are practically impermeable. The groundwater supply sources are replenished thru fractures in the rocks. This accounts for the high probability of encountering non-productive wells in these areas.

Spring are generally found in the difficult areas, and although the yield may not be substantial, the same may be the only viable source of water in the area.

D-3-3 Development Potential for Groundwater

An assessment of the water resources of Marinduque was undertaken in 1982 by the National Water Resources Council and for lack of data, the groundwater potential was roughly estimated based on the assumption that groundwater recharge is 10% of the annual rainfall in the province. Well capacities were determined from the average specific capacities of existing wells and assuming a maximum drawdown of five meters. Accordingly, the safe yield from shallow wells is taken to be 43,000 lpd while that from deep wells is 320,000 lpd. And as previously discussed, areas underlain by thick layers of sand/gravel in the Quaternary alluvium as well as those covered by the Boac formation with a preponderance of sandstone and conglomerate have higher potentials for groundwater development for domestic use. However, since both formations are distributed along the coast, the selection of well locations should take into consideration the safe distance from the shoreline so as to avoid salt water contamination in the future.

At the seven selected priority areas, the following groundwater conditions and its development potentials are observed:

- Bagtingon area - The western half of the area has been classified as shallow well zone while the eastern half is included in the deep well zone. Considering the thin sand/gravel shallow aquifer with an average thickness of one meter or less, and the predominance of fine clastic members in the sedimentary formations in the deep well areas, the potential for groundwater development is deemed to be relatively low in this area.

- Gasan area - The entire area is categorized as shallow well zone and with an average sand/gravel aquifer thickness of more than five meters, the same can be considered as having a fairly good groundwater potential. In this area, deep aquifers of conglomerate belonging to the Boac formation exist, and can also be developed in areas located at a safe distance from the shoreline.

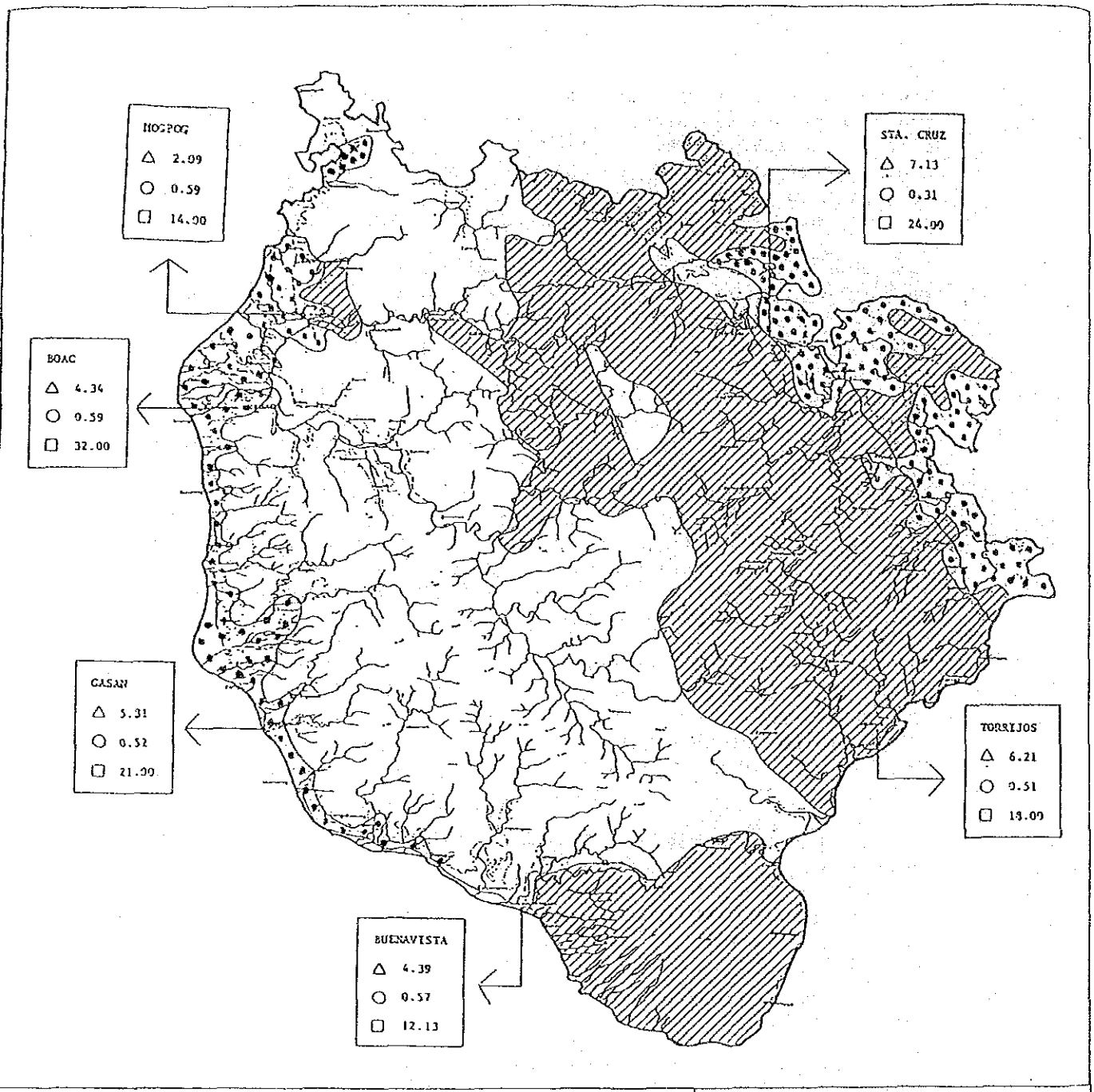
- Boac area - The western part is a shallow well zone while the eastern part is a deep well zone. A large portion of the Boac area has a high potential for groundwater development due to the presence of thick sand/gravel layers and conglomerate/sandstone beds in the alluvium and Boac formations, respectively, as well as the existence of free-flowing wells in Barangays Lupac and Tanza.

- Mogpog area - The area is divided into three categories: shallow well zone in the western coastal areas, a difficult zone at the middle and a deep well zone at the eastern portion of the Mogpog area. Of these, the difficult zone has a very low potential while the areas classified as the shallow and deep well zones have high potential as these areas have similar conditions to that of the Boac area - thick aquifers in the alluvium and Boac formations and the presence of flowing wells.

- Sta. Cruz area - A major portion of the area is classified as the shallow and deep well zones. The alluvium in the shallow well zone as well as the clastic members of the Miocene formations in the deep well zones, is considered to be not important hydrologic units in this part of Marinduque due to its apparent limited vertical and lateral extent.

- Tagum-Angas area - This area is categorized mainly as a shallow well zone. Although the alluvium appears to be thick in some portions of the flood plains of the Tawiran river, the upper 20 m, more or less, of the same consist predominantly of clay and therefore, the area is considered to have a low potential for groundwater development. In the places where deep well aquifers of sand/gravel occur beneath the thick clay layer as in Tawiran, the potential may be better.

- Matuyatuya area - The western side is a difficult zone while the eastern side is a shallow well area. Both zones have low potential for groundwater development.



LEGEND

- Shallow well areas
- Deep well areas
- Difficult areas
- △ Average static water level, mbgs
- ○ Average specific capacity, lps/m
- □ Average well depth, m
- Stream network

THE INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT IN MARINDUQUE

Figure D-3-1

Groundwater Map

Source: National Water Resources Council

APPENDIX E AGRICULTURE

APPENDIX E AGRICULTURE

APPENDIX E AGRICULTURE

E-1 Present Condition

Table E-1-1 Acreage of Every Slope

Slope (%)	Acreage (ha)	Ratio (%)
0	4,700	5.8
0- 3	8,300	10.3
3- 8	7,200	9.0
8-15	12,500	15.5
15-18	17,600	21.9
18 over	30,200	37.5
Total	80,500	100.0

Table E-1-2 Chemical Analyses of the Surface Soils of the Different Soil Types

Soil type No.	Soil type	Total nitrogen (%)	PH Value	Available nutrients in parts per million (p.p.m)							
				Ammonia (NM_3)	Nitrates (NO_3)	Phosphorus (P)	Potassium (K)	Calcium (ca)	Magnesium (Mg)	Manganese (Mn)	Iron (Fe)
96	San Manuel sandy loam	0.05	6.20	10	trace	115	203	1,300	60	9	trace
502	Cabahuan clay	0.16	6.25	20	15	76	127	3,200	60	20	4
506	Mogpog clay loam	0.11	5.95	14	1	12	57	2,400	30	17	18
505	Mogpog silt loam	0.09	4.20	25	30	trace	39	1,400	30	108	98
99	Uningan silt loam	0.09	6.90	10	25	208	208	2,600	40	16	trace
511	Banhigan clay loam	0.07	5.30	10	trace	3	102	2,700	50	53	6
503	Timbo clay loam	0.21	5.70	10	10	12	310	1,200	30	22	trace
507	Banto clay loam	0.14	4.80	10	10	6	66	1,700	70	41	12
514	Mtutuya-tuya clay loam	0.10	6.15	10	trace	10	119	2,900	60	14	trace
268	La Castellana clay loam	0.12	5.50	10	40	8	210	2,100	40	19	trace
501	Maranlig clay	0.10	4.94	10	trace	trace	38	400	20	55	9
513	Boac clay loam	0.15	5.60	10	25	trace	17	2,300	60	35	trace
509	Dolores clay loam	0.12	5.50	10	trace	3	176	1,200	30	13	3
510	Tagum clay loam	0.10	5.85	10	10	trace	70	3,000	50	44	1
508	Tarug clay loam	0.14	5.65	18	3	35	142	3,400	80	47	1
512	Balanacan clay	0.13	5.80	10	trace	trace	87	1,800	40	19	trace
500	Gasan clay loam	0.15	5.60	10	10	13	114	2,800	100	36	6
153	Bolinao clay	0.21	7.80	10	10	7	217	13,900	500	37	trace
132	Faraon clay	0.32	7.05	10	trace	12	114	7,500	230	13	trace
516	Balut loam	0.20	6.30	10	trace	39	215	2,300	40	35	trace
499	Gasan loamy sand	0.10	6.60	10	10	99	330	1,300	30	2	2
504	Laylay sandy loam	0.08	6.20	10	trace	160	153	800	20	5	trace

Table E-1-3 Farm Household and Labor Force in Marinduque Province

(unit: households, persons)

Year	Total Household	Total Population	Farm Household	Agricultural Labor Foice
1980	32,263	173,715	16,395	26,935
1989	38,218	205,780	19,421	31,907
1995	42,800	230,400	21,700	35,700
2000	46,900	253,100	23,900	39,200
2010	56,700	305,500	28,800	47,400

Source: "Population Census 1980" "Census of Agriculture 1980 NCSO".

Notes : The figures in the future are estimated based on the following Conditions.

(1) 1.9% of annual in creaing rate of population.

(2) Age range of working is 15 years and over up to 60 years old.

Table E.1.4. Number and Area of Farms by Tenure of Farm: 1971 and 1980

Tenure of Farm	Number of Farms		Area of Farms Land (In Hectares)			
	1971	1980	1971		1980	
MARINDUQUE				%		%
All Farms	12,205	16,395	43,518	(100)	44,555	(100)
Owned	8,740	9,492	31,952	(74)	24,933	(56)
Partly-Owned	1,590	2,657	5,775	(13)	9,034	(20)
Tenanted/leased	1,600	3,816	4,371	(10)	9,165	(21)
Other Farms	275	430	1,420	(3)	1,423	(3)

Source: 1980 Census of Agriculture

Note : Details may not add up to total because of rounding

Table E-1-5 Cropped Acveage, Production and Yield

Crops	Harvested Area (ha)	Unit Yield (ton/ha)	Production (ton)
1. Coconut 1/	32,470	1.01	32,800
2. Paddy (Including upland rice)	10,894	1.52	16,606
3. Corn	1,020	0.63	639
4. Mungbean	130	0.68	88
5. Camote	51	2.14	109
6. Banana	580	7.13	4,135
7. Mango	67	0.56	37
8. Papaya	52	1.92	100
9. Citrus (Calamansi)	48	1.83	88

Source: Department of Agriculture (1988)

Note : 1/ P.C.A. 1987

Table E-1-6 Livestock and Poultry (1980 - 1987)

(unit: per head)

Specie	1980	1981	1982	1983	1984	1985	1986	1987
1. Cattle	6,540	6,742	6,950	7,164	7,462	7,692	7,922	8,080
2. Carabao	20,679	21,318	21,977	22,656	23,325	24,046	24,765	25,262
3. Horse	4,959	5,112	5,270	5,432	5,600	5,744	5,850	5,967
4. Hogs	43,220	45,020	46,895	48,345	49,840	51,381	53,950	55,568
5. Goat	12,514	12,769	13,030	13,295	13,635	14,056	14,406	14,694
6. Chicken	213,246	222,131	231,386	241,027	259,712	267,665	288,415	297,087
7. Duck	9,820	10,229	10,655	10,984	11,323	11,673	12,023	12,504

Source: Department of A-riculture (DA)

Table E-1-7 Number of Animals Slaughtered (head) and Slaughter Houses

District	No. of Slaughter Houses	No. of Animals Slaughtered (head) - 1987				
		Total	Cattle	Caracao	Hog	Goats
1. Municipality:						
- Buenavista	1	625	5	33	587	-
- Casan	1	1,911	91	302	1,518	-
- Boac	1	2,234	109	312	1,813	-
- Mogpog	1	2,429	89	402	1,938	-
- Sta. Cruz	1	5,065	543	34	4,488	-
- Torrijos	1	607	79	29	499	-
2. Marinduque Province		12,871	916	1,112	10,843	-

Source: Bureau of Agricultural Statistics Boac, Marinduque

Table E-1-8 Post Harvest Facilities

Location	Types Rice Mill (ordinary & semi-cono)	Number
Santa Cruz	- do -	23
Mogpog	- do -	15
Boac	- do -	10
Gasan	- do -	8
Buenavista	- do -	2
Torrijos	- do -	18
Total		76

Source: Department of Agriculture (D.A.)

Table E-1-9 Study Area of Marinduque

(unit: sq.km)

Municipality	Total Area (1)	Reserved Forest Area (2)	Islands Area (3)	Study Area (1)-(2)-(3)
Boac	212.7	38.8	-	173.9
Buenavista	78.6	23.4	0.2	55.0
Gasan	119.3	25.2	2.7	91.4
Mogpog	87.7	-	0.3	87.4
Santa Cruz	246.6	3.1	21.0	222.5
Torrijos	214.3	39.5	-	174.8
Total	959.2	130.0	24.2	805.0

Source: Total area: Provincial Planning and Development Office
Reserved forest area and Islands area:
JICA Study Team (1:50,000 topographic map)

Table E-1-10 Land Classification by Soil Type

(unit: ha or %)

Land Classification	Soil Types	Soil Type No.	Marinduque Acreage	Marinduque Rate	Study Area Acreage	Study Area Rate
A	Umingan Silt Loam	99	146	0.2	146	0.2
	San Manuel Sandy Loam	96	2,323	2.4	2,323	2.9
	Sub-total		2,469	2.6	2,469	3.1
Bw	Cabahuan Clay	502	847	0.9	847	1.1
	Mogpog Silt Loam	505	1,063	1.1	1,063	1.3
	Mogpog Clay Loam	506	2,014	2.1	2,014	2.5
	Matuyatuya Clay Loam	514	399	0.4	399	0.5
	Sub-total		4,323	4.5	4,323	5.4
Bs	Gasan Loamy Sand	499	993	1.0	993	1.2
	Gasan Clay Loam	500	216	0.2	216	0.3
	Laylay Sandy Loam	504	669	0.7	669	0.8
	Sub-total		1,878	1.9	1,878	2.3
Ds	Beach Sand	118	600	0.6	600	0.7
	Sub-total		600	0.6	600	0.7
M	Maranlig Clay	501	19,595	20.4	17,065	21.2
	Timbo Clay Loam	503	4,019	4.2	2,559	3.2
	Banto Clay Loam	507	17,750	18.5	15,490	19.3
	Banhigan Clay Loam	511	16,196	16.9	11,536	14.3
	Balanacan Clay	512	6,227	6.5	6,227	7.7
	Boac Clay Loam	513	2,414	2.5	2,414	3.0
	Faraon Clay	132	3,943	4.1	2,043	2.6
	Tarug Clay Loam	508	1,473	1.5	1,473	1.8
	Dolores Clay Loam	509	1,102	1.1	1,102	1.4
	Tagum Clay Loam	510	3,063	3.2	3,063	3.8
	Bolinao Clay	153	720	0.8	-	-
	Balut Loam	516	173	0.2	173	0.2
	La Castellana Clay Loam	268	3,517	3.7	3,287	4.1
	Tarug-Faraon Complex	515	2,037	2.1	2,037	2.5
	Sub-total		82,229	85.7	68,469	85.1
X	Hydrosol	1	1,975	2.1	1,775	2.2
	Sub-total		1,975	2.1	1,775	2.2
Y	Rough Mountainous Land	202	2,446	2.6	986	1.2
	Sub-total		2,446	2.6	986	1.2
	Total		95,920	100.0	80,500	100.0

Table E-2-1 Production and Consumption Balance of Rice

1. Present Situation

1.1 Cropping acreage of paddy and production

Irrigated	900 ha	x 190% x 2.5 ton/ha	=	4,300 ton
Rainfed	4,500 ha	x 140% x 1.6 ton/ha	=	10,200 ton
Upland paddy	3,500 ha	x 85% x 0.7 ton/ha	=	2,100 ton
		Total		16,600 ton

1.2 Consumption of rice

	at present (1989)	in future (2010)
Population	205,000	305,500
Consumption (kg/person)	103*	90**
Total consumption (rice in ton)	21,200	27,500
Total consumption (paddy in ton)	35,500	45,900

* Provincewide (Marinduque), 1989
** Nationwide (Philippines), 1979-81

1.3 Balance of paddy production

	at present	in future
Production	16,600 ton	16,600 ton
Consumption	35,500 ton	45,900 ton
Balance	- 18,900	- 29,300
Self-Sufficiency rate	47 %	36 %

2. Proposed Situation

2.1 Cropping Acreage of paddy

1) Irrigated

a) Rehabilitation of existing facilities	760 ha
b) New irrigation projects	1,520 (*1)
c) Individual pump/Self irrigation	390
Total	2,670 ha

(*1 Excludes intercropped paddy in coconut land)

2) Inter-cropped paddy in coconut land

About 1,650 ha. area out of the total coconut land which are located on the low-land under 3 percent slope is suitable to paddy field soil classification. These areas are proposed for new irrigation development with 75% percent land utilization rate.

1,650 has x 75% = 1,240 ha

3) Rainfed and Upland paddy

Rainfed	2,980 has
Upland paddy	3,500 has

2.2 Production and Self sufficiency rate in 2010

Irrigated (Sub-Total 3,910 has)

Paddy 2,670 ha x 175% x 4.0 ton/ha = 18,700 ton

Inter cropped paddy in coconut land
1,240 ha x 175% x 4.0 ton/ha = 8,700 ton

Rainfed 2,980 ha x 110% x 2.5 ton/ha = 8,200 ton

Upland Paddy
3,500 ha x 100% x 0.9 ton/ha = 3,100 ton

Total 38,700 ton

Self sufficiency 38,700/45,900 x 100 = 84%

Table E-2-2 Cropping Area

(Unit: ha)

Crops Name	Present	Proposed			Total
		Medium Range	Long Range	Coconut Area inter.cropping	
Coconut	32,470	31,100	29,550	-	29,550
Paddy rice	8,010	8,240	7,950	2,170	10,120
Irrigated	1,710	4,500	4,670	2,170	6,840
Rainfed	6,300	3,740	3,280	-	-
Diversified C.	5,445	7,800	8,300	2,100	10,400
Upland rice	2,975		3,150	-	-
Corn	1,020	2,000	2,000	700	2,700
Pulse Crops	450	900	1,100	700	1,800
Root Crops	700	800	900	-	-
Vegetable	300	600	800	700	1,500
Fruit trees	-	1,500	1,600	1,700	3,300
Banana	(580)	700	200	600	800
Other Fruit	(160)	800	1,400	1,100	2,500
Industrial C.	-	200	500	1,500	2,000
Coffee	(80)	200	500	1,500	2,000
Forage Crop	2,810	3,320	4,000	4,000	8,000
Total	48,735 (820)	52,158	51,900	11,470	63,370

Table E-2-3 Various Crop Yield

(unit: ton/ha)

Crop Name	Present	Without Project	With Project
Coconut	1.01	1.0	1.1
Paddy Rice			
Irrigated	2.50	2.7	4.0
Rainfed	1.60	1.7	2.5
Upland Rice	0.70	0.8	0.9
Diversified C.			
Corn	0.63	0.7	1.5
Pulse Crops	0.68	0.7	1.1
Root Crops	2.14	2.0	10.0
Vegetable	3.08	4.0	10.0
Fruit Trees			
Banana	7.13	7.0	12.0
Other Fruit	2.05	2.5	7.0
Coffee	0.67	0.7	1.0
Forage Crop		2.0*	4.0*

Note: * dried grass

Table E-2-4 Amount of Appied Fertilizer

Unit: ha

	N kg	P kg	K kg	14:14:14 Cavans	46:0:0 Cavans	0:16:0 Cavans	0:0:60 Cavans
Rice							
-Irrigated	60	30	30	4	2	-	-
-Rainfed	40	20	20	3	1	-	-
-Upland	30	10	10	1	1	-	-
Vegetable	40	20	20	3	1	-	1/3
Pulse/Legumes	15	30	30	1	-	1	1/2
Grains (Corn)	30	10	10	1	1	-	-
Root Crops	30	40	60	4	-	1-1/2	1
Fruit Tree 1 year	40	15	15	2	1	-	-
(Industrial) 5 year	80	30	40	4	2	-	2/5
Forage Crops	50	50	50	7	-	-	-

Table E-2-5 Crops Production

	Present	Proposed	
		Medium Range	Long Range
Coconut	32,500	34,210	32,505
Paddy Rice			
Irrigated	4,600	18,000	27,400
Rainfed	10,700	9,400	8,200
Diversified C.			
Upland Rice	2,400	3,200	3,200
Cron	700	3,000	4,100
Pulse/legumes	300	1,000	2,000
Root Crops	1,400	8,000	9,000
Vegetable	1,200	2,400	15,000
Fruit Trees			
Banana	4,100	8,400	9,600
Other Fruit	400	5,600	17,500
Industrial C.			
Coffee	56	700	2,000
Forage Crops	5,620 *	13,200 *	32,000 *

Note: * dried grass

E-3 Agricultural Development Project

1. Strengthening of Research Staff (D.A.)
2. Marinduque Agricultural Development and Promotion Farm (M.A.D.P.F.)
3. Strengthening of Agricultural Extension Workers (A.E.W.) (A.P.T.)
4. Pest/Disease Observatory (P./D.O.)
5. Seed Bank
6. DA Municipal Nurseries
7. Irrigation Paddy Cultivation Demonstration Farm
8. Rainfed Paddy/Diversified Crops Cultivation Demonstration Farm
9. Vegetable Cultivation Demonstration Farm
10. Coconut Intercropping Demonstration Farm
11. Hillside Farming Demonstration Farm for Coconut Area
12. Agro-forest Demonstration Farm
13. Post-harvest Facilities for Rice
14. Post-harvest Facilities for Corn
15. Post-harvest Facilities for Coconut
16. Coconut Timber Utilization
17. Rehabilitation of Marinduque Breeding Station (M.B.S.)
18. Cattle Dispersal
19. Carabao Dispersal
20. Goat Stock Farm
21. Goat Dispersal
22. Backyard Poultry Demonstration Farm
23. Grazing Field Demonstration Farm
24. Remodelling of Slaughter House (S.H.R.)
25. Integrated Agriculture Trading Center (I.A.T.C.)
26. Multi-Purpose Agricultural Cooperatives (M.P.A.C.)
27. Strengthening of Registration System of Livestock (S.R.S.L.)
28. Mutual Aid System for Livestock (M.A.S.L.)
29. Public Animals Auction Market (P.A.A.M.)

1. Strengthening of Research Staff

1. Location: Boac, Marinduque

2. Objective: To strengthen and increase the research staff of DA

3. Major facilities/equipment:

- Provision of Additional Personnel

Vegetables	1 person
Rice	1 "
Fruits	1 "
Food crops	1 "
Industrial crops	1 "
Soil/Fertilization	1 "
Pest/Disease control	1 "
Agro-processing	1 "
Farm management/Farm economics	1 "
Farm mechanization	1 "
Water management	1 "
Total	11 persons

- Provision of Equipment

Micro computer	3 sets
Copy machine	1 set
Pick up truck	2 units
Motorcycle (100 to 125 cc)	11 units

2. Marinduque Agricultural Development and Promotion Farm

1. Location: Tamayo, Sta. Cruz, Marinduque

2. Objectives:

Field application tests on farming patterns are carried out to improve the present farm technics for paddy and other diversified crops such as corn, mungobean, etc. and to establish new farm technics for such crops as vegetables, fruits, industrial crops, etc. in cooperation with or under the supervision of DA. Based on the results of the tests, suitable farming patterns including farming techniques would be selected.

