. Rural Electrification	10,275	3,160	13,435	-	-	-	-	-	-	10,275	3,160	13,435
Sub-total	47,452	55,785	103,237	7,399	11,141	18,540	3,869	3,774	7,643	58,720	70,700	129,420
III. Materials	5,877	-	5,877	734	-	734	424	-	424	7,035	-	7,035
IV. Land Acquisition	-	2,584	2,584	-	677	677	-	305	305	-	3,566	3,566
V. Engineering	4,903	1,922	6,825	613	241	854	263	103	366	5,779	2,266	8,045
VI. Government Administration	-	3,921	3,921	-	781	781	-	265	265	-	4,967	4,967
VII. Contingency	8,735	9,632	18,367	1,312	1,926	3,238	684	668	1,352	10,731	12,226	22,957
VIII. Equipments	44,276	-	44,276	10,273	-	10,273	1,838	-	1,838	56,387	-	56,387
IX. Total	111,243	75,844	185,087	20,331	14,766	35,097	7,078	5,115	12,193	138,652	93,725	232,377
X. Price Escalation	22,433	22,995	45,428	4,100	4,598	8,698	1,427	1,593	3,020	27,960	29,186	57,146
XI. Grand Total	133,676	96,839	230,515	24,431	19,364	43,795	8,505	6,708	15,213	166,612	122,911	289,523
(US$ x 10^3)	(17,823)	(12,912)	(30,735)	(3,257)	(2,582)	(5,839)	(1,134)	(894)	(2,028)	(22,215)	(16,388)	(38,603)

The annual expenditures of the financial initial cost is shown in Appendix K-1.

The economic cost of the project consist of the following:

(1) total initial cost (financial) excluding interest during construction, price escalation, land acquisition costs and tax for local contractor;
(2) minus salvage value of construction equipment;
(3) plus operation, maintenance and replacement costs during the project life.

The economic initial costs are shown in Appendix K-2.

7-5. Project Benefits

As mentioned before in this chapter, only the direct tangible benefit arising from the irrigation aspect would be used for the EIRR calculation.

This benefit can be measured as the difference between the net production value with and without the project.

Table 7-2 shows the said difference of ₱55,054,000 annually after attaining the target yield of rice. In this table, the cropped area of corn as a representative of field crop has been assumed by the field inspection and available information obtained through interviewing the farmers as well as municipality officers concerned because no reliable data on this matter was available in spite of the efforts of Filipino and Japanese staff.

Development period to attain the target yield has been considered as long as 5 years after completion of the construction works.

TABLE 7-2. NET PRODUCTION VALUE

		Without Project					With Project		
		Paddy					Paddy		
		Rainfed	Irrigated Wet	Irrigated Dry	Corn	Total	Wet	Dry	Total
I.	Yield (ton/ha)	1.3	2.0	2.2	0.7		3.5	4.0	
II.	Unit Price (₱/ton)	1,127	1,127	1,127	800		1,127	1,127	
III.	G.P.V. (₱/ha)	1,465	2,254	2,479	560		3,945	4,508	
IV.	Production Cost (₱/ha)	495	1,058	1,039	241		1,647	1,695	
V.	N.P.V. (₱/ha)	970	1,196	1,440	319		2,298	2,813	
VI.	Cropped Area (ha)	10,310	500	500	500	11,810	12,790	13,200	25,990
VII.	Total N.P.V. (₱x10^3)	10,001	588	720	160	11,469	29,391	37,132	66,523

Incremental N.P.V.: ₱55,054,000 (Project Benefit)

Incremental Production of Paddy: 82,062 tons

7-6. Economic Internal Rate of Return (EIRR)

Based on the above assumption, the present worth values of costs and benefits are calculated as follows:

(Unit: 1,000 ₱)

Discount Rate	10%	12.5%	15%
Benefit	254,428	172,727	121,967
Cost	177,609	157,320	141,433

Thus, the EIRR of the project is 13.5 per cent which indicates the Cagayan Integrated Agricultural Development Project (CIADP) economically feasible.

7-7. Sensitivity Analysis

Several of the basic assumptions made in the economic evaluation of the project have been varied in order to examine their impact on the EIRR. These factors are as follows:

i) the cost and the benefit vary 10 per cent in the range
ii) the completion of construction works is delayed by one year
iii) one year delay in reaching full development
iv) a combination of cost increase at 10 per cent and benefit decrease at 10 per cent (the worst case)

The result of these assumptions on the EIRR are computed as shown below:

Alternative	EIRR (%)
i) construction costs increased 10%	12.6
ii) benefit decreased 10%	12.4
iii) one year delay of construction works	12.6
iv) one year delay of full development	12.9
v) combination of i) and ii)	11.6

7-8. Water Charge

The determination of water charge would depend on the national policy whether investments for the project should be recovered in totality.

In this project, the water charge has been proposed so as to cover the operation and maintenance cost of the project except the maintenance cost of the trunk road (27.2 km) which will be maintained by Bureau of Barangay Road under the DPH. Thus, the water charges per hectare are worked out at ₱169 and ₱194 in first and second croppings, respectively (see Appendix K-3).

Considering the further expansion of national irrigation system, it is desirable that the water charge to farmers would have to cover the repayment of foreign currency loan and finally the total investment outlay. In this connection, the farm budget analysis (see Table 7-3) indicates whether farmers can afford in part repayment of the Project cost.

7-9. Farm Budget

According to "A socio-economic study of farmers in selected towns of Cagayan" prepared by the Special Studies Division, Planning Service, Office of the Secretary, Department of Agriculture, 558 farms in 7 towns of Amulung, Iguig, Alcala, Lal-lo, Camalaniugan, Buguey and Aparri were selected on a random basis and interviewed in October 1975. Valuable information such as tenure status, living costs, sharing system and so forth, have also been obtained from the said publication.

In order to exercise the realistic estimate of future financial balance in farms with the project, three typical farm sizes by two tenure systems have been developed and analyzed.

Table 7-2 shows the summary of the farm budgets and details are compiled in Appendix K-4.

In the table 7-3, only the share-croppers of 1 hectare would not be able to enjoy the same living standard as planned without its off-farm income and to bear the amortization of foreign currency loans.

TABLE 7-3. SUMMARY OF FARM BUDGET ANALYSIS

Farm Size (ha.)	1.0	2.0	3.0
Tenure System	Owner	Owner	Owner
Family Size	6	6	6
Crop Income	6,114	13,409	20,707
Farming Expenditure	2,059	4,353	7,348
Net Farm Income	4,055	9,056	13,359
Household Expenditure	2,866	2,866	2,866
Farm Family Surplus	1,189	6,190	10,493
Amortization of F.C. Loan	1,150	2,301	3,451

Farm Size (ha.)	1.0	2.0	3.0
Tenure System	Share	Share	Share
Family Size	6	6	6
Crop Income	4,265	9,711	15,161
Farming Expenditure	2,059	4,353	7,348
Net Farm Income	2,206	5,358	7,813
Off-farm Income	660	-	-
Farm Family Income	2,866	5,358	7,813
Household Expenditure	2,866	2,866	2,866
Farm Family Surplus	0	2,492	4,947
Amortization of F.C. Loan	1,150	2,301	3,451