Through continuous and various field trainings on farming patterns, the extension workers, farmer leaders and other farmers would be able to adopt the new farm management technics. The new farm techniques would be transferred to the other farmers in order to increase farm income.

3. Major Activities:

- Provision of technical guidelines for crop farming
- Establishment of criteria for crop fertilization based on simple soil analysis
- Establishment of criteria on water management
- Development of rotational cropping system on diversified crops
- Farm management analysis based on field application tests by farming pattern
- Development of intercropping technology under coconut plantation

4. Acreage:

4.1	Total area:	6.5 ha.
4.2	Building and others:	1.5 ha.
4.3	Demo-farm and field application farm:	5.0 ha.

1)	Coconut + upland crops (vegetables, corn, etc.)	(1.0 ha)
2)	Coconut + fruit and industrial crops	(0.5 ha)
3)	Coconut + forage crops	(0.5 ha)
4)	Paddy	(1.0 ha)
5)	Upland crops (vegetables, corn, etc.)	(1.0 ha)
6)	Fruit and industrial crops	(1.0 ha)

5. Building and others

5.1	Administrative office (Existing)	(300 sq.m.)
5.2	Lecture rooms	300 sq.m.
5.3	Dormitory (Existing)	300 sq.m.
5.4	Laboratory	250 sq.m.
5.5	Warehouse and research room	400 sq.m.
5.6	Farm management house	300 sq.m.
	(Warehouse for fertilizers, seeds, insecticides, etc. motorpool, office, etc.)	
5.7	Working house of farm labors	60 sq.m.
5.8	Isolation chamber	180 sq.m.
5.9	Animal shed	100 sq.m.
	Total	(2,190 sq.m.)
		1,890 sq.m.

6. Staffing

		No.
6.1	Training Farm Director	1
6.2	Administrative staff	
	Division Chief	1
	Administrator	1
	Cashier/Accounter/Bookkeeper	1
	Typist	2
	Janitor	2
	Driver	3
	Watchman	1
	Guardsman	3
6.3	Training staff	
	Division Chief	1
	Specialist	7
	Assistant Technician	8

		No.
6.4	Maintenance staff	
	Division Chief	1
	Mechanic	1
	Electrician	1
	Carpenter	1
	Field worker	6
	Total	40

7. Furnitures

Desks/Chairs	25 sets
Cabinet	10
Locker	25
Typewriter	2
Fireproof safe	1

8. Vehicles

Sedan car	1
Truck	1
Micro bus	1

9. Audio Visual Instruments for Training

TV set (20")	1
Video sets	1(incl. camera)
Movie set	1
OHP	1
Micro Computer	5
Word processor	5
Film projector	1
Copy machine	1
Typewriter	1

10. Experimental Equipment

	No.
Dryer	2 sets
Heater with thermostat	1
Refrigerator 400 l	1
Simple analizer	1
Balance	3
Microscope	2
Irrigation facility (4.5 ha)	1
Deepwell for drinking water	1
Experimental desk	3
Exhaust facilities	1
Pest/disease observatory	1 unit
Weather observation equipment	1 unit
Others (e.g. generator)	L.S.

11. Farm Machines

Plow	5 sets
Hallow	2
Rice milling machine	1
Sheller	1
Power-tiller with attachments	2
Grass cutter	7
Power sprayer	3
Duster	3
Farming tool	L.S.
Tractor with attachments (50 Hp, 30 Hp)	2

12. Annual O & M

Farm labours	5 persons
Electric charge 1,000 kwh x 12 mos.	12,000 kwh
Gasoline 50 l x 200 day x 2 mos.	20,000 lit.
Diesel oil 100 l x 150 day x 3 mos.	45,000 lit.

Fertilizer

14:14:14	2,400 kg
S.P.	100 kg
Potash	100 kg
Urea	200 kg
Lime 1.5 ton x 6 =	900 ton

Chemical input

Fungicide		
	Liquid	36 l
	Dust	28 kg
Insecticide		
	Liquid	18 l
	Dust	30 kg

3. Strengthening of Agricultural Extension Workers

1. Location: All municipalities

2. Objectives: To strengthen agricultural extension personnel and facilities.

3. Service Area:

Services will be extended not only to the beneficiaries of the agricultural development projects/programs but also all members of the Barangay (farmers) in the extension worker's service area.

Since one agricultural production technologist (APT) covers three Barangays, a total of 72 APTs would be recommended.

4. Major facilities/equipment:

- Motorcycle (100 - 125 cc)	72 sets
- Simple soil analysis equipment	12 units
- Microscope	6 sets
- Office equipment (copy machine, typewriter, etc.)	6 sets
- Books	L.S.
- BHF handy talking (12 watt)	72 sets
- BHF communication system (40 watt)	6 units

5. Others:

These extension workers (APT) should be re-trained at the proposed Marinduque Farmer's Training and Demonstration Farm.

4. Pest/Disease Observatory

1. Location: One station in each municipality for a total of 6 places.

2. Objectives:

To forecast accurately (SEWS, surveillance early warning system) and to prevent and control timely the occurrence of pest.diseases and rats. Data on present pest/diseases and rate should be collected at the station.

3. Major material/equipment (for each station):

- Solar flourescent light trap	1 unit
- Spore collector	1 unit
- Microscope	1 set
- Motorcycle (100 - 124 cc)	1 unit
- BHF handy talking (12 watt)	1 set
- Weather observation	1 unit

4. Staffing (for each station)

- Expert	1
- Assistant expert	1

5. Seed Bank

1. Location: Caigangan in Buenavista

2. Objectives:

To establish a stable seed distribution center for upland or diversified crops. The seeds produced in the center would be sold to the farmers at cheaper price.

3. Scale: 2.0 ha

4. Major facilities/equipment:

- Building	500 sq.m.
- Power tiller (10 Hp)	2 units
- Pick-up Truck (1 ton)	1 unit
- Motorcycle (100 - 125 cc)	2 units
- Manual winnower	1 unit
- Powered corn thresher	1 unit
- Irrigation system (2 ha)	1 unit

5. Annual O & M

- Farm input (fertilizer)	
14:14:14	400 kg.
Urea	200 kg.
S.P.	200 kg.
Potash	200 kg.
- Chemical input	
Fungicide	
Liquid	10 lit
Dust	10 kg.
Insecticide	
Liquid	10 lit
Dust	10 kg.
- Labours	5 persons

6. DA Municipal Nurseries

1. Location: One in every municipality or a total of six places.

2. Objectives:

To increase the number of fruits and diversified crop nurseries for distribution to farmers.

3. Scale: 2,000 - 5,000 sq.m. in each municipality

4. Major facilities/equipment (for each place)

- Irrigation facility	1 unit
- Deepwell (4", 30 m depth)	1 unit
- Working house/shed	100 sq.m.
- Pick-up truck (1.0 ton)	2 units
- Soil fumigator	1 unit (soil injector)

5. Annual O & M

- Fertilizer (14:14:14)	250 kg.
- Lime	500 kg.
- Chemical input	
Liquid	2.5 lit
Dust	2.5 kg.
- Insecticide	
Liquid	2.5 lit
Dust	2.5 kg.
- Nursery 5 spaces x 300 pcs.	1,500 pcs.
- Soil	900 cu.m.
- Labours	2 persons

7. Irrigated Paddy Cultivation Demonstration Farm

1. Location: One farm in each priority development area (a total of 7 areas)

2. Objective:

To demonstrate improve farm technics on irrigated paddy and introduce package of Technology (POT).

3. Scale:

5 to 10 ha. in each farm (one rotational block) under irrigation facilities along the main road.

4. Major facilities/equipments (for each farm)

- On-farm facilities such as farm road with 2.0 m width, farm ditches, farm drain*
- Power tiller and carabaos
  One unit of power tiller (10 Hp) with attachments
  One carabao for carabao-less farmer
- Power sprayer — 2 units
- Portable power duster — 2 units
- Power thresher — 1 unit
- Dry pavement (by using multi-purpose pavement under the road development scheme) — 500 sq.m.
- Warehouse — 100 sq.m.
- Rice mill (1/2 ton/hr) — 1 unit

5. Annual O & M

- Input materials:	
Compound fertilizer (14:14:14)	4,300 kg.
Urea (45%)	1,300 kg.
- Input chemical	
Fungicide	
Liquid	60 lit
Dust	140 kg.
Insecticide	
Liquid	80 lit
Dust	100 kg.
- Seed (HYV)	500 kg.

Note: *Irrigation facilities including on-farm facilities should be developed under the irrigation development scheme.

8. Rainfed Paddy/Diversified Crops Cultivation Demonstration Farm

1. Location: Two places (Gasan, Tagum-Angas)

2. Objective:

To demonstrate improved farming techniques for rainfed paddy/diversified crops.

3. Scale: 1-2 ha. each of rainfed paddy field along the main road.

4. Major facilities/equipment (for each farm):

- Power tiller and carabao
  One unit of power tiller (10 Hp) with attachment
  One carabao for carabao-less farmer
- Knap-sack type hand sprayer — 5 units
- Portable hand duster — 5 units
- Manual operated thresher — 1 unit
- Dry pavement (by using multi-purpose pavement under the road development scheme) — 500 sq.m.
- Warehouse — 100 sq.m.
- Rice mill (1/2 ton/hr.) — 1 unit
- Power corn thresher — 1 unit

5. Annual O & M

- Input materials
  - Compound fertilizer (14:14:14) — 1,000 kg.
    (215 kg. for paddy; 285 kg. for diversified crops)
  - Urea (65 + 90) — 310 kg.
- Input chemical
  - Fungicide
    - Liquid (3 + 6 lit/ha) — 18 lit
    - Dust (7 + 14 kg/ha) — 42 kg.
  - Insecticide
    - Liquid (4 + 8) — 24 lit
    - Dust (5 + 10) — 30 kg.
- Seed (HYV) (50 + 5) — 110 kg.

9. Vegetable Cultivation Demonstration Farm

1. Location: Six (6) places (Gasan, Buenavista, Torrijos, Sta. Cruz, Boac and Mogpog)

2. Objective:

To demonstrate improved and advanced faming techniques on vegetable cultivation.

3. Scale: 1-2 ha. each along the main farm-to-marker road

4. Major facilities/equipment (for each farm):

- Power tiller and carabao	
Power tiller (10 Hp) with attachments	1 unit
One carabao for carabao-less farmer	
- Knap-sack type hand sprayer	3 units
- Portable hand duster	3 units
- Deepwell with jetmatic hand pump (ϕ4" x 50 m depth)	
- Irrigation facilities	1 unit

5. Annual O & M

- Input materials	
Compound fertilizer (14:14:14)	600 kg.
Urea	200 kg.
Lime	7 ton
- Input chemical	
Fungicide	
Liquid	14 lit
Dust	34 kg.
Insecticide	
Liquid	22 lit
Dust	22 kg.
- Seed (HYV)	140 kg.

10. Coconut Intercropping Demonstration Farm (0 - 8% Slope)

1. Location: One farm each in six (6) municipalities

2. Objective:

To put up demonstration farms for the intensive utilization of idle space in coconut plantations by intercrop faming method.

3. Scale: 10 to 20 ha. each

4. Major facilities/equipment (for each farm):

- Power tiller with attachments (10 Hp)	1 unit
- Power sprayer	1 unit
- Nurseries: coffee, cacao, pineapple, papaya, kalamansi	

5. Annual O & M

- Seed : vegetables, corn, mungobeans, etc.
- Input materials (for the first year only)

Compound fertilizer (14:14:14)	6,000 kg.
Urea	2,000 kg,
Lime	30 ton

- Input Chemical

Fungicide	
Liquid (4 lit/ha)	80 lit
Dust (10 kg/ha)	200 kg.
Insecticide	
Liquid (6 lit/ha)	120 lit
Dust (7 kg/ha)	140 kg.

11. Hillside Farming Demonstration Farm for Coconut Areas (8 - 15% Slope)

1. Location: One farm each in six (6) municipalities

2. Objectives:

To establish a demonstration farm in slope areas planted to coconut and to establish a demonstration farm for contour ridge farm method of industrial crops in slope lands planted to coconut.

3. Scale: 5 to 10 ha. each

4. Major facilities/equipment:

- One carabao for carabao-less farmer
- Nurseries: arrow root, ubi, vanilla, citrus, coffee, black pepper, cacao, pineapple, banana, etc.

12. Agro-forest Demonstration Farm
(15 - 18% Slope)

1. Location: One farm each in Torrijos and Buenavista

2. Objectives:

To establish soil conservation methods by introducing pasture grass and intercrop farming insloped areas planted to coconut.

3. Scale: 5 to 10 ha.

4. Major facilities/equipment:

- Nurseries: citrus, coffee, cacao, pineapple, banana, etc.
- Seed : napiar grass, rhodes grass, vitiver (khus-khus), etc.

13. Post-harvest Facilities for Rice

1. Location: 7 places (one each in the seven priority development areas)

2. Objective:

To set up demonstration areas for improved rice post-harvest facilities.

3. Service Area: Irrigated area

4. Scale: 20 ha.

5. Major facilities/equipment:

- Dry pavement (by using multi-purpose pavement under the road development scheme)	500 sq.m.
- Warehouse	100 sq.m.
- Rice mill (1/2ton/hr.)	1 unit

14. Post-harvest Facilities for Corn

1. Location: One each insix (6) municipalities

2. Objective:

To set up demonstration areas for improved corn post-harvest facilities.

3. Scale: 20 ha.

4. Major facilities/equipment:

- Power corn thresher	1 unit
- Dry pavement (by using multi-purpose pavement under the road development scheme)	500 sq.m.
- Warehouse	50 sq.m.

15. Post-harvest Facilities for Coconut

1. Location: One each in six (6) municipalities

2. Objective:

To set up demonstration areas for improved coconut post-harvest facilities.

3. Service Area: 100 ha.

4. Scale: 500 sq.m.

5. Major facilities/equipment:

- Copra dryer 2,000 nut/day	2 units
- Charcoal kiln 7,000 nut/48 hr	1 unit
- Warehouse	200 sq.m.

16. Coconut Timber Utilization

1. Location: One each in the six (6) municipalities of the Province.

2. Objective:

To provide demonstration centers for the utilization of coconut timber.

3. Service Area: One (1) Barangay

4. Major facilities/equipment:

- Chain saw (33 cc)	5 sets
- Circular saw	5 sets
- Timber yard with shed	1,000 sq.m.
- Lumber yard with shed and disc saw	200 sq.m.
- Concrete pavement	200 sq.m.
- Saw dust yard	500 sq.m.

5. Staff 5 persons

17. Rehabilitation of Marinduque Breeding Station

1. Location: Napo, Sta. Cruz, Marinduque (Existing)

2. Objectives:

1) To strengthen artificial insemination programs in order to increase the number of superior and large animals.

2) To experiment on improved pasture grasses.

3) To experiment and improve on breeding and raising methods on livestocks.

4) To experiment on breeding and raising on new species of animals to be introduced in Marinduque.

5) To provide livestock hygiene services.

3. Scale: Building and pasture land (16 ha) (Existing)

4. Major facilities/equipment:

- Rehabilitation of the peripheral fence = 10 km
- Construction of animal shade or barn stock room

Carabao (male)	2 heads	30 sq.m.
Carabao (female)	10 heads	120 sq.m.
Cow (male)	2 heads	30 sq.m.
Cow (female)	10 heads	120 sq.m.
Swine (male)	5 heads	40 sq.m.
Swine (female)	5 heads	40 sq.m.
Goat	50 heads	30 sq.m.
Chicken	1,000 heads	200 sq.m.
Horse (for draft)	2 heads	50 sq.m.
	Total	660 sq.m.

- Water supply system
  Deepwell (ϕ4", 60m depth), submerged pump (1 unit, ϕ2")
  Water supply system including water tank
- Construction of pig pen with storage room or warehouse 240 m^2
- Improvement of the Administrative building 100 m^2
- Motorpool 300 m^2
- Storage/Warehouse for feeds 200 m^2
- Equipment
  - Tractor 70 - 50 Hp with attachments 1 unit each
  - Farm tools 1 set
  - Portable grass cutter 5 units
  - Generator (2 - 5 KVA) 2 units
  - Container for freezer semen 7 units
    30 l x 2, 3 l x 5
  - A-I Instruments 10 sets
  - Microscope 2 units
  - Furniture (desk, chair, etc.) L.S.
  - Generator (300 KVA) 1 unit
- Other equipment L.S.
  - Pick up truck (1.0 ton) 2 units
  - Station wagon 4 WD 1 unit
  - Instrument for preventive inoculation 100 sets
  - Refrigerator 400 lit 3 units
  - Incubator (300 - 500 pcs.) 3 units
  - Other necessary equipment for the successful performance of A-I L.S.
  - Motorcycle 5 units

5. Staffing:

5.1 Manager 1

5.2 Administrative Division
- Administrative Officer 1
- Administrative Staff 1

Cashier	1
Typist	1
Janitor	1
Driver	3
Watchman	1
Guardman	3

5.3 Extension Division (A-I)

Division Chief	1
A-I technician	3
Extension workers	3
Asst. A-I technician	3
Asst. extension workers	3

5.4 Production Division (Raising)

Division Chief	1
Technician	3
Field worker	10

5.5 Regulatory Division

Division Chief	1
Technician	2
Asst. technician	2
Total	45

6. Annual O & M

- Labours	5 persons
- Electric charge 700 kwh x 12 mos.	9,400 kwh
- Gasoline 30 lit x 200 days x 4	24,000 lit
- Diesel oil 50 lit x 100 days x 2	10,000 lit
- Fertilizer	
S.P. 170 kg/ha x 14 ha	2,400 kg.
Urea 200 kg/ha x 25 ha	2,800 kg.
Lime 1.5 ton x 14	21 ton

18. Cattle Dispersal

1. Location: At the existing Marinduque breeding station, Napo, Sta. Cruz.

2. Objective:

To multiply the number of cattles by dispersal of pregnant female cattles to cattle-less farmers

3. Major activities:

After pregnanting female cattles at the Malabon breeding station, the cattles would be released to cattle-less farmers. When the infant cattle is female, both cattles would be taken cared of by the farmer for at least 16 months for raising purposes, after which the female infant cattle would be turned to the breeding station. The farmer can keep the original cow.

4. Major materials/equipment:

Ten (10) heads of cows two years and older

5. Staffing:

Staff of the Marinduque Breeding Station may by utilized for this program.

19. Carabao Dispersal

1. Location: At the existing Marinduque breeding station, Napo, Sta. Cruz

2. Objective:

To increase the number of carabaos by dispersing pregnant female carabaos to carabao-less farmers.

3. Major activities:

Pregnant female carabaos are distributed to carabao-less farmers. When the newly born carabao is female, it stays with the farmer for 16 months for raising purposes. The original carabao is returned to the breeding station after 16 months. The case is also the same with the male born carabaos.

4. Major materials:

Ten (10) heads of female carabaos which are more than two years old

5. Staffing:

Staff of the Marinduque Breeding Station in Napo may be utilized for these program.

20. Goat Stock Farm

1. Location: MIST School area, Poctoy, Torrijos

2. Objective:

To breed and stock 100 heads of goat for the goat dispersal program. These goats could also be utilized for the field practices of the MIST students.

3. Major activities:

The 100 heads of goat would be breeded and stocked in the MIST Poctoy school area. The new improved goat breed would be provided by the Marinduque breeding station. About ten (10) goat would be provided to farmer beneficiaries. After breeding and increasing his stock, the farmer returns back to the stock farm, ten (10) goats to be dispersed again to other farmers.

4. Major materials/equipment:

- Goat shed	50 sq.m.
- Building (100 sq.m. lecture room) (50 sq.m. O & M room)	150 sq.m.
- Equipment	
Furniture	1 set
Typewriter	1 unit
Deepwell	1 pls
Inner road	500 m (64 m)
Bridge/box culvert	1 (20 m X 4 m)
Locker	1 set

21. Goat Dispersal

1. Objective:

To multiply the number of goats by dispersing a suitable number of goats to goat-less farmers.

2. Major activities:

A group of adult goats, which consists of one male goat and ten female goats, would be dispersed to goat-less farmers. The farmer in turn has to repay back by returning nine heads of new female adult goats and one head of new male adult goat to the Goat Stock Farm within a period of two years. The original goat stays with the farmer.

3. Major material/equipment:

100 heads of goats

22. Backyard Poultry Demonstration Farm

1. Location: One farm each in six (6) municipalities

2. Objective:

To put up demonstration farm for backyard poultry in order to increase farm income, provide employment opportunities and to upgrade nutrition of inhabitants.

3. Major activities:

200 heads of newborn chicks would be given to chicken-less farmers. The farmers in turn should repay the chicks equivalent to 30 pieces of eggs per head or its cash value within a period of one year to the breeding station in Malabon.

4. Major facilities/equipment:

- Floor feeding poultry house	40 sq.m.
- Filling bowl	4 pcs.
- Feeder	4 pcs.

23. Grazing Field Demonstration Farm

1. Location: Hillside or mountaineous areas each in the six (6) municipalities (less than 18% slope) of the Province

2. Objectives:

To establish a demonstration farm which would effectively use idle or cogon lands in or out of coconut plantations. High-grade grasses for feeds can be grown in the farm. With a stable production of grasses the life span of the grazing fields are expected to increase. These fields can be used by small scale farmers so that they can raise livestock to increase their farm income.

3. Method of establishment/improvement:

Land reclamation works without any land slope adjustment would be carried out in plowing the field.

4. Scale: 10 - 20 ha.

5. Major facilities/equipment:

- Tractor (50 ps)	1 unit
- Fence	3,000 m
- Drinking water facility	3 places
- Bathing area	3 places
- Fertilizer (for every few years)	
Phosphoric acid (50 kg/ha)	1 ton
Lime (3 t/ha)	60 ton

Note: Areas which suffer from soil erosion should be converted to forest lands which can be utilized as refuge for animals. Under DA's guidance, the farmer who want to raise livestock should talk over the working allotment and decide the rule for maintenance of meadow grass and animals.

24. Remodelling of Slaughter House

1. Location: Torrijos, Sta. Cruz, Boac, Mogpog, Buenavista.
(A total of 5 places)

2. Objective:

To freeze and store meat in accordance with demand and supply of meat.

3. Major facilities/equipment:

- Freezer	4 sq.m.
- Cold storage	20 sq.m.
- Concrete pavement with shade	30 sq.m.
- Water supply system	1
- Sewerage treatment facilities	1
- Generator (200 KVA)	1 unit

Note: Under the supervision of the regulatory division of the Marinduque Breeding Station, DA.

25. Integrated Agricultural Training Center

1. Location: Mogpog or Boac municipality

2. Objective:

To provide timely collection, storage and shipping of vegetables, agricultural, livestock and fish products so that farmers would be able to sell at the most advantageous price.

3. Scale: 2.0 ha

4. Major facilities/equipment:

- Warehouse	1,000 sq.m.
- Cold storage/Ice plant (10 ton/day)	300 sq.m.
- Freezer warehouse	200 sq.m.
- Packing facilities	L.S.
- Shipping facilities/houses	L.S.
- Administrative office	200 sq.m.
- BHF Communication system (40 - 60 watt)	1 set
- Micro computer system	1 set
- Freeze truck (4 ton)	1 unit
- Truck (4 ton)	3 units
- Motorcycle (100 to 125 cc)	5 units

5. Staffing:

Director	1
Ice plant expert	3
Cashier	1
Expert for products	5
Driver	4
Typist	1
Janitor	1
Total	16

26. Multi-Purpose Agricultural Cooperatives (MPAC)

1. Location: One MPAC for every 3 to 5 Barangays

2. Objectives:

To organize and revitalize farmers organization in Marinduque at the Barangay level through the NGO's and/or BACOD and form them into primary multi-purpose agricultural cooperatives (MPAC). These type of cooperatives will not only promote and develop agricultural cooperative production processing and marketing system but also engage in credit extension and provision of necessary services needed by the Barangay, say for example, labor needs, transportation needs, post-harvest facilities, etc.

3. Major activities:

The formation of MPAC must be initiated through the NGO's and where none are existing, through the BACOD of DA by organizing and/or revitalizing farmer's organization in the area. Farmers from three to five contiguous Barangays may organize themselves to form the MPAC, the services of which would depend on the existing needs and resources of the organization which may include all or any of the following services: credit extension, buying agricultural product, production, marketing, procurement, sale of consumer goods and provision of other services.

The BACOD will train NGO's on the over-all concept, nature, policies, types and techniques of cooperative development which they in turn will infuse into the farmers. Training for NGO leaders will be undertaken at the Marinduque Farmer's Training and demonstration Farm. The NGO's shall directly be involved in the establishment and organization of the MPAC in accordance with the guidelines made by BACOD.

For the MPAC to be more effective, aside from the main office/center, other sub-centers/offices shall be put up in other Barangay member areas to serve as warehouse/collection and/or meeting point of goods and/or services.

4. Staffing:

Main Office/Center	
Administrative Officer	1
Bookkeeper	1
Clerk	1
Warehouse helper	2
Sub-Office/Center	
Warehouseman	1
Warehouse helper	2

5. Major facilities/equipment: (for each MPAC)

- Main Officer/Center	
Administrative office	50 sq.m.
Store space	100 sq.m.
Warehouse for materials	50 sq.m.
Rice mill	50 sq.m.
Warehouse for agricultural output	200 sq.m.
Collecting/shipping place	100 sq.m.
- Sub-Office/Branch Office	
Administrative office (3 to 5 places)	20 sq.m. each
Warehouse (3 to 5 places)	100 sq.m. each
- Equipment for Main Office	
Truck (4 ton)	1 unit
Motorcycle (100 to 125 cc)	1 unit
Balancing (Max. 100 kg.)	5 sets
Desk and Chair	9 sets
Locker	2 sets
Typewriter	5 units

Cash register	5 units
Power thresher	5 units
Milling machine	1 unit
Dryer	1 unit
Power tiller (10 Hp)	5 units

6. Annual O & M

Electric charge
Gas
Light/Oil

27. Strengthening of Registration System of Livestock

1. Location: Every municipality

2. Objectives:

The actual number of livestock would be recorded to establish a suitable development plan for increasing the number of livestock. The program aims to increase the number of superior livestock, the protection of illegal movement of livestock without the permission of the provincial Governor and to prevent the illegal slaughtery of livestock with diseases.

3. Major activities:

- Preliminary registration
  - Number or name of father and mother of infant livestock
  - Birthday
  - Health check by the inspector of DA
  - Preliminary registration card

- Registration
  - Certificate of Ownership (CO) of health check
  - Certification tags (at least two certification tags)
  - Photo of livestock
  - Measurement of weight and height

- Time of Registration

  Preliminary registration

Carabao	within 6 months after birth
Cow	within 6 months after birth
Horse	within 6 months after birth

- Advanced Registration

  Superior species should be registered.

4. Act (outline):

- Farmers

1. When a farmer wants to slaughter his livestock, he should get an approval with the Bureau of Animal Industry (BAI), the Municipal office and get an stamp of approval from the Meat Inspector (MI) prior to slaughtering.

2. When a livestock dies, the owner should report this matter to BAI,to the Municipal office and to the MI, and receive a guarantee test. After passing the test, he can sell or eat the meat.

3. Sanitation should be maintained at the slaughter houses with proper water supply and drainage.

- Middle man

1. Meat without Certificate of Ownership (CO) or Certificate of Transfer (CT) from the slaughter house should not be sold by the middle man.

- Penalty

1. Anyone who violates this act should pay some penalties (ex. 6,000 pesos or 6 months imprisonment or more)

5. Materials and equipment:

- Registration book	
- CO for registration	
- Camera	6 sets
- Stamps	6 sets
- Tags	35,000 pcs.

6. O & M Cost:

Film (black and white)

28. Mutual Aid System for Livestock

1. Location: Throughout the Province

2. Objective:

The program aims to compensate farmers for death of livestock through the mutual aid system.

3. Major activities:

A specific amount of money is collected from livestock farmers which would be kept and managed by the Provincial Government. These fund would be used to pay farmers whose livestock dies of illness, accident or infection, which is 80% of the selling cost of the livestock. When infection spreads throughout the province due to the neglect and lack of prevention measures by the government, loss of livestock should be compensated by them.

29. Public Animal Auction Market

1. Location: One in each municipality (A total of 6 places)

2. Objectives:

An auction market would be established in order to sell animal meat at fair cost. A temporary storage facility would be needed to have a stable supply of meat for sale in the market.

3. Major activities:

The Municipal government would rent out facilities such as refrigerators or cold storage houses to the middle man and the auctioner. The rental charge would be based on the cost of electricity, labor and others and would be used for the management of the market.

In case there is an over supply of meat, the surplus meat could be kept at the cold storage. When the supply is low, the stored meat could be released to the consumers to maintain the stable flow and price of meat.

4. Building (for one place)

- Administrative office	(50 sq.m. x 6)	300 sq.m.
- Auction place	(100 sq.m. x 6)	600 sq.m.
- Cold storage room	(50 sq.m. x 6)	300 sq.m.
- Refrigeration room	(30 sq.m. x 6)	180 sq.m.
- Others	(20 sq.m. x 6)	120 sq.m.

5. Major facilities/equipment (for one place)

- Office furniture	L.S.
- Motorcycle (100 - 125 cc)	1 unit
- BHF Communication system (40 - 60 W)	1 set
- Cold storage and refrigeration equipment	1 unit

Table E-3-1 Expected Number of Beneficiaries

	Development Plan	Employees (Persons)	Beneficiaries Direct	Beneficiaries Indirect
1.	Strengthening of Research Staff (D.A.)	6	-	47,400 P
2.	Marinduque Agricultural Development and Promotion Farm (M.A.D.P.F.)	60	900 P	"
3.	Strengthening of Agricultural Extension Workers (A.E.W.) (A.P.T.)	31	-	"
4.	Pest/Disease Observatory (P./D.O.)	2	-	"
5.	Seed Bank	15	1,600-3,000 FH	28,800 FH
6.	DA Municipal Nurseries	30	300 FH	(All FH)
7.	Irrigation Paddy Cultivation Demonstration Farm	-	8,000 FH	"
8.	Rainfed Paddy/Diversified Crops Cultivation Demonstration Farm	-	6,000 FH	"
9.	Vegetable Cultivation Demonstration Farm	-	14,300 FH	"
10.	Coconut Intercropping Demonstration Farm	-	3,800 FH	"
11.	Hillside Farming Demonstration Farm for Coconut Area	-	2,600 FH	"
12.	Agro-forest Demonstration Farm	-	1,000 FH	"
13.	Post-harvest Facilities for Rice	14	1,300-1,600 FH	"
14.	Post-harvest Facilities for Corn	12	480- 600 FH	"
15.	Post-harvest Facilities for Coconut	12	3,000 FH	"
16.	Coconut Timber Utilization	60	300 FH	"
17.	Rehabilitation of Marinduque Breeding Station (M.B.S.)	58	26,000 FH	28,800 FH
18.	Cattle Dispersal	-	680 FH	"
19.	Carabao Dispersal	-	680 FH	"
20.	Goat Stock Farm	1	-	-
21.	Goat Dispersal	-	3,830 FH	28,800 FH
22.	Backyard Poultry Demonstration Farm	-	1,250 FH	"
23.	Grazing Field Demonstration Farm	30	1,200 FH	"
24.	Remodelling of Slaughter House (S.H.R.)	75	26,000 FH	"
25.	Integrated Agriculture Trading Center (I.A.T.C.)	45	17,300 FH	"
26.	Multi-Purpose Agricultural Cooperatives (M.P.A.C.)	905	26,000 FH	"
27.	Strengthening of Registration System of Livestock (S.R.S.L.)	12	26,000 FH	"
28.	Mutual Aid System for Livestock (M.A.S.L.)	12	26,000 FH	"
29.	Public Animals Auction Market (P.A.A.M.)	40	26,000 FH	"
	Total	1,420		

Note: P: Person(s)
FH: Farm Household

E-4 Agrarian Reform

Table E-4-1

Progress of Agrarian Reform (As of June, 89)

Manicipality	Total Scope		Accomplishment			
	No. of Beneficialy	Area (ha)	No. of Beneficialy	Ratio	Area (ha)	Ratio
Boac	159	56.5	118	74	39.3	70
Buenavista	41	15.6	-	-	-	-
Gasan	224	92.3	101	45	41.5	45
Moqpog	36	11.5	24	67	5.8	50
Sta. Cruz	132	83.5	83	63	46.1	55
Torrijos	47	23.9	22	47	14.3	60
Total	639	283.3	348	54	147.0	52

Source: DAR Provincial office

Table E-4-2 Number of Land Owner by Farm Size
(as of June 1988)

Area Class	Baoc	Mogpog	Sta. Cruz	Torrijos	Buenavista	Gasan	Toatl	
100 ha and above	1	-	2	7	-	-	10	(0.5)
50 to 100 ha	4	-	2	5	1	1	13	(0.6)
24 to 50 "	16	2	14	21	6	6	65	(3.2)
15 to 24 "	48	12	33	44	10	12	159	(7.8)
12 to 15 "	31	6	34	31	22	15	139	(6.8)
7 to 12 "	166	67	176	126	39	81	655	(32.1)
5 to 7 "	154	82	195	412	56	102	1,001	(49.0)
Total	420	169	456	646	134	217	2,042	(100.0%)

Source; DAR, 1989

Table E-4-3 Land Holding Area of Land Owner by Farm Size
(as of June, 1988)

Area Class	Baoc	Mogpog	Sta. Cruz	Torrijos	Buenavista	Gasan	Toatl	
100 ha and above	102	-	463	1,261	-	-	1,826	(9.1)
50 to 100 ha	246	-	110	319	67	59	801	(4.0)
24 to 50 "	513	60	424	673	187	207	2,064	(10.3)
15 to 24 "	673	210	581	796	198	217	2,675	(13.4)
12 to 15 "	417	80	447	436	324	173	1,877	(9.4)
7 to 12 "	1,479	587	1,464	1,117	211	715	5,573	(27.9)
5 to 7 "	900	478	1,175	1,683	328	596	5,160	(25.9)
Total	4,330	1,415	4,664	6,285	1,315	1,967	19,976	(100.0%)

Source; DAR, 1989

APPENDIX F IRRIGATION, DRAINAGE AND VILLAGE WATER SUPPLY

APPENDIX F IRRIGATION, DRAINAGE AND VILLAGE WATER SUPPLY

APPENDIX F IRRIGATION, DRAINAGE AND VILLAGE WATER SUPPLY

F-1 Irrigation Plan

F-1-1 Present Condition

1) Service Area

The acreage of about 5,400 ha is used as paddy field based on the data of DA, 1988. In the central part of the area, the terrain of the land is mountainous such that paddy field are laid on a narrow gorge. On the other hand, many paddy field were observed in the low laying area, along river stream and seashore. The paddy field which is located at an alluvial plain, has an elevation less than ten meters.

As of August 1989, the total potential service area is about 1,240 ha of paddy fields but actual irrigated area is about 900 ha (73%). The total potential service area covered by NIA-CIS is 647 ha while the actually irrigated during wet season is only 447 ha or a service rate of 69%. For individual pumps, the total potential service area is 32 ha but the actually irrigated area is 15 ha or a service rate of only 47%. Meanwhile, the total potential service area under pump irrigation covered by DA is 124 ha while the actually irrigated area is 63 ha or a service rate of 51%. Under the gravity irrigation, 27 ha is the potential service area but no area is actually irrigated. For the SWIP, the total potential service area is 29 ha while the actually irrigated area is 7 ha or a service rate of 24%. Per estimate, the potential service area for self irrigated facilities is 381 ha while the actually irrigated is 374 ha or a service rate of 98%. (refer to Table F-1-1)

2) On-farm Facilities

There are some on-farm facilities in the CISs areas. After big flood gave severe damages on an intake facility, those facilities were not maintained by farmers. On the general plan of CISs, the proposed

density is 13 m/ha on an average. After they are damaged, these facilities became idle. The density of the existing on-farm facilities is quite small compared with the standard which is 60 m/ha. (refer to Table F-1-3)

In the present operational CIS area, the small scale on-farm facilities are observed to be well functioning. These on-farm facilities are not lined in the area.

The farm drains were not constructed for draining excess water on the field. The reason is estimated that the paddy area is generally steepy. But for upper unit production, the drainage systems will be needed in future.

F-1-2 Problems on Existing Irrigation System

1) CIS

As of August 1989, NIA has 21 existing CISs, ten of which are fully-operational, seven are partially- operational and four are non-operational. The reasons why not fully operational are: none rehabilitation after it has been damaged by flood and/or defective constructions of intake works. (refer to Table F-1-2 and Figure F-1-1)

The CISs indicated in Figure F-1-1 are under following reasons.

Reason A - Defective construction of intake works

Pawa-Tagwak (5)	Poctoy (12)
Busay (13)	Marlangga (16)

Reason B - Destroyed dam by flood damages

Katubugan (4)	Mabuhay (17)
Bagtingon (19)	Malbog (20)

Reason C - Non-maintenance of intake works and canals

Amoingon (2)	Balanacan (6)
Lipa (8)	Banuyo (21)
Landy-Baliis (7)	

Reason D - Dry-up of water source

Malinao (18)	Bonliw (11)

2) DA

All of the DA projects are not presently maintained because no technical person is actually supervising the project after it was turned over by the defunct Farm Systems and Development Corporation (FSDC) to DA.

F-1-3 Irrigation Planning

1) Effective Rainfall

The effective rainfall for paddy cropping is estimated as the amount of 80% of daily rainfall more than 5 mm and less than 80 mm.

2) Cropping Calendar

In order to increase farm income and to reach self sufficient of rice, double cropping system would be recommended. (refer to Figure F-1-2)

3) Irrigation Efficiency

The irrigation efficiency of 0.5 (based on conveyance loss of 20% on the main and lateral canals, distribution loss of 20% and application loss of 20%) could be applied in designing the facilities.

4) Evapotranspiration and ETcrop

The maximum rate of 5.8 mm/day and the minimum rate of 3.1 mm/day of evapotranspiration could be calculated in May and January, respectively. The crop coefficient ratio fluctuated from 0.95 to 1.1. Therefore, monthly ETcrop rate will vary from 3.7 in October to 5.0 mm/day in June for the first crop, from 3.3 in January to 5.1 mm/day in March for the second crop. The percolation rate of 1.5 mm/day could be used by considering the soil texture in a paddy field. (refer to Tables F-1-4 and F-1-5)

5) Water Requirement on Preparatory Works

Irrigation water will be necessary for the preparatory works such as ploughing, harrowing and land leveling before transplanting of paddy when the farmers meet no adequate amount of rainfall. The amount of water requirement (WR) on the preparatory work would be calculated by a following equation.

$$WR = Sw + S1 + S2 + EV + P + SL$$

Sw; standing water depth for transptanting = 50 mm
S1; amount of water to saturate the top-soil = 15 mm
S2; water to be required for saturation of sub-surface soil = 15 mm
EV; mean evapotranspiration rate during the preparatory works
first crop (5.0 + 4.9)/2 = 4.8 mm
second crop (4.2 + 3.9)/2 = 4.1 mm
P + SL; percolation and seepage loss = 1.5 mm/day
EV + P + SL; first crop (4.8 + 1.5) x 20 days = 130 mm
second crop (4.1 + 1.5) x 20 days = 110 mm

The amount of water depth (WR) of 210 mm (= 50 + 15 + 15 + 130) would be necessary for the preparatory works of the first crop, and also 190 mm for the second crop. Water for the preparatory works will be given on a field at three times.

Application	First Crop	Second Crop
First application of water at 20 days before transplanting	80 mm	70 mm
Second application at 10 days before transplanting	80 mm	70 mm
Third application of water at one day before transplanting	50 mm	50 mm

6) Irrigation Return Flow

Considering the location of the irrigable area and irrigation method of paddy cultivation, some amount of return flow of irrigation water would be expected in the area. For the study, the rate of 25% of the amount of the paddy irrigation would be assumed and applied for irrigation planning. In this case, some suitable facilities would be required to catch water at the downstream of the irrigation system.

7) Diversion Water Requirement

The 10-days diversion water requirement is calculated by using the proposed rainfall of one to five years in return period. The maximum value without effective rainfall is 1.6 lit/sec/ha. (refer to Table F-1-6)

F-1-4 Proposed Irrigation Projects

1) Proposed Irrigation System

The gravity irrigation system is the most advantageous for farmers due to low operation and maintenance cost. First priority would be given to this system. Small scale water impounding project would also be proposed depending on the topographical, hydrological and geological conditions necessary for the foundation of the dam. When the intake water level is lower than the elevation of the target irrigation area, pump irrigation system would be recommended.

2) Proposed Irrigation Acreage

The first priority to irrigate the target area would be given to the rehabilitation works of the existing irrigation system (760 ha). In the Study Area, 27 new irrigation projects would be proposed based on the topo-maps on a scale of 1:10,000. The new construction of irrigation system has 2,760 ha of potential area. These projects would include paddy field of about 1,240 ha which would be intercropped in the coconut lands. A cropping intensity of 75% is expected taking into consideration actual cropping density of coconut trees and soil adaptability of paddy.

1,650 ha x 75% = 1,240 ha

The proposed irrigation projects would be executed for three development stages as follows:

Development Stage	Project	Paddy Area
Short Term	Rehabilitation of existing facilities (21 CISs, 4 CPs, 2 SWIPs)	760 ha
	On-going 4 CIPs	260
	Tagum-Angas CIP	480
	(Sub Total)	(1,500)
Medium Term	9 projects of the First Package CIP	680
	(Sub Total)	(680)
Long Term	Binunga MPP	710
	Other 12 CIPs	630
	(Sub Total)	(1,340)
	Total	3,520
Grand Total	3,520 ha + 390 ha (Self Irrigation) = 3,910 ha.	

After completion of above projects, the irrigable area will expand to 3,910 ha as 4.3 times bigger than the present area. (refer to Figure F-1-3 and Table F-1-7)

3) Rehabilitation

Four systems namely: Poctoy, Marlangga, Mabuhay and Malinao which have drought problems during the dry season would be changed to impounding type facilities. Because the intake site of Malinao CIS is not suitable to impounding type, this system will be supplied water from neighbouring Bonliw CIS to be reconstructed to impounding type. Full reconstruction of intake work would be undertaken for Amoingon, Bagtingon and Malbog systems which were damaged by typhoon and seepage.

Rehabilitation work for the existing irrigation systems are as follows:

a)	Intake Work	(Total 18)
	Full Reconstruction	3
	Partial Improvement	9
	Conversion to Impounding Type (H less than 10m)	4
	Mini-Concrete Dam	2

Also, water gates would be provided for a more effective use of water resources and protection for flood discharge that will invade the farm.

b)	Canal Improvement	(Total 45 km)
	Concrete Canal	24
	Earth Canal	21

These projects would be undertaken on a short term development basis.

4) New Projects

The on-going 4 CIPs and Tagum-Angas CIP are nominated for short term development programme. For medium and long term development, 9 CIPs and 13 CIPs as well as Binunga MPP will be proposed for development.

a) CIP (Communal Irrigation Project)

The total number of above CIPs is 26, and 8 CIPs out of them have been completed in detail design by NIA. (refer to Table F-1-8 and Figures F-1-6 to F-1-8)

b) Tagum-Angas CIP

The Tagum-Angas CIP is small scale resources project located in Sta. Cruz. Detailed drawing of this dam has been completed by NIA, and its purposes are irrigation, village water supply and hydro power. The irrigation service area is 630 ha (480 ha paddy and 150 ha diversified crop). To supplement the upland areas, irrigation facilities such as farm ponds would be implemented after developing field irrigation management techniques for diversified crops. The village water supply is proposed of 324 cu.m per day as follows:

60 lit x 5,400 persons = 324 cu.m/day

The hydro power generation is 1.4 GWH per annum. (refer to Figure F-1-4 and Tables F-1-9, F-1-10)

c) Binunga MPP

Binunga Dam is proposed at the upstream site near Boac river confluence with Culapnit river, and its drainage area is 84 sq.km. Binunga MPP consists of four purposes, namely; irrigation, water supply, hydro power and flood control. The service area is 920 ha of paddy including the existing CISs area of 210 ha which is spread on the right bank side of Boac river.

As a result of water balance for 25 years, the reservoir capacity for these water utilization scheme is 5.7 MCM for w=1/10 years. All the water releases for irrigation and water supply would be utilized for power generation of 3.0 GWH per annum. Further this dam has flood

control capacity of 4.2 MCM that is equivalent to the rainfall of 50 mm on the catchment area. The reservoir sediment volume is estimated at 2.1 MCM for 50 years using the specific sediment value of 500 cu.m/sq.km/year. The total reservoir capacity is 12 MCM. The height of dam above streambed is 32 m and the volume of embankment is 450,000 cu.m.

Alternatively, if the paddy area (about 100 ha) in the left side of Boac river was appended to the service area, the water utilization capacity of this dam would be 7.2 MCM, and 13.5 MCM of the total reservoir capacity. Because the existing hydrological data in the Boac river basin is insufficient to planning water utilization, the data of Tawiran river was used for the water balance of Binunga dam. Further hydrological analysis and feasibility study for above problems would be needed in the near future. (refer to Figure F-1-5 and Table F-1-11)

Table F-1-1 Existing Irrigation Systems and Area

System/Project & Proper Authority	Potential Service Area (ha)	Actual Irrigated Area (ha)	Irrigation Service Efficienty (%)
1. Communal Irrigation System (NIA)	647	447	69
2. Communal Project (DA)			
Pump	124	63	51
Gravity	27	0	0
3. Small Water Impounding Project (DA)	29	7	24
4. Individual Pump (NIA)	32	15	47
5. Self Irrigation			
Private Pump	15	8	98
Gravity	366	366	
		(906)	
Total	1,240	900	73

Source: NIA Provincial Office and JICA Study Team (as of Aug., 1989).

Table F-1-2 Present Condition of Existing CIS by NIA

Item	No.	Potential Area (ha)	Actual Irri. Area (ha)		Service Irri. Efficiency(%)
			W.Season	D.Season	
		(1)	(2)		(2)/(1)
Total CISs	21	647	447	406	69
Fully-operational	10	465	389	366	84
Partially operational	7	118	58	40	49
Non operational	4	64	-	-	-

Source: NIA Provincial Office and JICA Study Team

Table F-1-3 Present Condition of CIS's Facilities

No.	Name of CIS	Potential Area (ha)	Irri. Area (ha)	Type of Diversion	Irrigation Facilities				
					M. Canal (km)	L. Canal (km)	On Farm (km)	Total (km)	Density (m/ha)
1.	Mansabang	150	150	Gate	1.2	3.7	-	4.9	33
2.	Amoingon	10	5	Core	1.5	-	-	1.5	150
3.	Mayho-Malbog	13	10	Trape	1.5	-	0.4	1.9	146
4.	Katubugan	16	5	Core	1.5	1.5	-	3.0	188
5.	Fawa-Tagwak	32	10	Pier	0.6	1.0	-	1.6	50
6.	Balanacan	16	10	Trape	1.0	-	0.6	1.6	107
7.	Landy-Baliis	60	60	Trape	2.8	1.4	1.9	6.1	102
8.	Lipa	10	5	Core	0.1	1.0	-	1.1	110
9.	Matuyatuya	23	15	Ogee	0.8	1.0	-	1.8	78
10.	Sibuyao	11	10	Ogee	1.2	0.4	-	1.6	145
11.	Bonliw	20	20	Ogee	1.9	1.0	-	2.9	145
12.	Poctoy	15	-	Ogee	1.6	0.8	1.1	3.5	233
13.	Busay	5	3	Trape	1.8	-	-	1.8	360
14.	Malindig	27	27	Core	3.1	-	1.3	4.4	163
15.	Ilaya	19	18	Ogee	1.3	-	-	1.3	68
16.	Marlangga	22	-	Ogee	1.0	-	-	1.0	45
17.	Mabuhay	15	-	Ogee	0.5	-	-	0.5	33
18.	Malinao	12	-	Ogee	0.5	-	-	0.5	42
19.	Bagtingon	9	9	Core	1.5	-	-	1.5	167
20.	Malbog	133	70	Ogee	6.6	0.7	3.0	10.3	77
21.	Bannyo	30	20	Pier	1.1	1.3	-	2.4	80
	Total	647	447		33.1	13.8	8.3	55.2	
				Density	51	21	13	85 (m/ha)	

Source: Based on General Layout Plan of CIS by NIA

Note : Trape = Trapezoidal

Table F-1-4 Calculation of Evapotranspiration by Penman Equation

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
W	0.74	0.75	0.76	0.77	0.77	0.77	0.77	0.76	0.77	0.76	0.76	0.75
Rns	4.0	5.0	6.1	6.4	5.8	5.0	5.0	4.7	4.5	4.5	4.4	3.6
f(T)	13.2	13.4	13.7	13.8	13.8	13.8	13.8	13.8	13.7	13.5	13.3	13.1
f(ed)	0.14	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11
f(n/N)	0.42	0.55	0.64	0.64	0.55	0.42	0.42	0.37	0.37	0.42	0.46	0.37
Rnl	0.8	0.8	1.0	0.9	0.8	0.6	0.6	0.5	0.5	0.6	0.6	0.5
Rn	3.2	4.2	5.1	5.5	5.0	4.4	4.4	4.2	4.0	3.9	3.8	3.1
1-W	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.23	0.24	0.24	0.25
f(u)	0.65	0.65	0.84	0.84	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.84
ea	32.3	33.2	35.1	37.8	39.2	38.3	37.2	35.9	36.8	36.1	35.5	33.0
ed	20.3	28.2	27.7	29.5	30.6	31.0	30.7	30.7	30.5	30.4	29.8	27.3
ea-ed	2.0	5.0	7.4	8.3	8.6	7.3	6.5	5.2	6.3	5.7	5.7	5.7
WxRn	2.73	3.15	3.88	4.24	3.85	3.39	3.39	3.19	3.08	2.96	2.89	2.33
(1-W)x(f(u) x(ea-ed)	0.34	0.81	1.49	1.60	1.29	1.09	0.97	0.81	0.94	0.89	0.89	1.20
Eto	3.1	4.0	5.4	5.8	5.1	4.5	4.4	4.0	4.0	3.9	3.8	3.5

Note: Annual Eto = 1,566.4 mm, Meteorological data = Calapan (1977 - 1986)

Table F-1-5 ETcrop of Paddy

Month	Eto (mm/day)	First Crop Kc	First Crop ETcrop (mm/day)	Second Crop Kc	Second Crop ETcrop (mm/day)
Jan.	3.1	-	-	1.05	3.3
Feb.	4.0	-	-	1.05	4.2
Mar.	5.4	-	-	0.95	5.1
Apr.	5.8	-	-	-	-
May	5.1	-	-	-	-
Jun.	4.5	1.1	5.0	-	-
Jul.	4.4	1.1	4.8	-	-
Aug.	4.0	1.05	4.2	-	-
Sep.	4.0	1.05	4.2	-	-
Oct.	3.9	0.95	3.7	-	-
Nov.	3.8	-	-	1.1	4.2
Dec.	3.5	-	-	1.1	3.9

Table F-1-6 Diversion Water Requirement Computation

(Unit: mm)

Month	Jan.			Feb.			Mar.			Apr.			May			Jun.		
Decade	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Rainfall (W=1/5)	23	25	19	-	-	-	-	16	-	-	-	-	-	24	19	38	40	44
Crop Water Reqt.	48	48	53	57	57	46	59	37	8	-	-	-	-	-	-	27	53	92
Eff. Rainfall	18	20	15	-	-	-	-	13	-	-	-	-	-	19	15	30	32	35
Crop Irri. Reqt.	30	28	38	57	57	46	59	24	8	-	-	-	-	-	-	0	21	57
Overall Eff. (%)	67	67	67	67	67	67	67	67	67	-	-	-	-	-	-	67	67	67
Diversion Reqt.	45	42	57	85	85	69	88	36	12	-	-	-	-	-	-	0	31	85
W.D. (ℓ/S/ha)	0.5	0.5	0.8	1.0	1.0	0.8	1.0	0.4	0.0	-	-	-	-	-	-	0	0.4	1.0
W.D. without Rain	0.8	0.8	0.8	1.0	1.0	1.0	1.0	0.6	0.1	-	-	-	-	-	-	0.5	0.9	1.6

Month	Jul.			Aug.			Sep.			Oct.			Nov.			Dec.			Total
Decade	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	(*1)
Rainfall (W=1/5)	39	39	20	19	18	13	22	40	23	59	60	48	54	59	62	21	40	20	
Crop Water Reqt.	85	80	69	57	57	63	57	57	57	46	29	6	23	47	82	79	71	59	1,609
Eff. Rainfall	31	31	16	15	14	10	18	32	18	47	48	38	43	47	50	17	32	16	611
Crop Irri. Reqt.	54	49	53	42	43	53	39	25	39	0	0	0	0	0	32	62	39	43	998
Overall Eff. (%)	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	
Diversion Reqt.	81	73	79	63	64	79	58	37	58	0	0	0	0	0	48	93	58	64	1,490
W.D. (ℓ/S/ha)	0.9	0.8	0.8	0.7	0.7	0.8	0.7	0.4	0.7	0	0	0	0	0	0.6	1.1	0.7	0.7	
W.D. without Rain	1.5	1.4	1.1	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.5	0.1	0.4	0.8	1.4	1.4	1.2	0.9	2,400

Note : First crop = June - October Second crop = November - March
Overall efficiency = 50% (Irrigation efficiency)/(1-25% (Return flow rate) = 67%
(*1) Irrigable effective amount

Table F-1-7 Proposed Irrigation/Drainage Project by Stage

No.		Name of Project	Irrigable Area (ha)	Intake Type	Drainage Improvement (ha)	Development Stage	Remarks
CIS	1	Mansabang	150	G	150	S(R)	-
"	2	Amoingon	10	D	10	S(R)	**
"	3	Maybo-Malbog	13	D	13	S(R)	-
"	4	Katubugan	16	D	16	S(R)	**
"	5	Pawa-Tagwak	32	D	32	S(R)	**
"	6	Balanacan	15	D	15	S(R)	**
"	7	Landy-Baliis	60	D	60	S(R)	-
"	8	Lipa	10	D	10	S(R)	**
"	9	Matuyatuya	23	D	23	S(R)	**
"	10	Sibuyao	11	D	11	S(R)	**
"	11	Bonliw	20	D/I	20	S(R)	**
"	12	Poctoy	15	D/I	15	S(R)	**
"	13	Busay	5	D	5	S(R)	**
"	14	Malindig	27	D	27	S(R)	**
"	15	Ilaya	19	D	19	S(R)	**
"	16	Marlangga	22	D/I	22	S(R)	**
"	17	Mabuhay	15	D/I	15	S(R)	**
"	18	Malinao (*1)	12	D	12	S(R)	-
"	19	Bagtingon	9	D	9	S(R)	**
"	20	Malbog	70	D	70	S(R)	**
"	21	Banuyo	30	D	30	S(R)	-
		Sub-Total	584				
CP	50	Masiga	53	P	53	S(R)	-
"	51	Laon	59	P	59	S(R)	-
"	52	Bintakay	12	P	12	S(R)	-
"	53	Mabuhay	27	D	27	S(R)	**
SWIP	54	Pawa	12	I	12	S(R)	-
"	55	Bantad	17	I	17	S(R)	**
		Sub-Total	180				18
		Total	(764) 760				

Notes: CIS - Communal Irrigation System (NIA) CP - Communal Project (DA)
SWIP - Small Water Impounding Project (DA)
CIP - Communal Irrigation Project (NIA)
MPP - Multi-purpose Project
D - Diversion G - Intake Gate P - Pump
I - Impounding Type /I - Change to Impounding Type
S - Short Term M - Medium Term L - Long Term
(R) - Rehabilitation Project
(N) - New Project
** - Rehabilitation of Intake Work

*1 Malinao C/S will be supplied water from Bonliw CIS's intake work to be reconstructed for impounding type.

(Cont')

No.		Name of Project	Irrigable Area (ha)	Intake Type	Drainage Improvement (ha)	Development Stage	Remarks
CIP	22	Tumagabok	20	D	20	S(N)	On going
"	23	Laon-Mataas	160	D	160	S(N)	"
"	24	Tawiran	60	D	60	S(N)	"
"	25	Malindig Ext.	20	D	20	S(N)	"
"	26	Bahi	90	I	90	M(N)	
"	27	Cabugao	30	I	30	M(N)	
"	28	Bachao	80	I	80	M(N)	
"	29	Antipolo	45	I	45	M(N)	
"	30	Amoingon	25	D	25	M(N)	
"	31	Balagasan	50	I	50	M(N)	
"	32	Bagtingon	200	I	200	M(N)	
"	33	Bangbang	120	I	120	M(N)	
"	34	Masaguisi	40	I	40	M(N)	
"	35	Cawit	40	I	40	L(N)	
"	36	Tugos (North)	50	I	50	L(N)	
"	37	Tugos (East)	25	D	25	L(N)	
"	38	Maybo Ext.	25	D	25	L(N)	
MPP	39	Binunga (*2)	710	Reservoir	710	L(N)	
CIP	40	Manlunay	70	I	70	L(N)	
"	41	Tiguion	50	I	50	L(N)	
"	42	Dawis	110	I	110	L(N)	
"	43	Bintakay	45	G	45	L(N)	
"	44	Buangan	35	I	35	L(N)	
"	45	Tagum-Angas (*3)	480	Reservoir	480	S(N)	
"	46	Laylay-Ihatub	90	I	90	L(N)	
"	47	Masiga Ext.	40	P	40	L(N)	
"	48	Tapuyan	50	D	50	L(N)	
		Total	2,760				
		Grand Total(*4)	3,910				

Notes: *2 Total Service Area 920ha = 710ha + 210ha (Existing CISs)
*3 Total Service Area, 630ha = 480ha (Paddy) + (150ha (Diversified Crop)
*4 3,910ha = 2,760ha + 760ha (Existing CIS, CP and SWIP)
+ 390ha (Individual Pump/Self Irrigation)

Source: JICA Study Team (based on topo-map 1:10,000)

Table F-1-8 Engineering Data of First Package CIP

Engineering Data	Project Name							
	Cabugao	Bachao	Antipolo	Amoingon	Balagasan	Bagtingon	Bangbang	Masaguisi
Municipality	Gasan	Gasan	Gasan	Boac	Boac	Buenavista	Gasan	Sta. Cruz
Service Area (*1) - ha	30	80	45	25	50	200	120	40
Intake Type	Storage	Storage	Storage	Diversion	Storage	Storage	Storage	Storage
Drainage Area - sq.km	1.1	2.8	2.5	2.6	2.1	8.2	0.8	0.2
Height of Dam - m	13.5	15.5	21.5	-	14.0	22.0	15.0	12.0
Volume of Dam - cu.m	43,500	50,700	94,700	-	59,500	166,800	68,100	53,100
Irri. Requirement - cum/s	0.080	0.192	0.129	0.064	0.096	0.384	0.144	0.080
Reservoir Capacity - MCM	0.334	0.740	0.420	-	0.350	1.400	0.600	0.180
Canal Length - km								
Main	1.82	4.19	1.68	2.00	2.10	6.47	2.38	1.63
Lateral	2.08	1.56	1.62	-	1.32	2.67	1.75	-

Source: Marinduque Irrigation Development Project by NIA (July, 1989)

Note : (*1) based on scale 1:10,000 topo maps by JICA Study Team

Table F-1-9 Engineering Data of Tagum-Angas CIP

HYDROLOGICAL DATA		
Drainage Area Above Dam - sq.km		25.00
Mean Annual Rainfall - mm		1657.00
Mean Annual Run-off - MCM		19.66
Inflow Design Flood - cu.m/s		381.20
LOCATION	Devilla River	
Dam		
Type	Rockfill	
Height of Dam above Streambed - m		31.60
Crest Elevation - m		70.60
Crest Length - m		125.00
Crest Width - m		8.00
Base Width - m		140.00
Volume of Embankment - cu.m.		131,300
SPILLWAY		
Type	Side Channel with Chute & Flip Bucket	
Crest Width - m		40.00
Crest Elevation - m		66.00
Chute Width - m		10.00
Design Capacity - cu.m/s		333.74
DIVERSION AND OUTLET WORKS		
Type	R.C. Conduit	
Number and Size	1-2.5 m. diameter	
Control	2-0.60 m. diameter H.P. Gates	
Diversion Requirement During Construction - cu.m/s		30.20
Irrigation Requirement - cu.m/s		0.53
Power Requirement - cu.m/s		1.83
Capacity at Normal Water Surface Elevation - cu.m/s		5.06
Capacity at Minimum Water Surface Elevation		1.83
RESERVOIR ELEVATION		
Maximum Water Surface Elevation - m		68.58
Normal Water Surface Elevation - m		66.00
Minimum Water Surface Elevation - m		46.00
RESERVOIR AREA AT		
Maximum Water Surface Elevation - ha		35.20
Normal Water Surface Elevation - ha		26.40
Minimum Water Surface Elevation - ha		3.20
RESERVOIR CAPACITY AT		
Maximum Water Surface Elevation - MCM		3.648
Normal Water Surface Elevation - MCM		2.865
Minimum Water Surface Elevation - MCM		0.119
IRRIGABLE AREA		
Paddy (480ha) + Deversified Crop (150ha) =		630 (*)
HYDRO POWER FACILITIES		
Installed Capacity - KW		300
Number and Capacity of Units - KW		3-100
Rated Head - m		20.90
Maximum Head - m		26.40
Minimum Head - m		13.40
POWER WATERWAY		
Diameter of Penstock - m		0.35 m ϕ
Controls		3-0.35 m ϕ Butterfly Valves
ANNUAL ENERGY GENERATION		
Firm - GWH		0.5
Secondary - GWH		0.9
Total - GWH		1.4 (*)
SWITCHYARD		Outdoor 10.00m x 6.00

Source: F/S Report (NIA)

(*) JICA Study Team

Table F-1-10 Water Balance of Tagum-Angas CIP

*** WATER BALANCE -- TAGUM.ANGAS *** AREA= 630.0 HAS.

YEAR	INFLOW (MCM)	IRRI. (MCM)	SUPPLY (MCM)	POWER (MCM)	DEMAND (MCM)	EVAPO (MCM)	SPILL (MCM)	SHORT (MCM)	C-SHORT (MCM)	ENERGY (GWH)	VOLUME (MCM)	W-LEVEL (EL-M)
											0.000	39.000
1	18.140	7.982	0.120	6.545	14.646	0.185	2.713	0.000	0.000	0.628	0.596	53.000
2	42.840	7.982	0.120	20.653	28.755	0.141	12.890	1.215	1.215	1.354	2.865	66.000
3	27.290	7.982	0.120	13.120	21.222	0.187	7.741	0.946	0.946	1.021	1.951	61.923
4	27.830	7.982	0.120	13.081	21.183	0.137	7.731	1.381	1.381	0.918	2.111	62.780
5	27.350	7.982	0.120	12.348	20.449	0.150	6.482	0.486	0.486	0.942	2.865	66.000
6	44.920	7.982	0.120	25.043	33.145	0.255	11.521	0.000	0.000	1.883	2.865	66.000
7	28.540	7.982	0.120	15.693	23.795	0.249	4.496	0.000	0.000	1.344	2.865	66.000
8	37.370	7.982	0.120	21.538	29.639	0.254	7.477	0.000	0.000	1.682	2.865	66.000
9	58.420	7.982	0.120	23.768	31.869	0.255	26.296	0.000	0.000	1.810	2.865	66.000
10	53.380	7.982	0.120	24.953	33.054	0.254	20.072	0.000	0.000	1.876	2.865	66.000
11	36.290	7.982	0.120	12.844	20.946	0.182	15.162	0.000	0.000	1.070	2.865	66.000
12	36.790	7.982	0.120	18.852	26.954	0.244	9.592	0.000	0.000	1.516	2.865	66.000
13	14.330	7.982	0.120	6.481	14.582	0.153	0.000	0.406	0.406	0.605	2.865	66.000
14	28.820	7.982	0.120	15.241	23.343	0.208	5.269	0.000	0.000	1.243	2.865	66.000
15	23.810	7.982	0.120	13.624	21.726	0.228	1.856	0.000	0.000	1.205	2.865	66.000
16	32.680	7.982	0.120	20.384	28.485	0.234	3.961	0.000	0.000	1.591	2.865	66.000
17	50.130	7.982	0.120	23.403	31.505	0.250	18.375	0.000	0.000	1.785	2.865	66.000
18	55.360	7.982	0.120	24.297	32.399	0.239	22.722	0.000	0.000	1.827	2.865	66.000
19	32.260	7.982	0.120	18.365	26.466	0.248	6.399	0.000	0.000	1.490	2.011	62.245
20	34.150	7.982	0.120	14.499	22.600	0.175	10.661	0.140	0.140	1.130	2.865	66.000
21	41.180	7.982	0.120	20.149	28.250	0.249	12.681	0.000	0.000	1.591	2.865	66.000
22	37.130	7.982	0.120	19.835	27.937	0.232	8.961	0.000	0.000	1.556	2.865	66.000
23	25.380	7.982	0.120	14.388	22.490	0.197	2.693	0.000	0.000	1.173	2.865	66.000
24	24.590	7.982	0.120	14.821	22.922	0.207	1.461	0.000	0.000	1.221	2.865	66.000
25	31.180	7.982	0.120	18.986	27.087	0.251	3.842	0.000	0.000	1.530	2.865	66.000
MEAN	34.806	7.982	0.120	17.316	25.418	0.214	9.242	0.183	0.183	1.360		

Reservoir Capacity

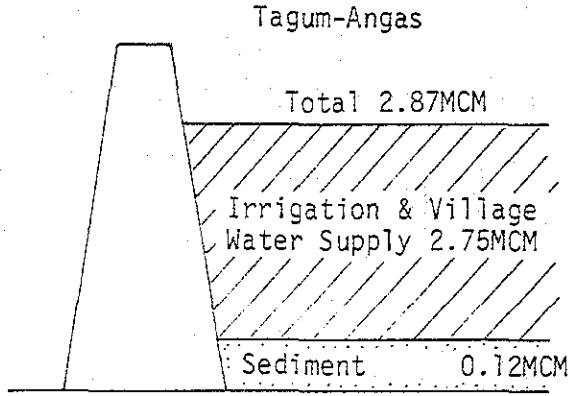


Table F-1-11 Water Balance of Binunga MPP

*** WATER BALANCE -- BINUNGA.MPP *** AREA= 920.0 HAS. BF=0.87 CU.M/S./100SQ.KM

YEAR	INFLOW (MCM)	BASE-F (MCM)	U.R.D (MCM)	IRRI. (MCM)	SUPPLY (MCM)	POWER (MCM)	DEMAND (MCM)	EVAPO (MCM)	SPILL (MCM)	SHORT (MCM)	C-SHORT (MCM)	ENERGY (GWH)	VOLUME (MCM)	W-LEVEL (EL-M)
													2.100	79.000
1	60.950	16.800	44.150	13.708	0.720	8.041	22.469	0.643	19.407	0.000	0.000	1.287	3.731	82.194
2	143.942	21.160	122.782	13.708	0.720	30.280	44.708	0.571	74.343	0.909	0.909	2.503	7.800	88.000
3	91.694	17.292	74.403	13.708	0.720	23.271	37.699	0.635	38.560	0.407	0.407	2.373	5.716	85.106
4	93.509	15.679	77.830	13.708	0.720	23.340	37.768	0.562	41.079	1.579	1.579	2.018	5.716	85.106
5	91.896	19.228	72.668	13.708	0.720	17.978	32.406	0.570	38.813	1.205	1.205	1.837	7.800	88.000
6	150.931	22.731	128.200	13.708	0.720	45.038	59.466	0.719	68.015	0.000	0.000	3.927	7.800	88.000
7	95.894	19.803	76.091	13.708	0.720	29.731	44.159	0.711	31.222	0.000	0.000	3.031	7.800	88.000
8	125.563	22.731	102.832	13.708	0.720	42.328	56.756	0.717	45.359	0.000	0.000	3.801	7.800	88.000
9	196.291	22.731	173.560	13.708	0.720	50.228	64.656	0.722	108.181	0.000	0.000	4.187	7.800	88.000
10	179.357	22.181	157.176	13.708	0.720	45.110	59.538	0.722	96.916	0.000	0.000	3.915	7.800	88.000
11	121.934	19.870	102.064	13.708	0.720	21.958	36.386	0.655	65.022	0.000	0.000	2.463	7.800	88.000
12	123.614	22.731	100.883	13.708	0.720	37.517	51.945	0.705	48.233	0.000	0.000	3.544	7.800	88.000
13	48.149	18.064	30.084	13.708	0.720	9.014	23.442	0.640	6.002	0.000	0.000	1.738	7.800	88.000
14	96.835	19.488	77.347	13.708	0.720	20.982	35.410	0.665	41.271	0.000	0.000	2.531	7.800	88.000
15	80.002	19.736	60.265	13.708	0.720	25.827	40.255	0.675	19.335	0.000	0.000	2.788	7.800	88.000
16	109.805	21.899	87.906	13.708	0.720	33.819	48.247	0.697	38.962	0.000	0.000	3.327	7.800	88.000
17	168.437	21.475	146.962	13.708	0.720	42.312	56.740	0.708	89.514	0.000	0.000	3.706	7.800	88.000
18	186.009	21.664	164.346	13.708	0.720	41.378	55.806	0.697	107.843	0.000	0.000	3.671	7.800	88.000
19	108.394	19.950	88.443	13.708	0.720	35.819	50.247	0.706	39.574	0.000	0.000	3.300	5.716	85.106
20	114.744	20.904	93.840	13.708	0.720	28.071	42.499	0.598	48.659	0.000	0.000	2.442	7.800	88.000
21	138.365	20.904	117.461	13.708	0.720	34.849	49.277	0.717	67.467	0.000	0.000	3.348	7.800	88.000
22	124.757	20.677	104.080	13.708	0.720	30.173	44.601	0.699	58.780	0.000	0.000	3.094	7.800	88.000
23	85.277	21.509	63.768	13.708	0.720	25.063	39.491	0.669	23.608	0.000	0.000	2.824	7.800	88.000
24	82.622	20.933	61.689	13.708	0.720	28.069	42.497	0.671	18.521	0.000	0.000	2.917	7.800	88.000
25	104.765	22.731	82.034	13.708	0.720	37.375	51.803	0.719	29.512	0.000	0.000	3.562	7.800	88.000
MEAN	116.949	20.515	96.435	13.708	0.720	30.703	45.131	0.672	50.568	0.164	0.164	2.965		

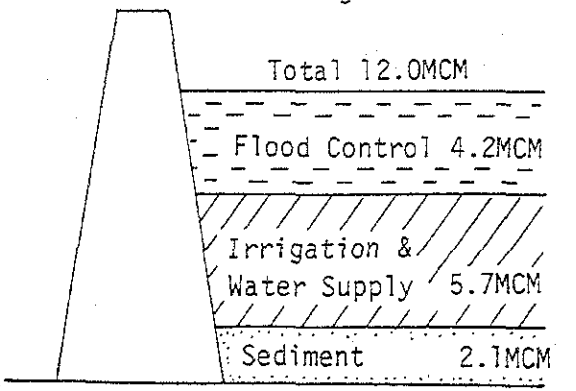
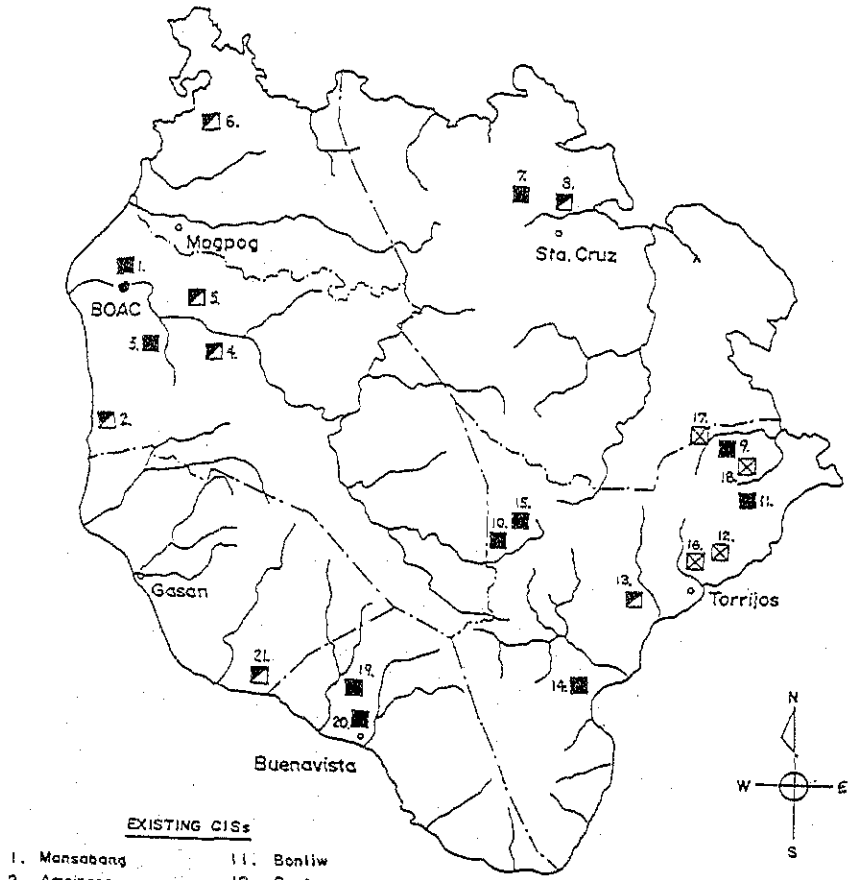


Figure F-1-1 Location Map of Communal Irrigation System
(As of Aug. 1989)



EXISTING CISs

1. Mansasbang
2. Amoingon
3. Mayba-Malbog
4. Katubugan
5. Pawa-Tagwak
6. Balanacan
7. Landy-Bellis
8. Lipa
9. Matuyatuya
10. Sibuyao
11. Bantiw
12. Poctoy
13. Busay
14. Malindig
15. Ilaya
16. Mariangga
17. Mabuhay
18. Malinao
19. Bagtingan
20. Malbog
21. Banuyo

0 5 10 Km.

Legend:

- FULLY-OPERATIONAL
- PARTIALLY-OPERATIONAL
- NON-OPERATIONAL

Figure F-1-2 Relation between Climatic Conditions and Paddy Cropping Pattern

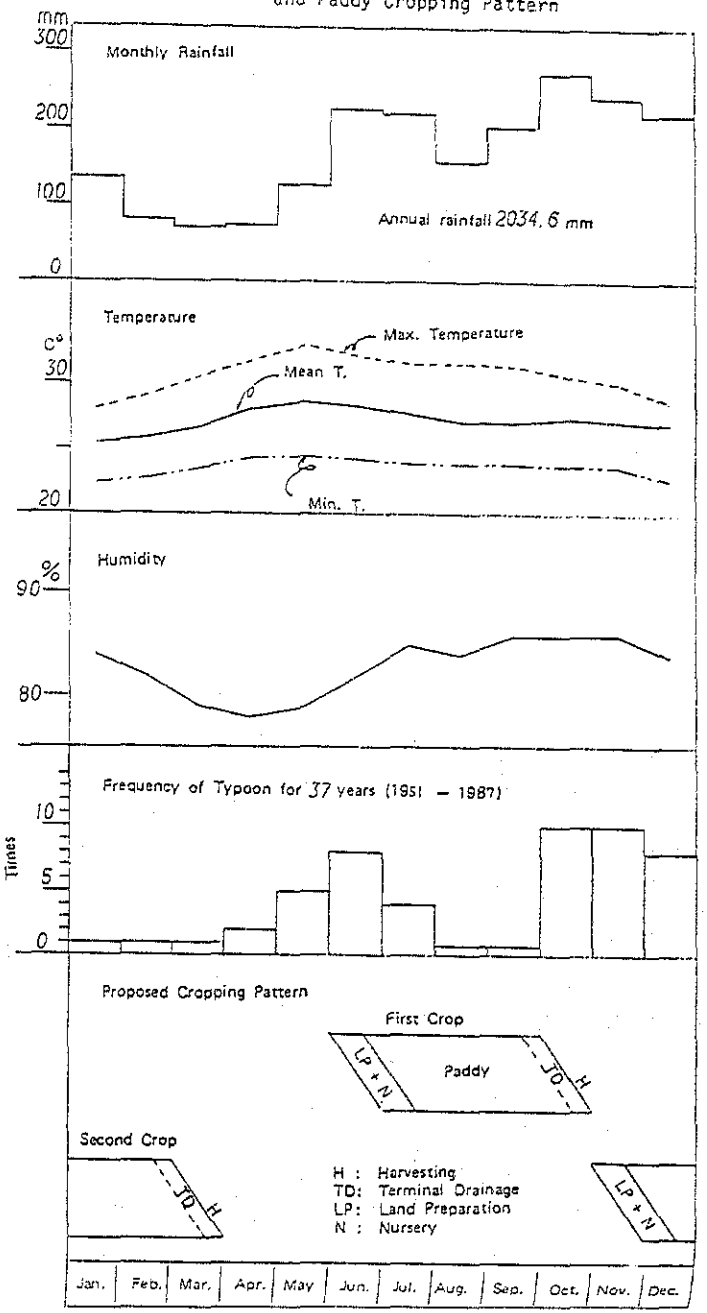
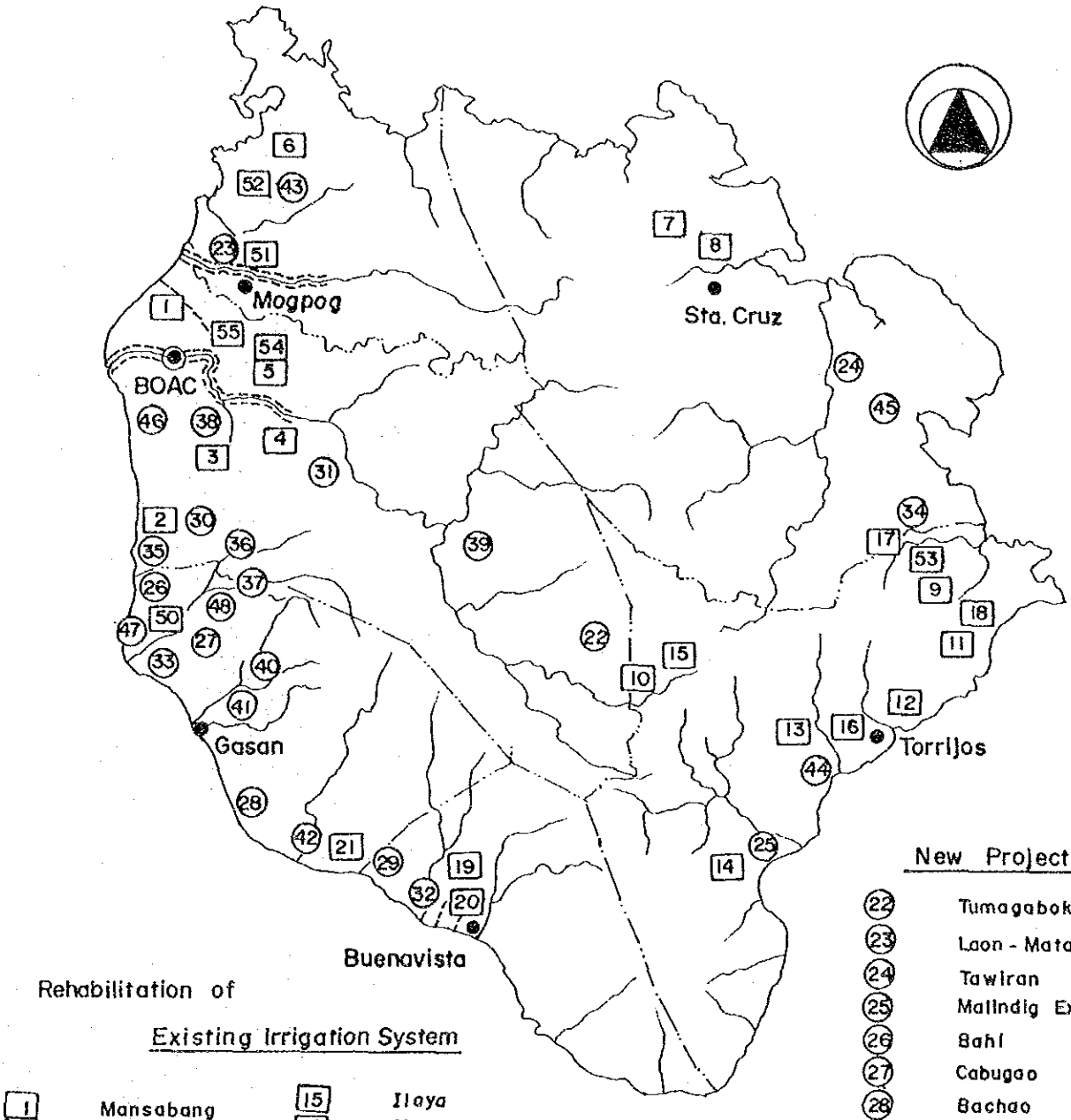


Figure F-1-3 Location Map of Proposed Irrigation / Drainage Project



Rehabilitation of

Existing Irrigation System

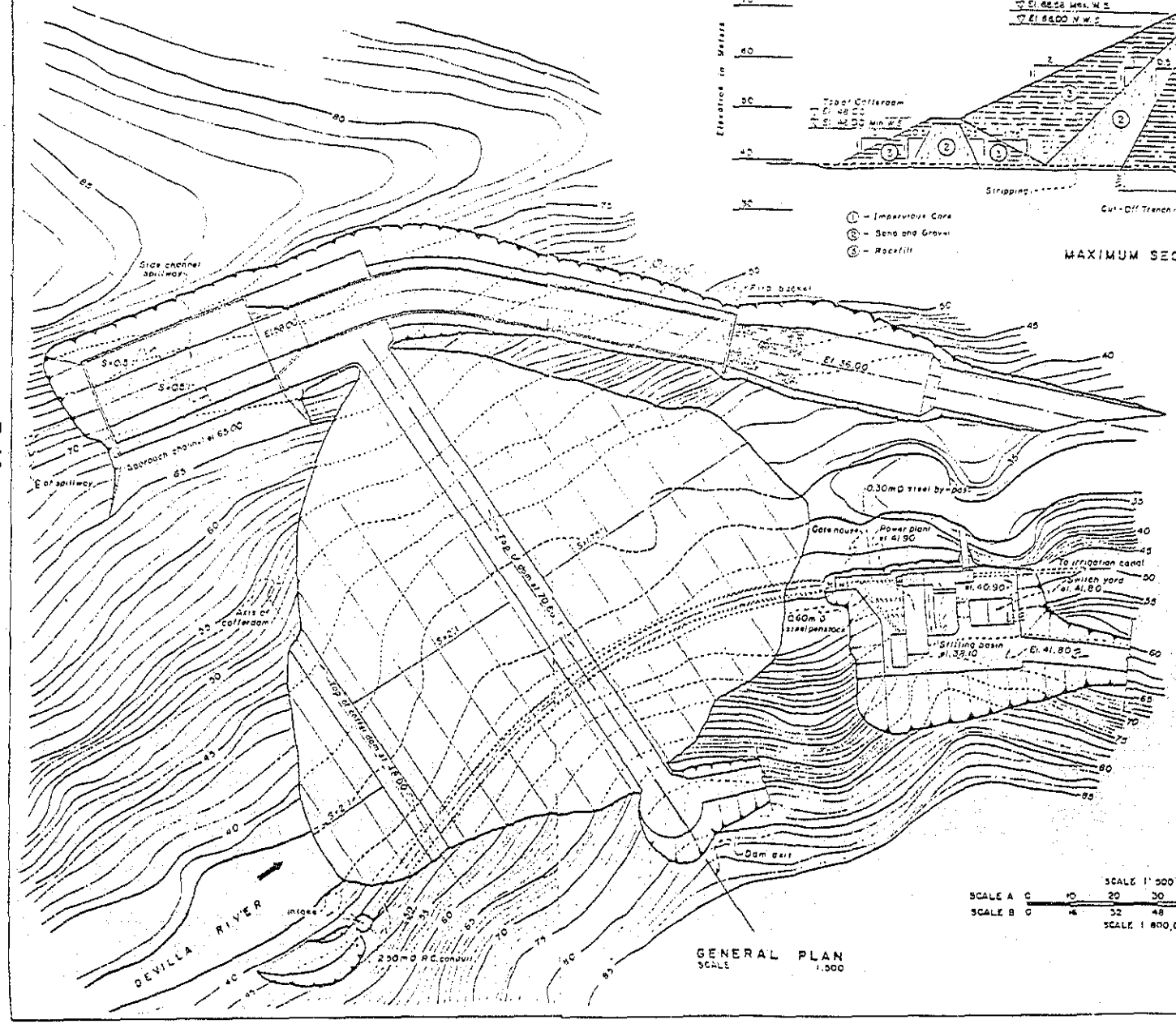
1	Mansabang	15	Ilaya
2	Amoingon	16	Mariangga
3	Maybo - Malbog	17	Mabuhay
4	Katubugan	18	Malinao
5	Pawa - Tagwak	19	Bagtingon
6	Balanacan	20	Malbog
7	Landy - Balils	21	Banuyo
8	Lipa	50	Masiga
9	Matuyatuya	51	Laon
10	Sibuyao	52	Bintakay
11	Bontiw	53	Mabuhay
12	Poctoy	54	Pawa
13	Busay	55	Bantad
14	Malindig		

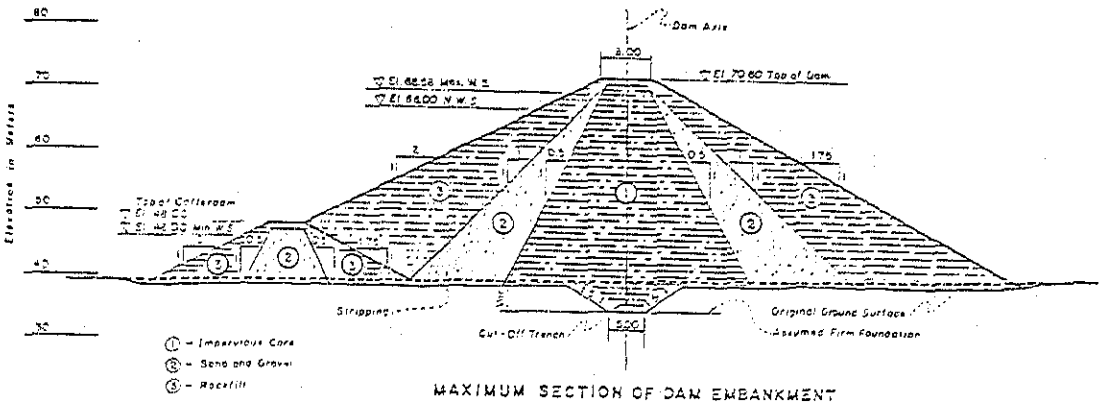
New Project

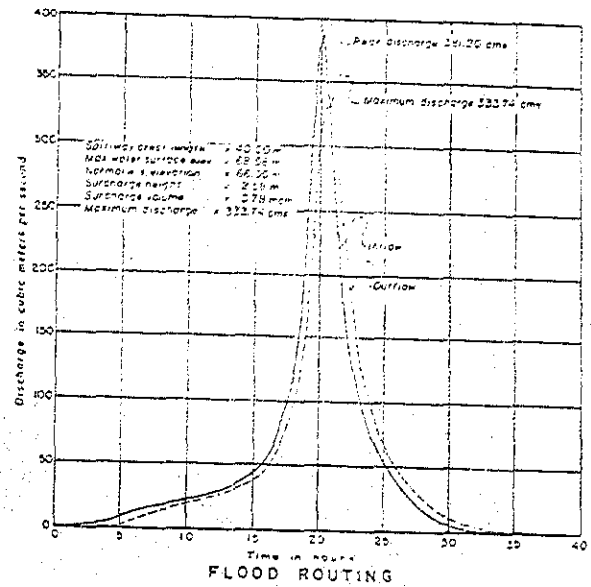
40	Manlunay	22	Tumagabok
41	Tiguion	23	Laon - Mataas
42	Dawis	24	Tawiran
43	Bintakay	25	Malindig Ext.
44	Buangan	26	Bahi
45	Tagum - Angos	27	Cabugao
46	Laylay - Ihatub	28	Bachao
47	Masiga Ext.	29	Antipolo
48	Tapuyan	30	Amoingon
		31	Balagasan
		32	Bagtingon
		33	Bangbang
		34	Masaguisi
		35	Cawit
		36	Tugos (North)
		37	Tugos (East)
		38	Maybo Ext.
		39	Binunga MPP

Flood Protection Dike

Figure F-1-4 Layout of Tagum-Angas Dam







SCALE A 0 10 20 30 40 50 m
SCALE B 0 16 32 48 64 80 km
SCALE 1:800,000

NATIONAL IRRIGATION ADMINISTRATION
MANILA, PHILIPPINES

TAGUM ANGAS SWIM PROJECT
STA. CRUZ, DAVAO DEL SUR

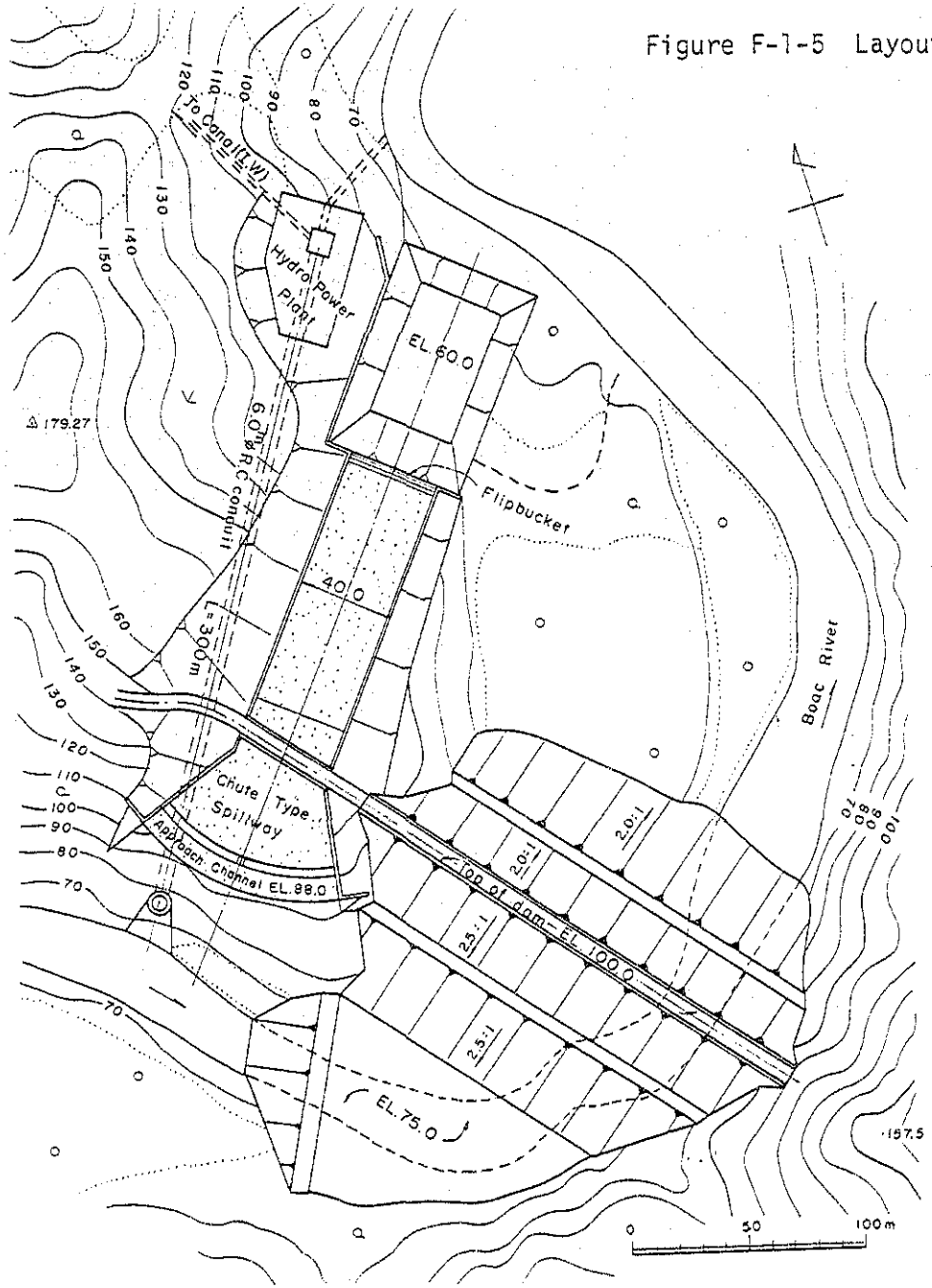
TAGUM ANGAS DAM
LAYOUT OF DAM EMBANKMENT AND APPURTENANT STRUCTURES

FEASIBILITY DESIGN DRAWING

MERALCO INDUSTRIAL ENGINEERING SERVICES CORPORATION

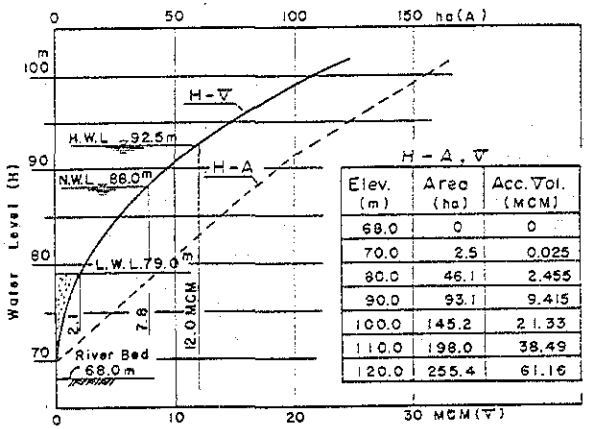
TASP IV-2

Figure F-1-5 Layout of Binunga Dam



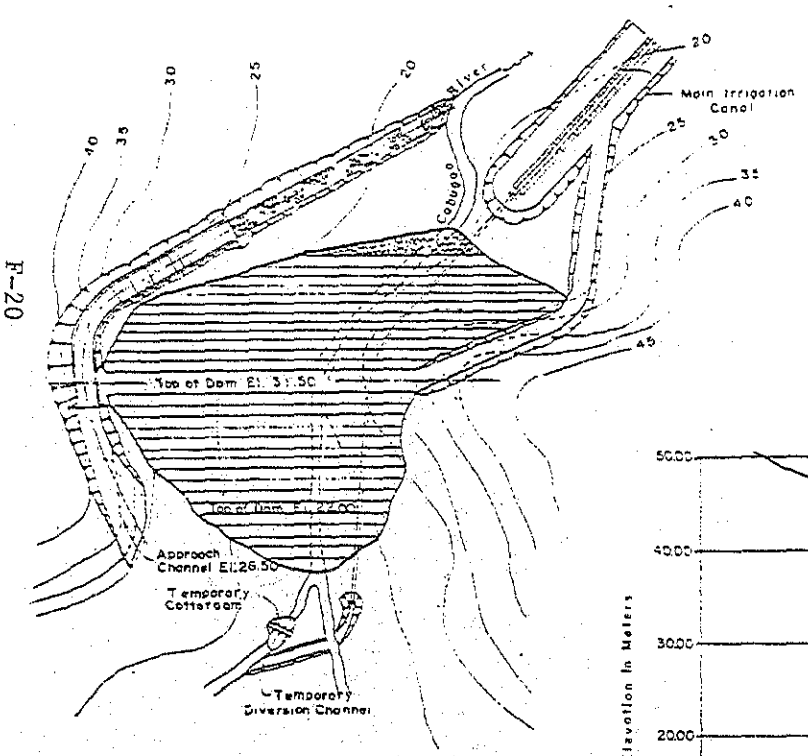
Engineering Data

Catchment Area	84 sq·km
Height of Dam	32 m
Reservoir Capacity	12 MCM
Dam Volume	450,000 cu.m
Purpose	I.W.P.F.
Service Area	920 ha
Canal Length	38 km
Water Supply	2,000 cu.m./day
Energy Generation	3.0 GWH/year

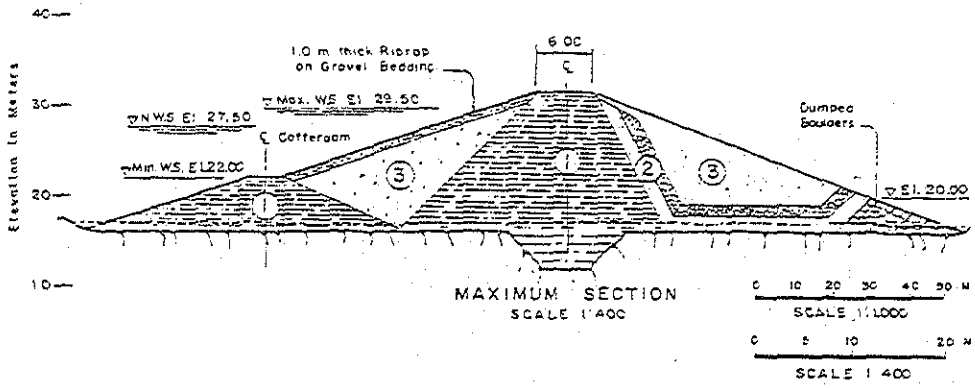


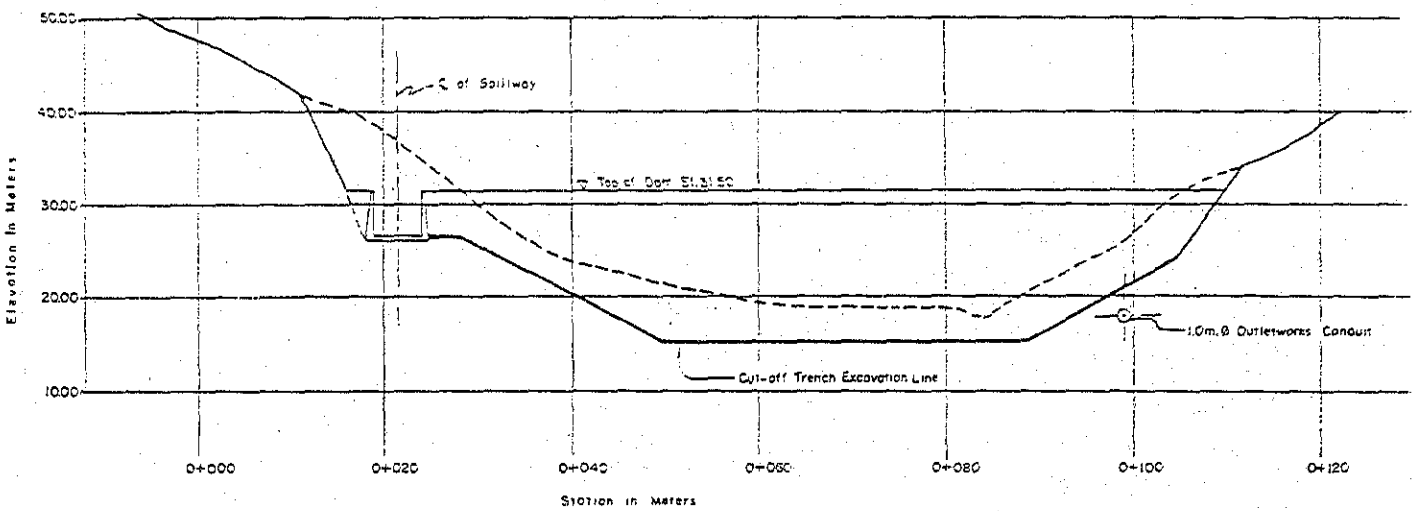
Elev. (m)	Area (ha)	Acc. ∇ol. (MCM)
68.0	0	0
70.0	2.5	0.025
80.0	46.1	2.455
90.0	93.1	9.415
100.0	145.2	21.33
110.0	198.0	38.49
120.0	255.4	61.16

Figure F-1-6 Layout Plan of CIP
(1) Cabugao CIP

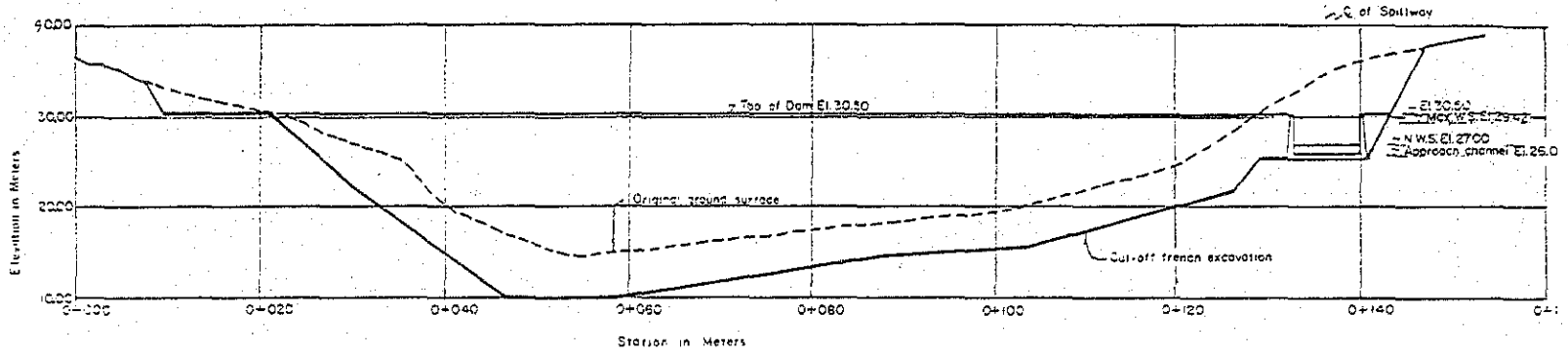


GENERAL PLAN
SCALE 1:1000



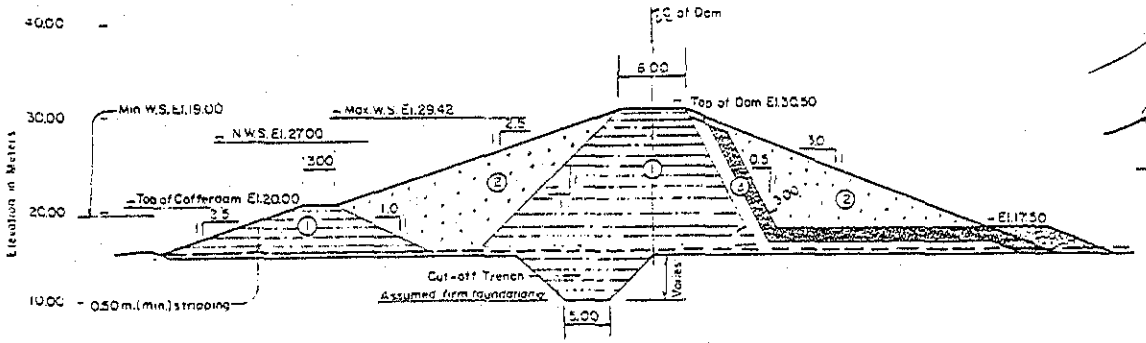


PROFILE
Scale 1:400

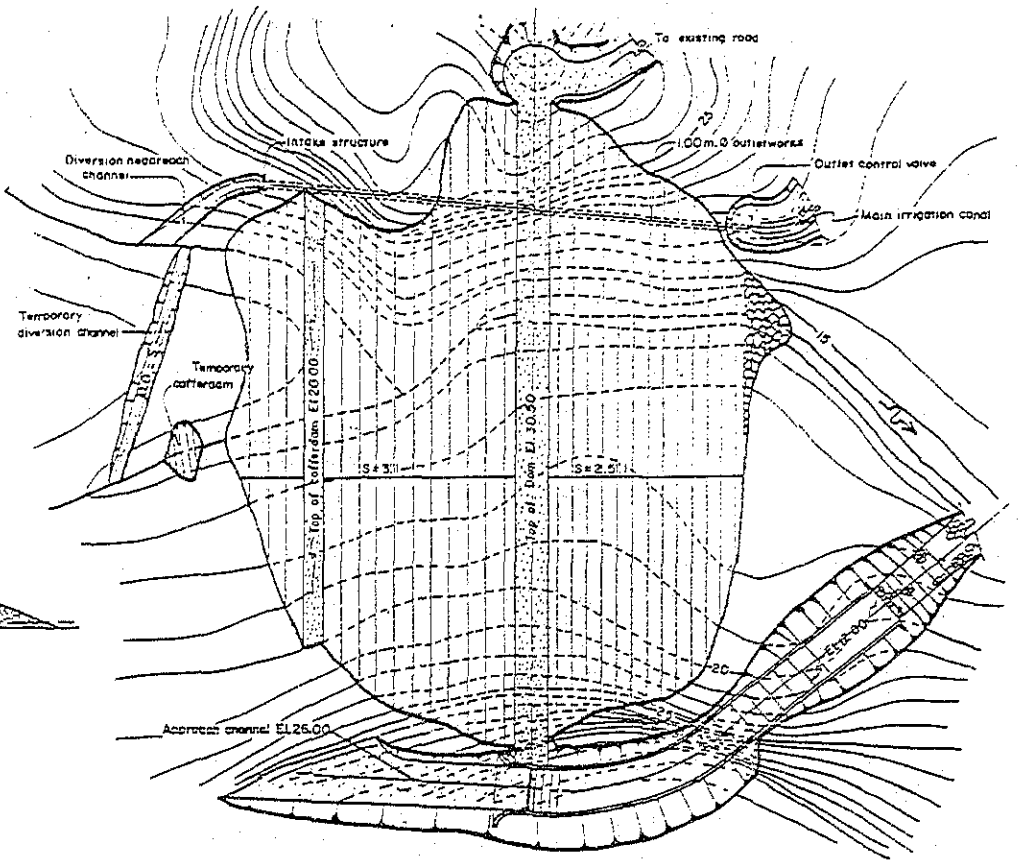


PROFILE

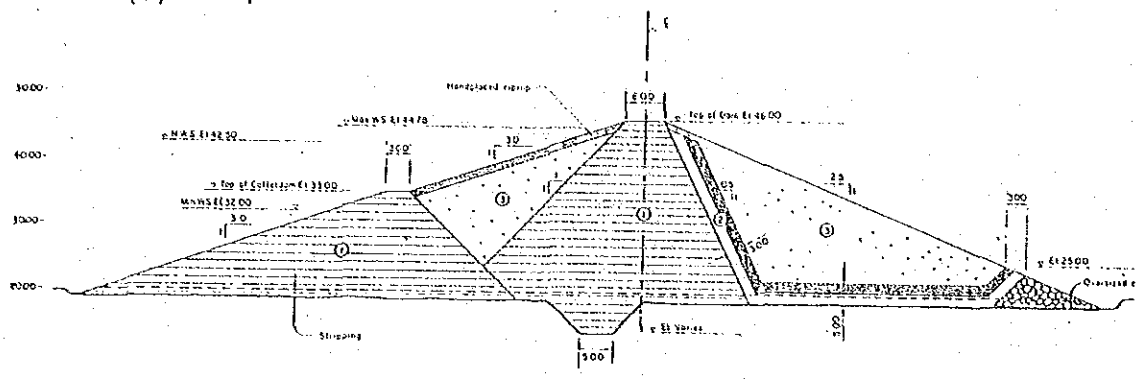
(2) Bachao CIP



MAXIMUM SECTION



(3) Antipolo CIP



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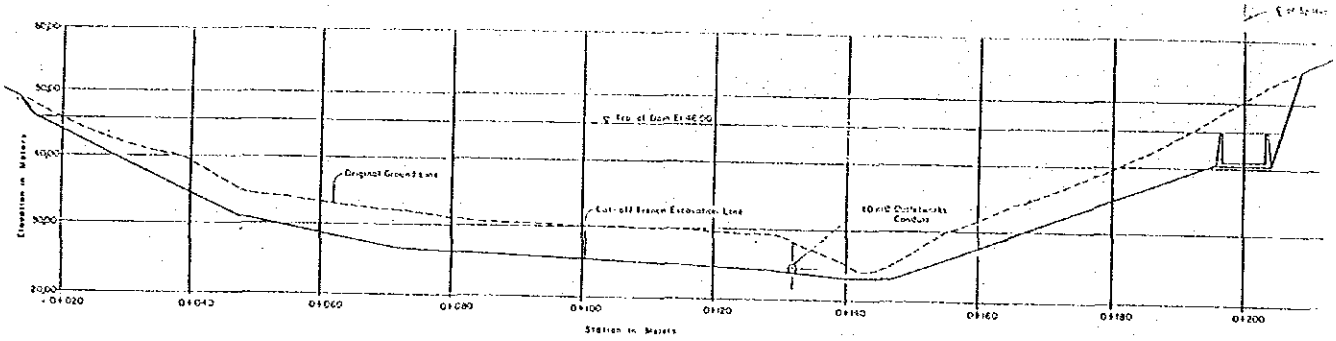

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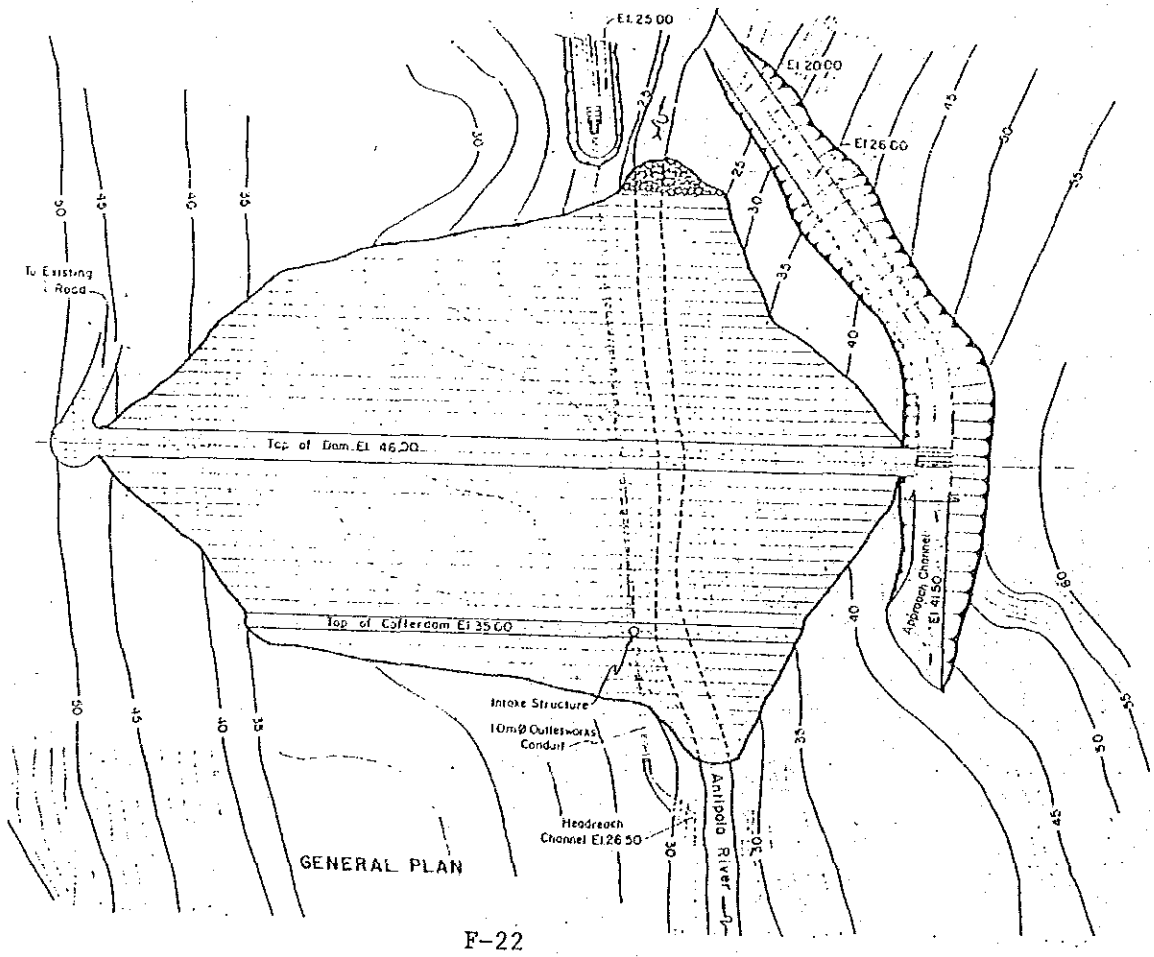
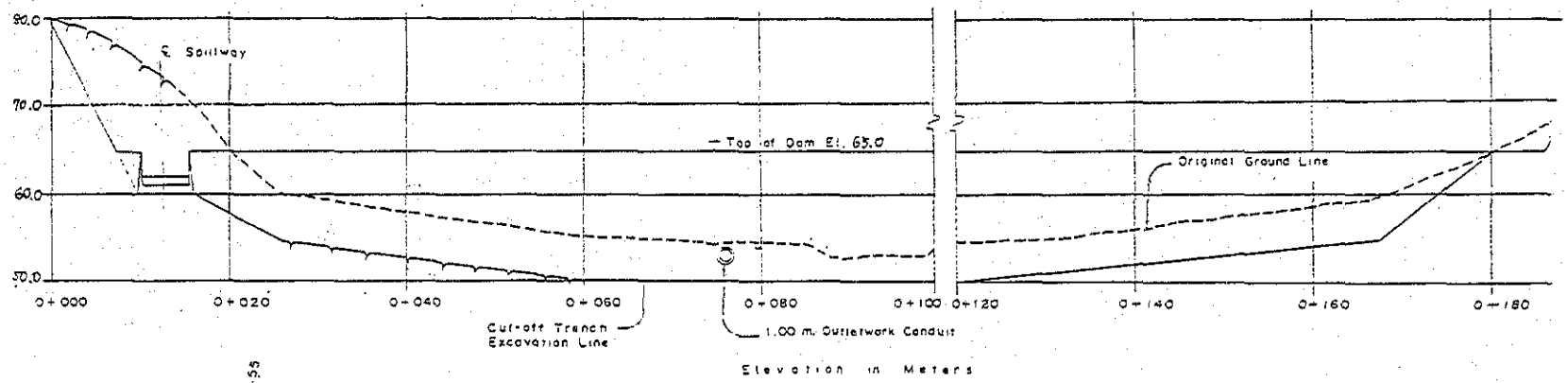
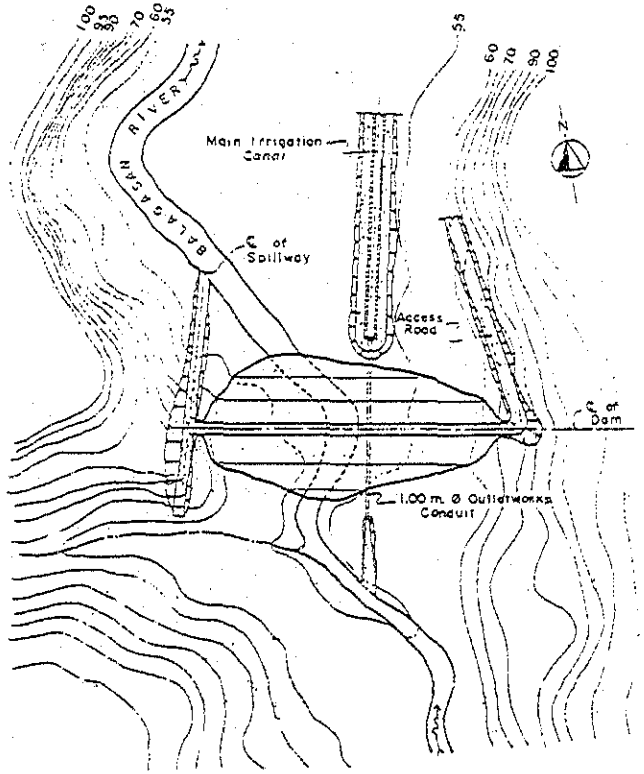


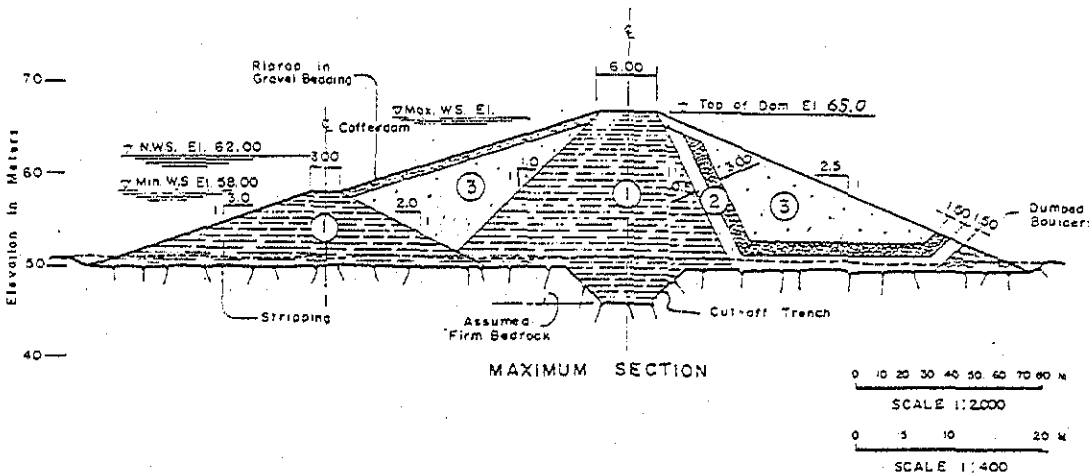
GENERAL PLAN

(4) Balagasan CIP



PROFILE



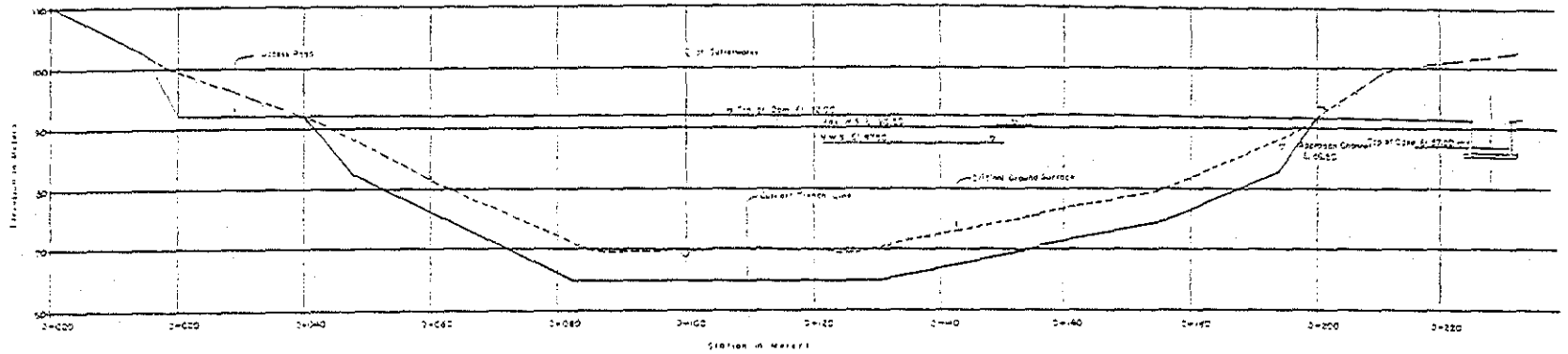


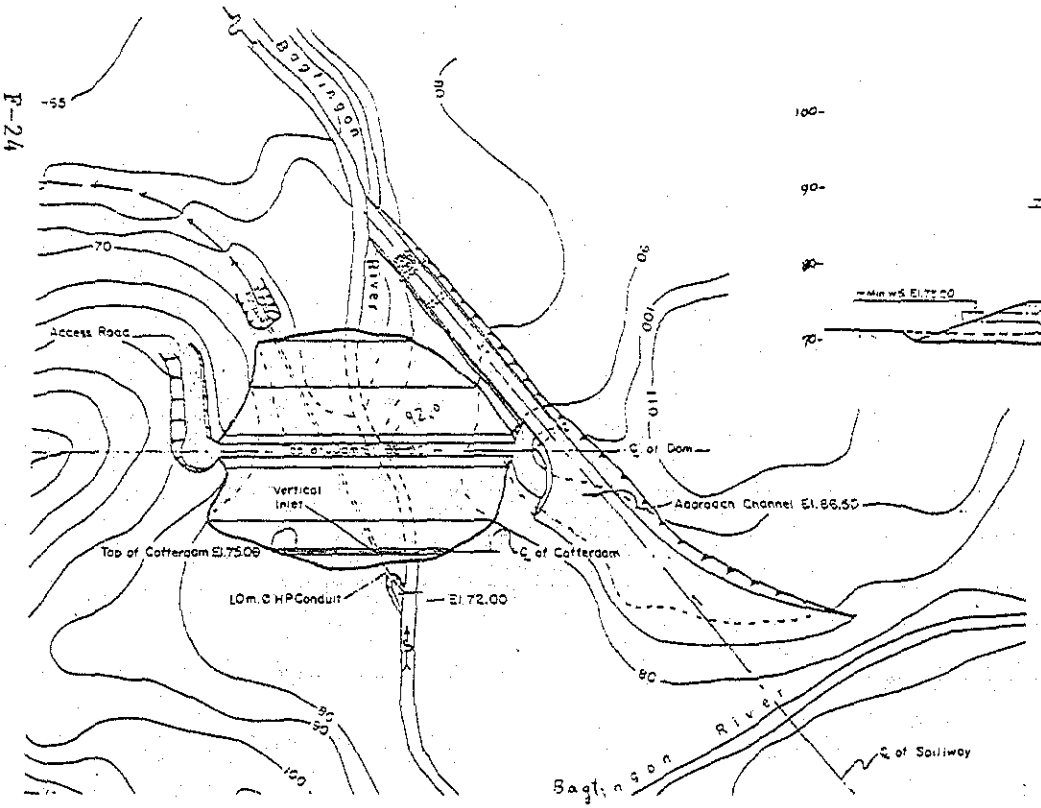
MAXIMUM SECTION

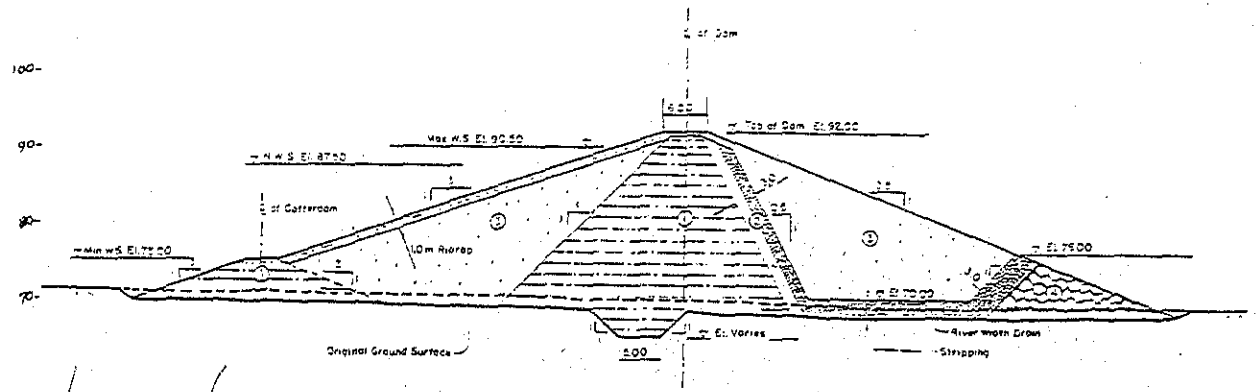
SCALE 1:2000

SCALE 1:400

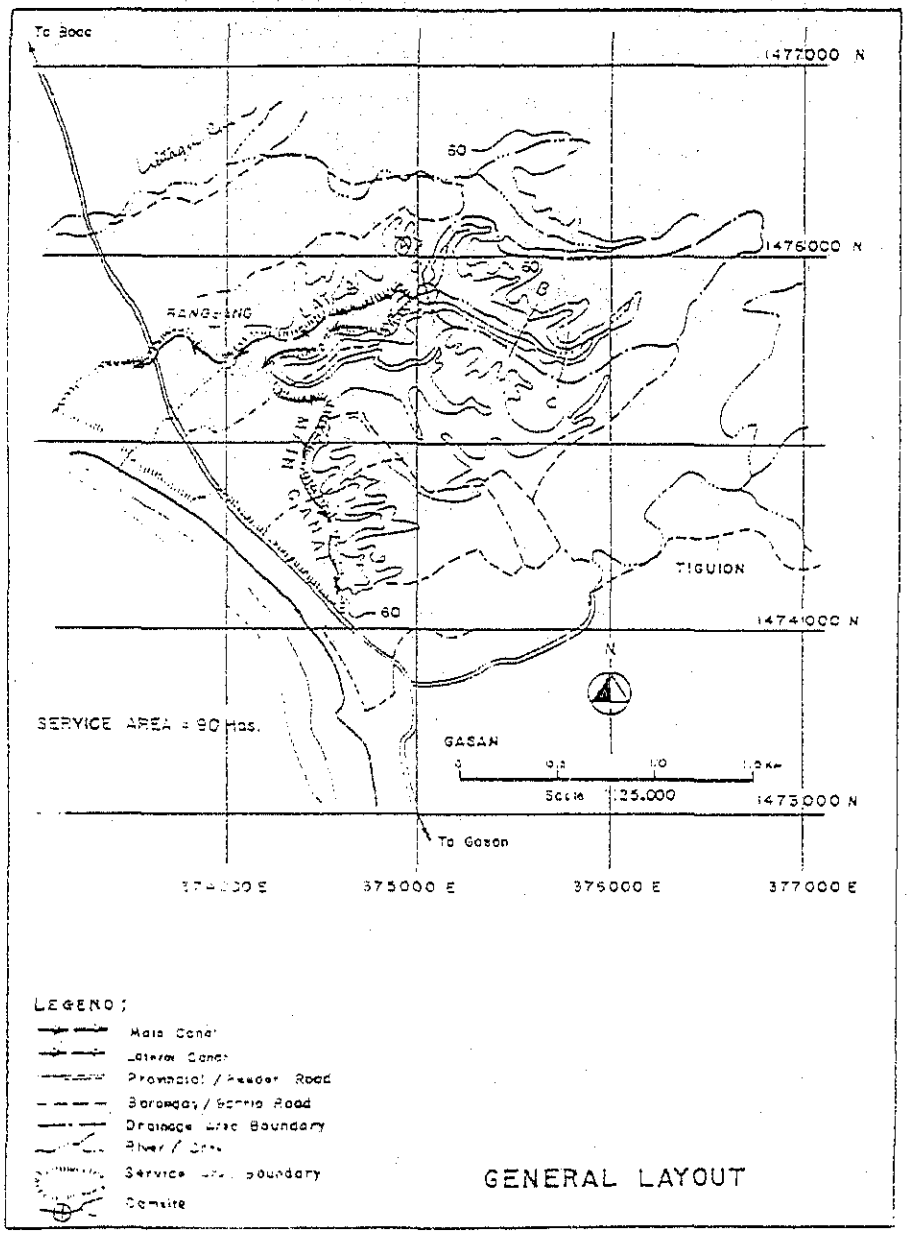
(5) Bagtingon CIP







(6) Bangbang



(7) Masaguisi

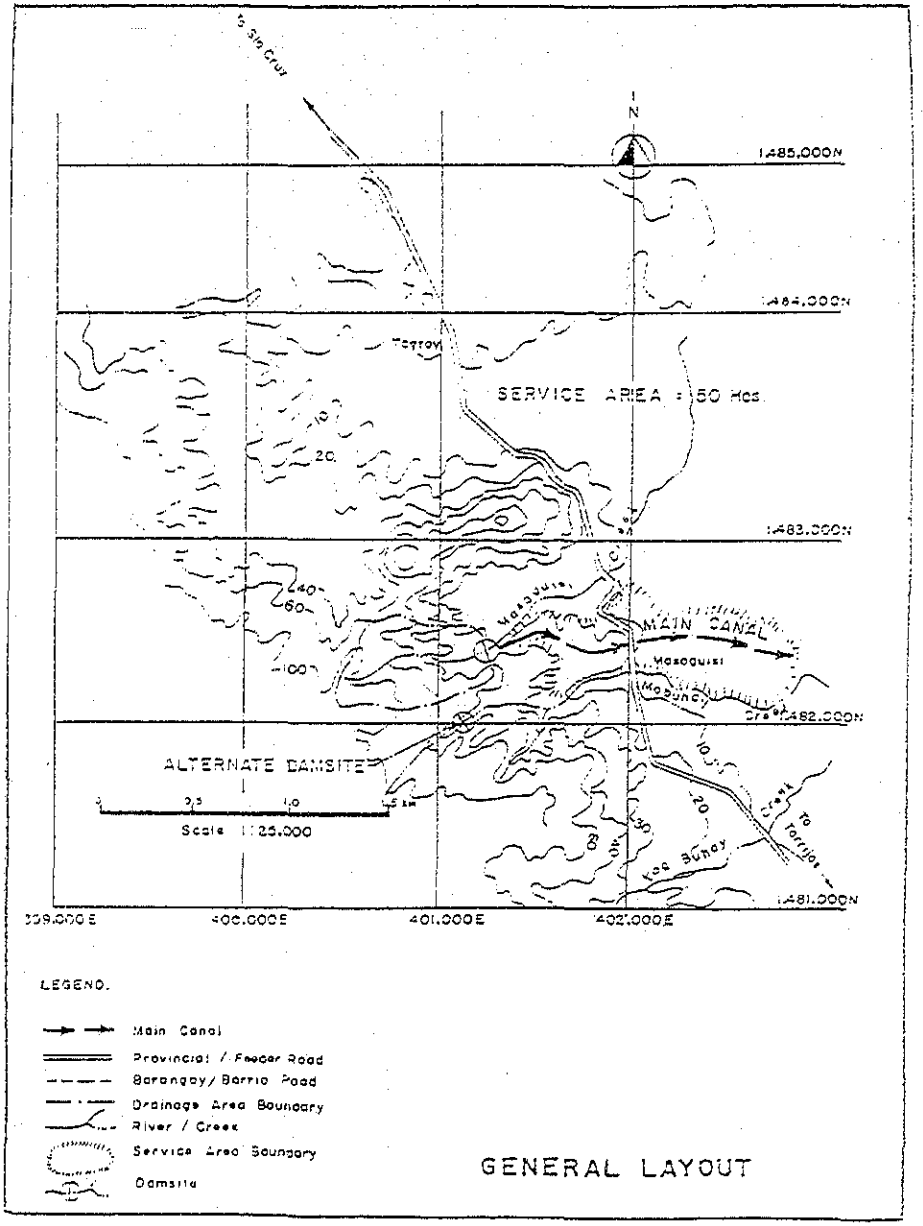
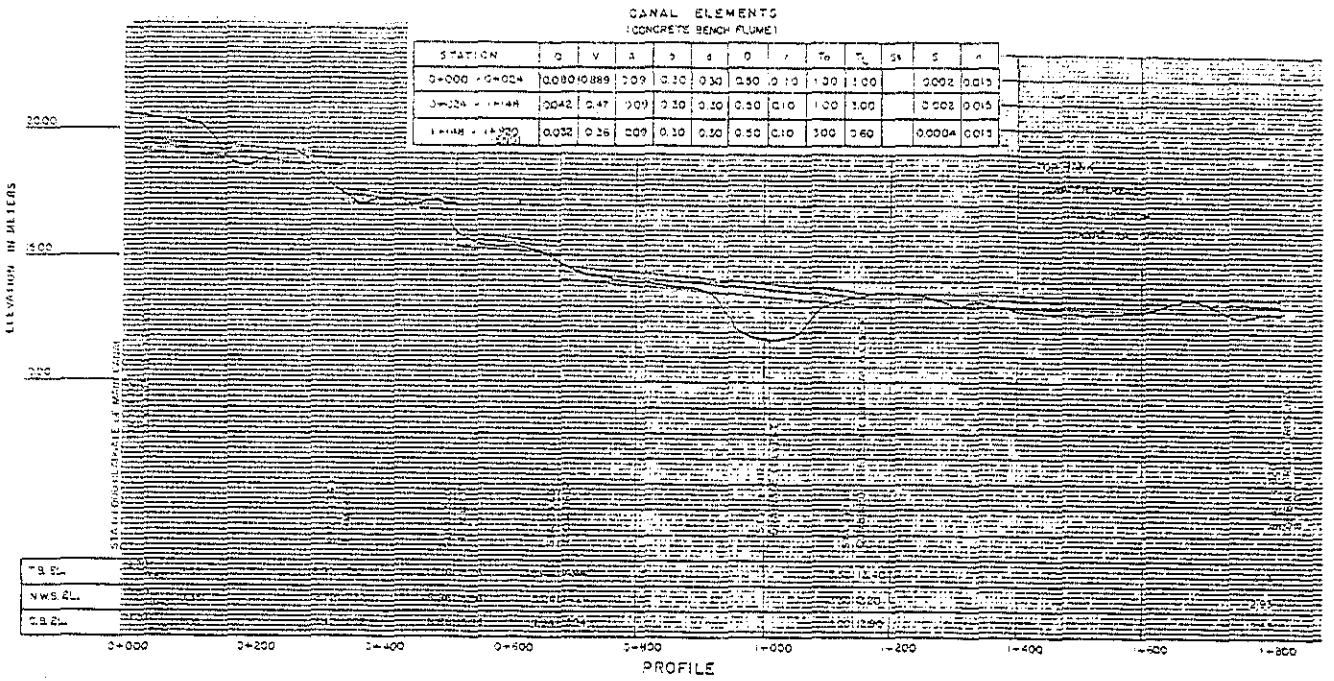
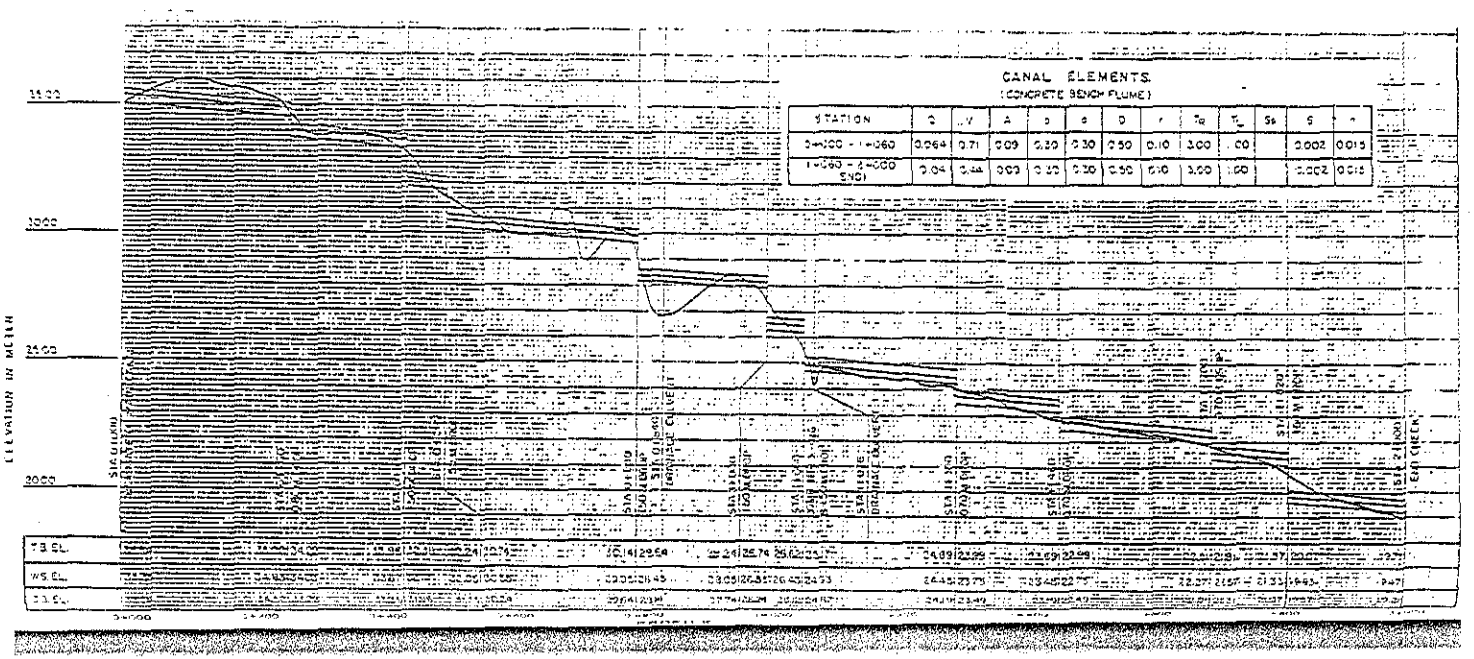


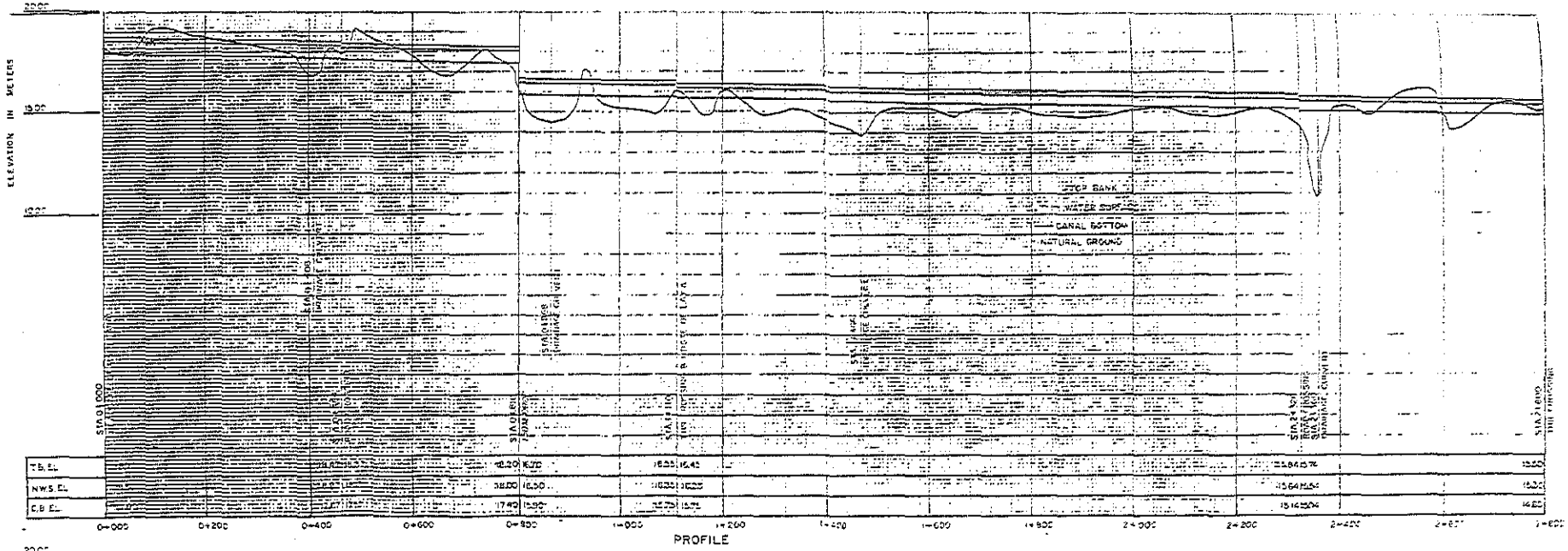
Figure F-1-7 Canal Profile of CIP

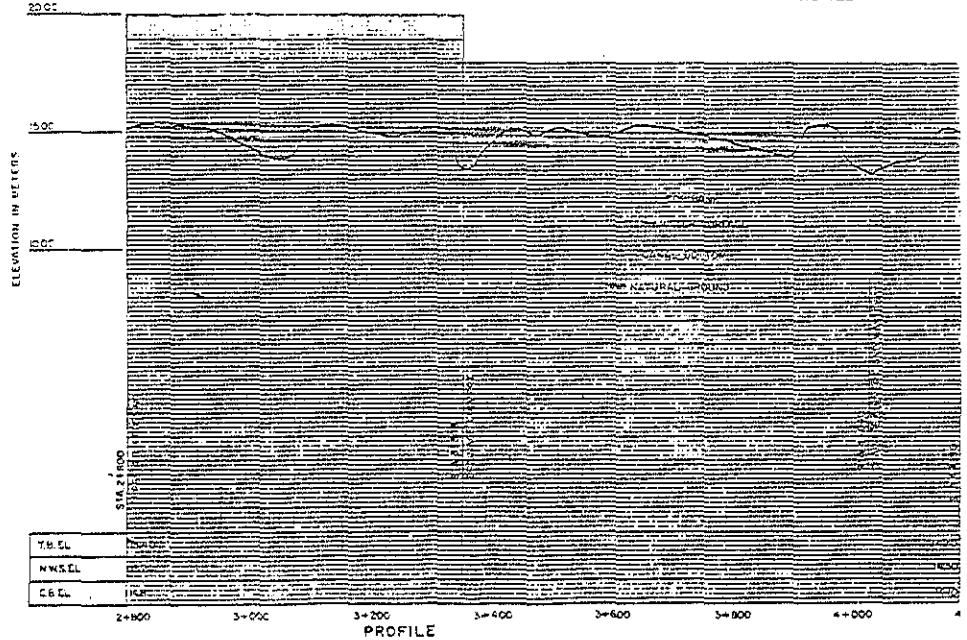


(1) Cabugao CIP



(2) Amoingon CIP



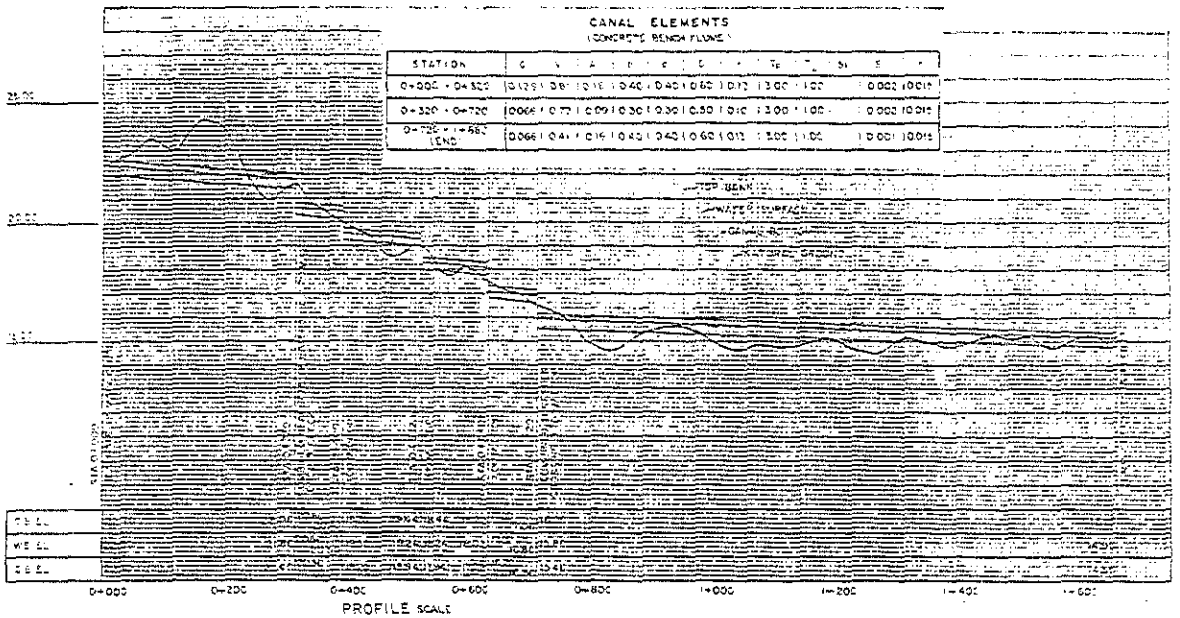


(3) Bachao CIP

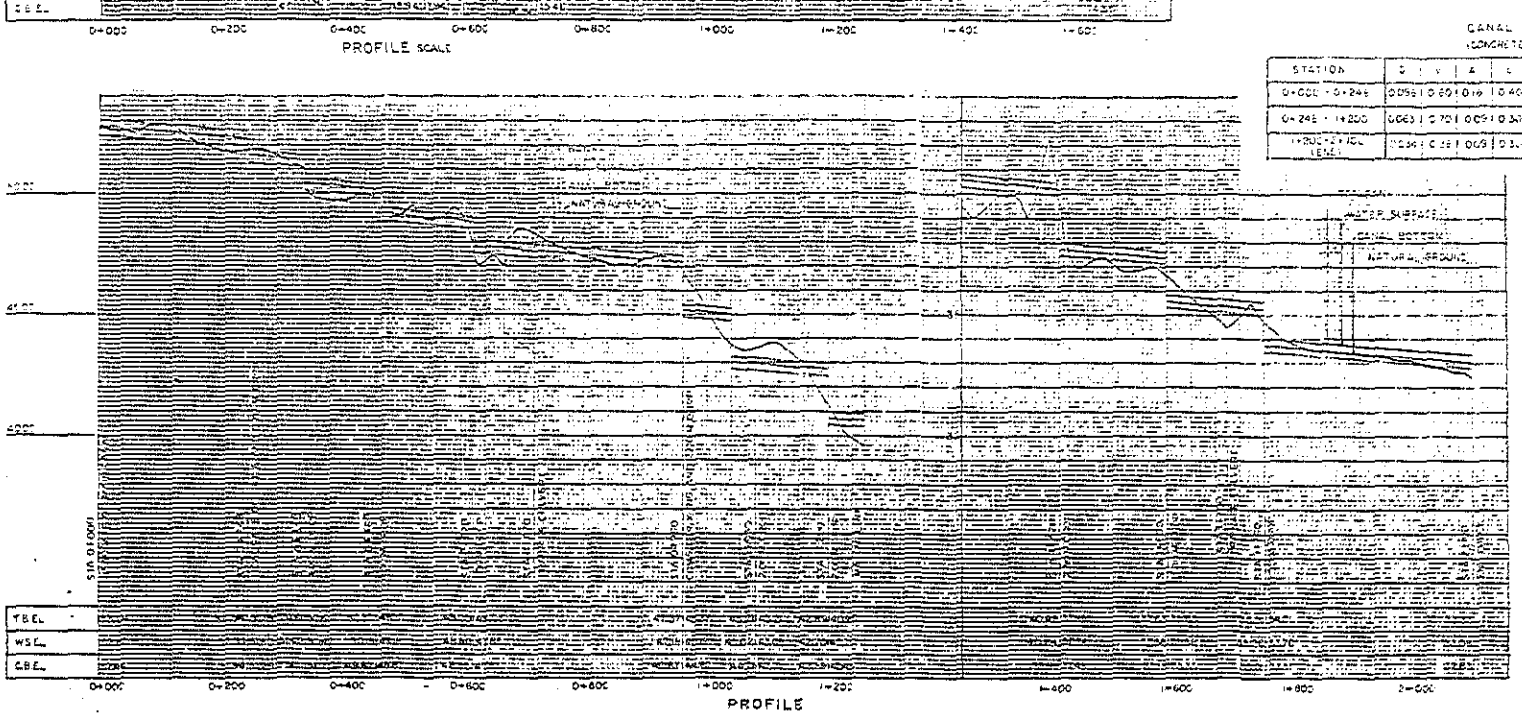
CANAL ELEMENTS

(CONCRETE BENCH FLUME)

STATION	Q	V	A	b	d	D	r	TR	T_L	Ss	S	n
0+000 - 0+464	0.192	0.53	0.36	0.60	0.60	0.90	0.20	3.00	1.00		0.0005	0.015
0+464 - 1+110	0.192	0.53	0.36	0.60	0.60	0.80	0.20	3.00	1.00		0.0005	0.015
1+110 - 2+800	0.123	0.50	0.25	0.50	0.50	0.70	0.167	3.00	1.00		0.0005	0.015
2+800 - 4+190 (END)	0.077	0.48	0.16	0.40	0.40	0.60	0.13	3.00	1.00		0.0005	0.015

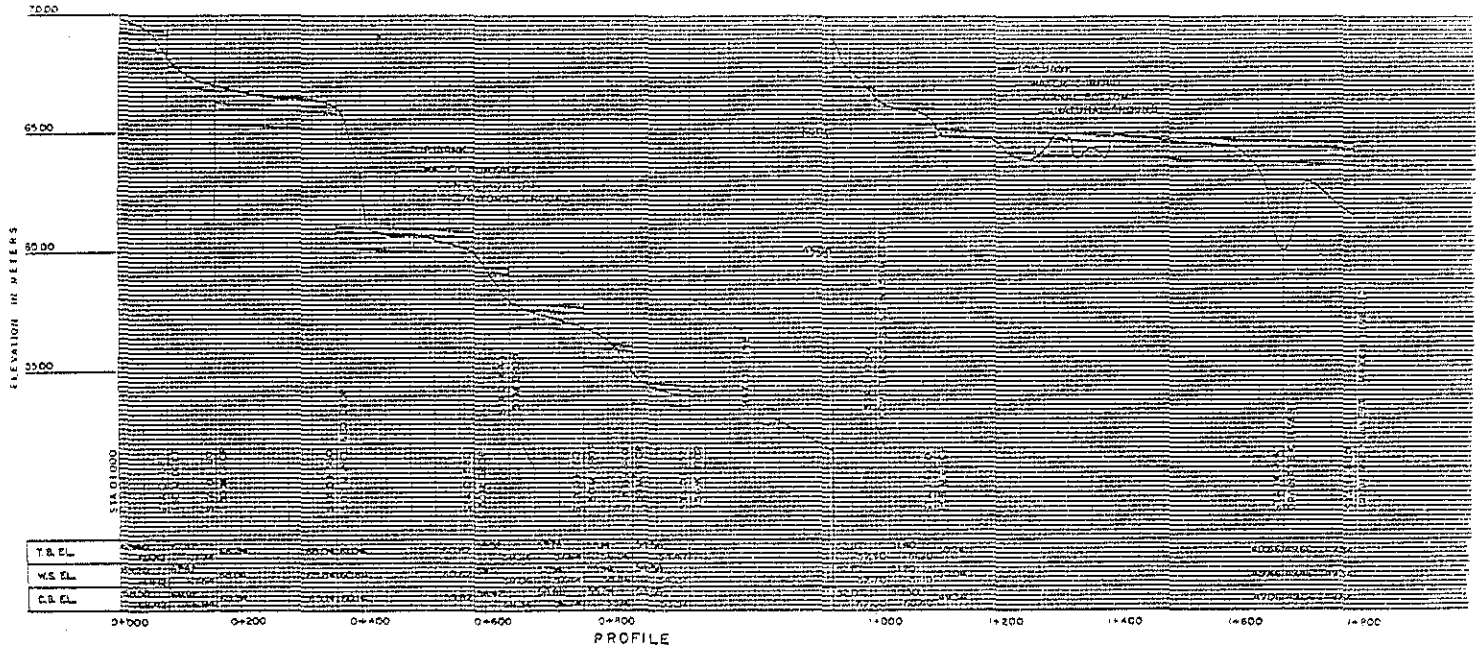


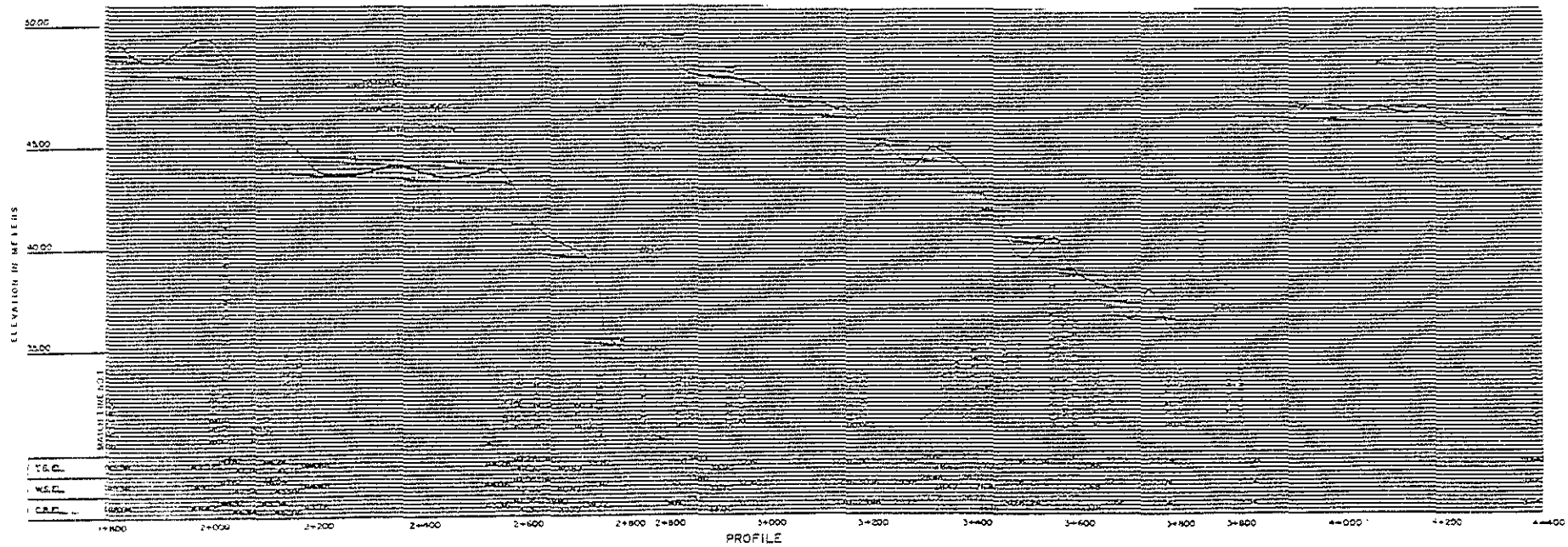
(4) Antipolo CIP

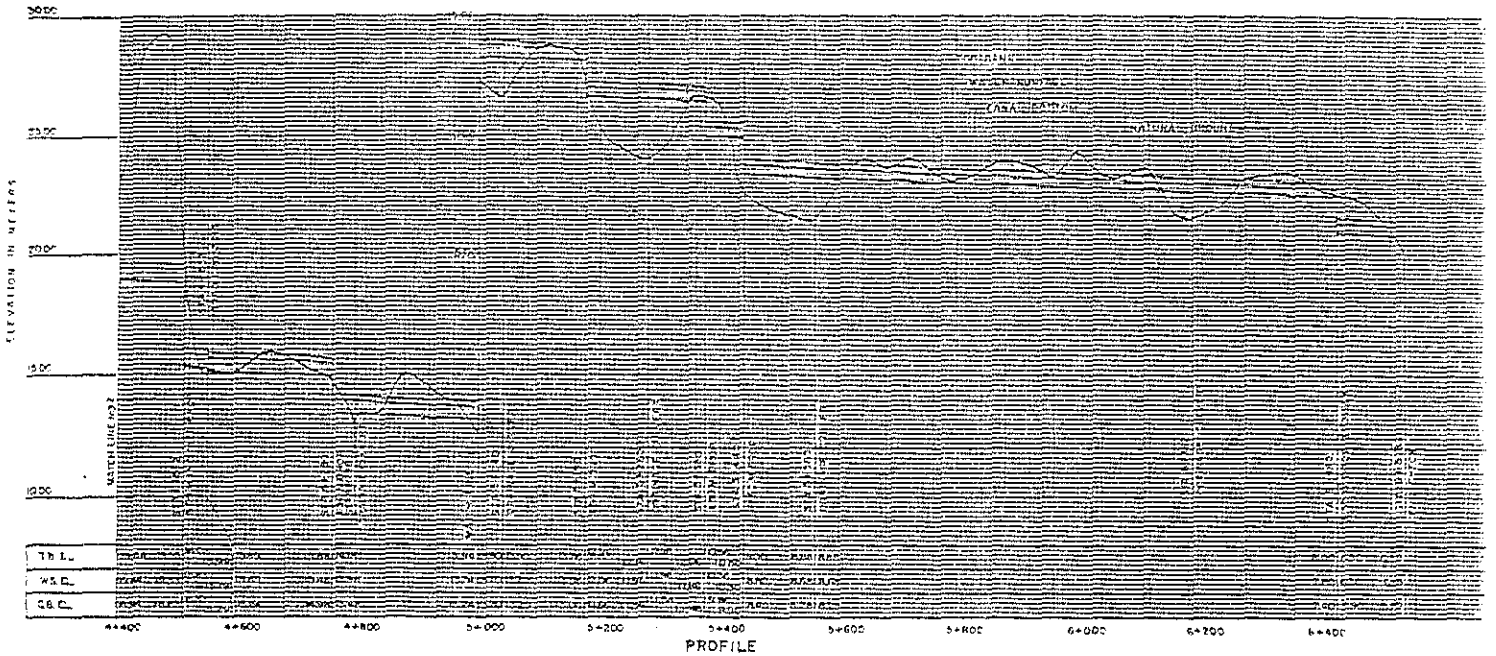


(5) Balagasan CIP

(6) Bagtingon CIP (1/2)







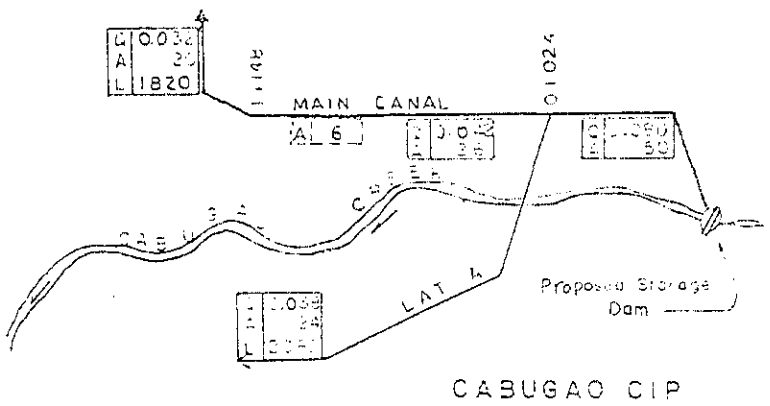
(6) Bagtingon CIP (2/2)

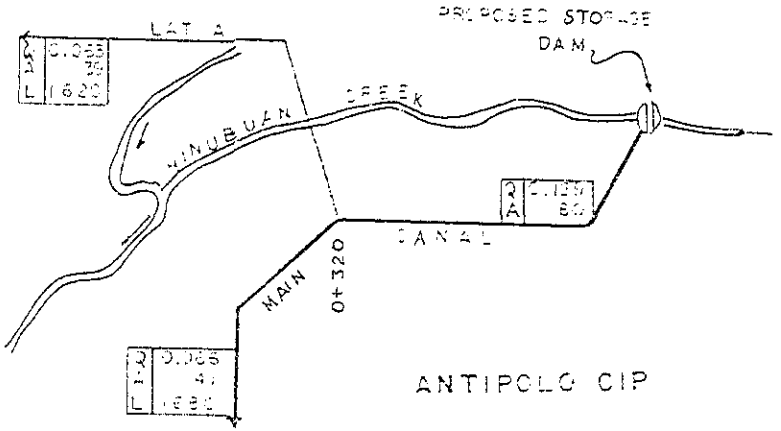
CANAL ELEMENTS

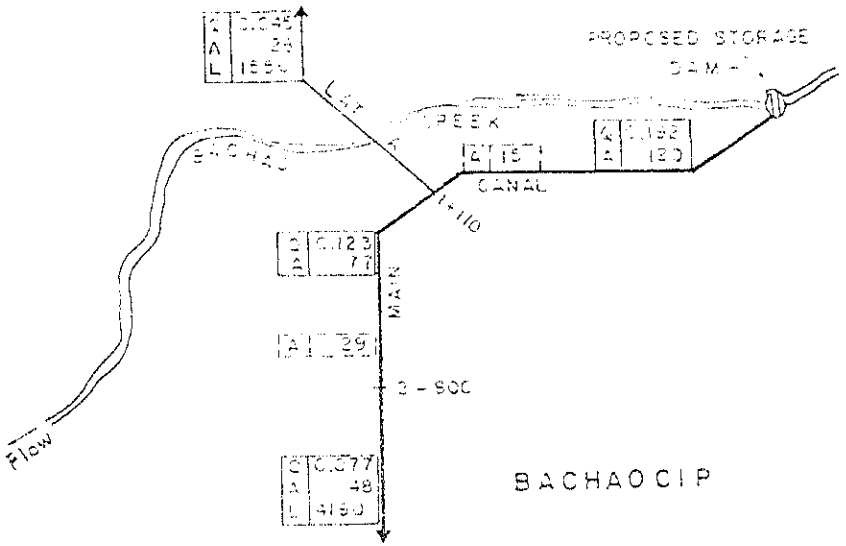
(CONCRETE BENCH FLUME)

STATION	Q	V	A	b	d	D	r	T_R	T_L	Ss	S	n
0+000 - 1+800	0.384	0.784	0.49	0.70	0.70	0.90	0.23	1.00	3.00		0.001	0.015
1+800 - 2+220	0.384	0.784	0.49	0.70	0.70	0.90	0.23	1.00	1.00		0.001	0.015
2+220 - 3+572	0.384	0.784	0.49	0.70	0.70	0.90	0.23	1.00	3.00		0.001	0.015
3+572 - 5+180	0.186	0.74	0.25	0.50	0.50	0.70	0.167	1.00	3.00		0.001	0.015
3+572 - 5+180	0.186	0.74	0.25	0.50	0.50	0.70	0.167	1.00	3.00		0.001	0.015
5+180 - 6+548 (END)	0.114	0.71	0.16	0.40	0.40	0.60	0.13	1.00	3.00		0.001	0.015

Figure F-1-8 Irrigation Network Diagram(1)







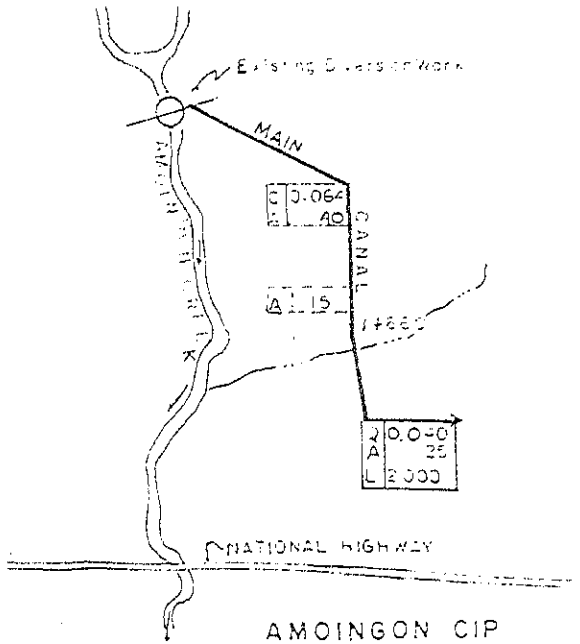
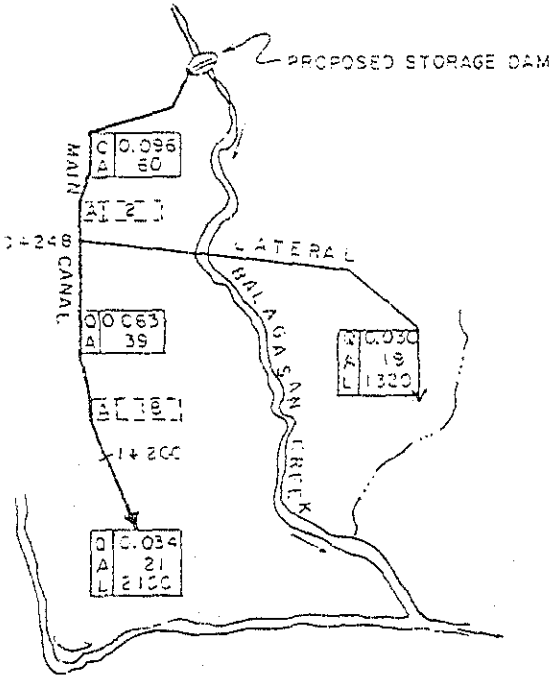
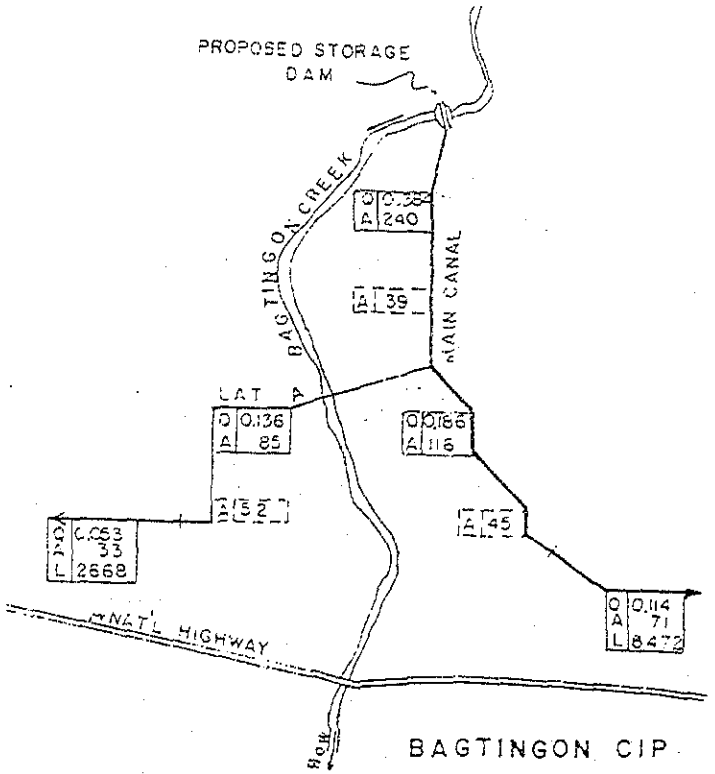


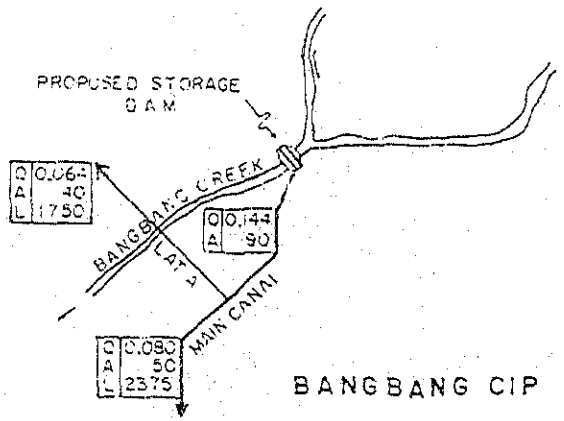
Figure F-1-8 Irrigation Network Diagram(2)



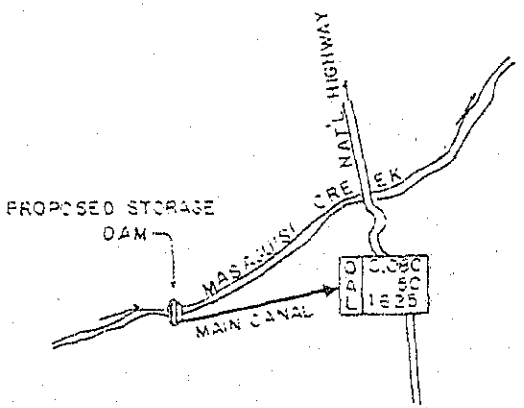
BALAGASAN CIP (mainit)



BAGTINGON CIP



BANGBANG CIP



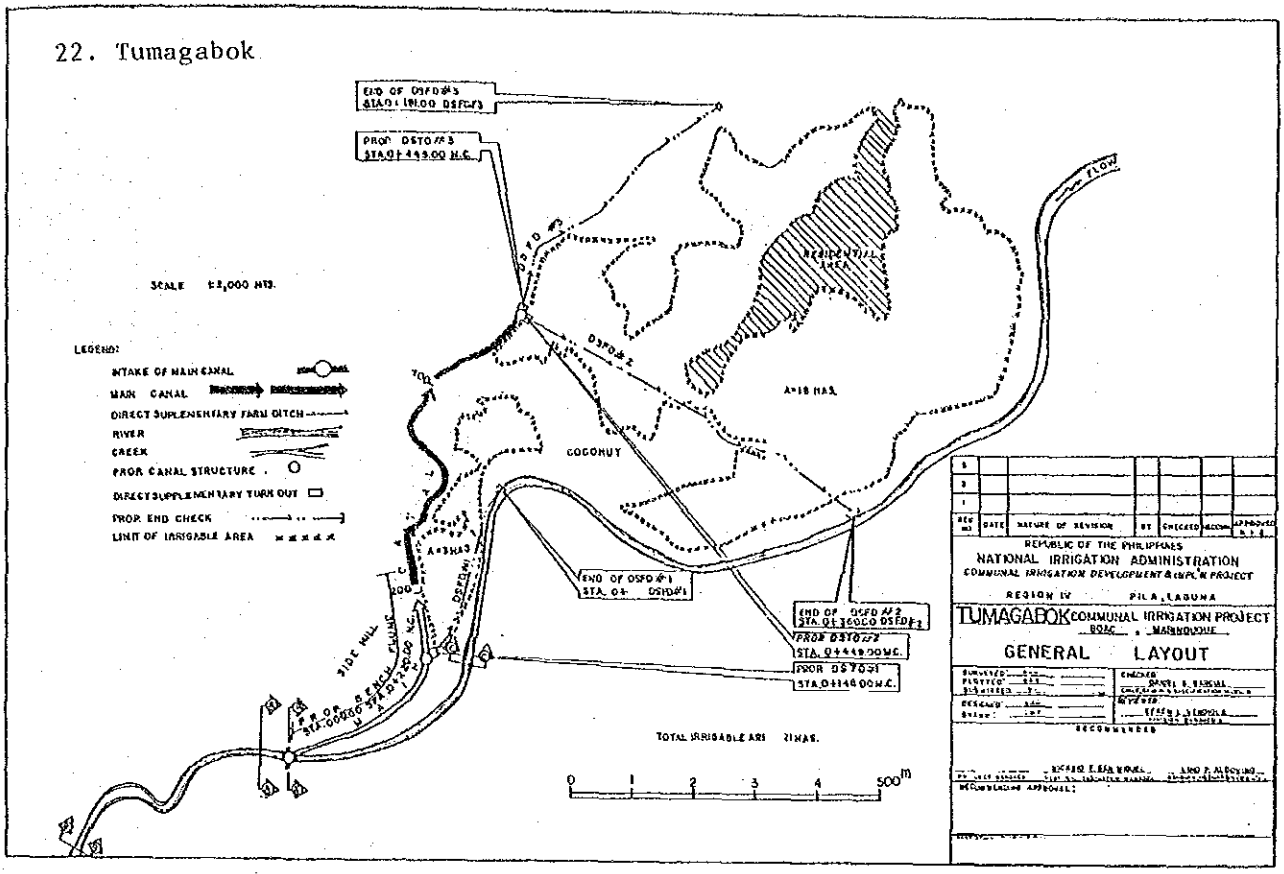
MASAGUISI CIP

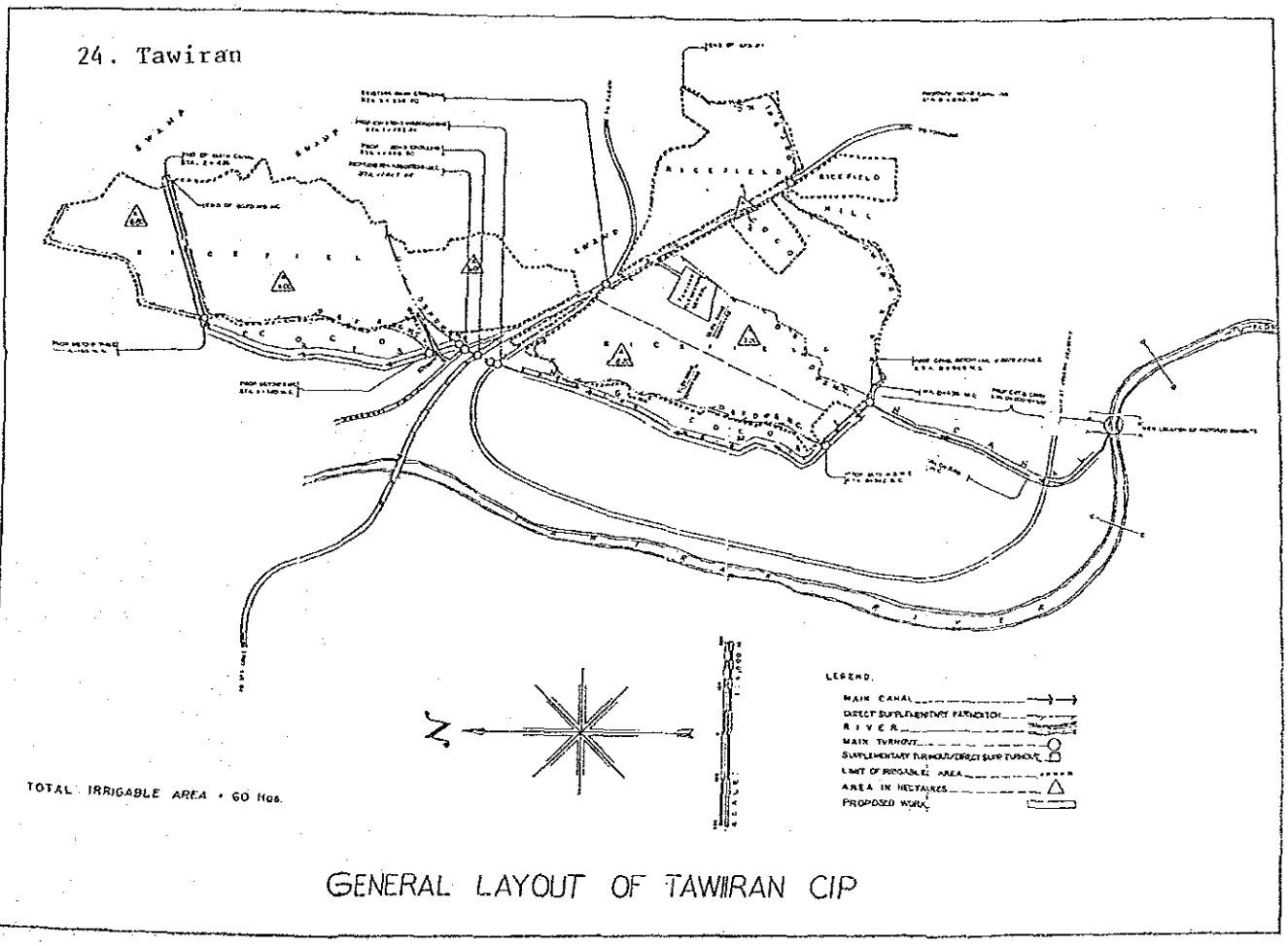
LEGEND

- A — Design Service Area (ha)
- A — Area included in upstream design capacity (ha)
- Main Canal
- Lateral Canal
- Q — Canal Design Capacity (m^3/s)
- L — Canal Length (m)

NOTE; Water requirement used for paddy = 1.60 Liter/sec/ha

Figure F-1-8 General Layout of CIP by NIA(1)





GENERAL LAYOUT OF TAWIRAN CIP

Figure F-1-8 General Layout of CIP by NIA(2)

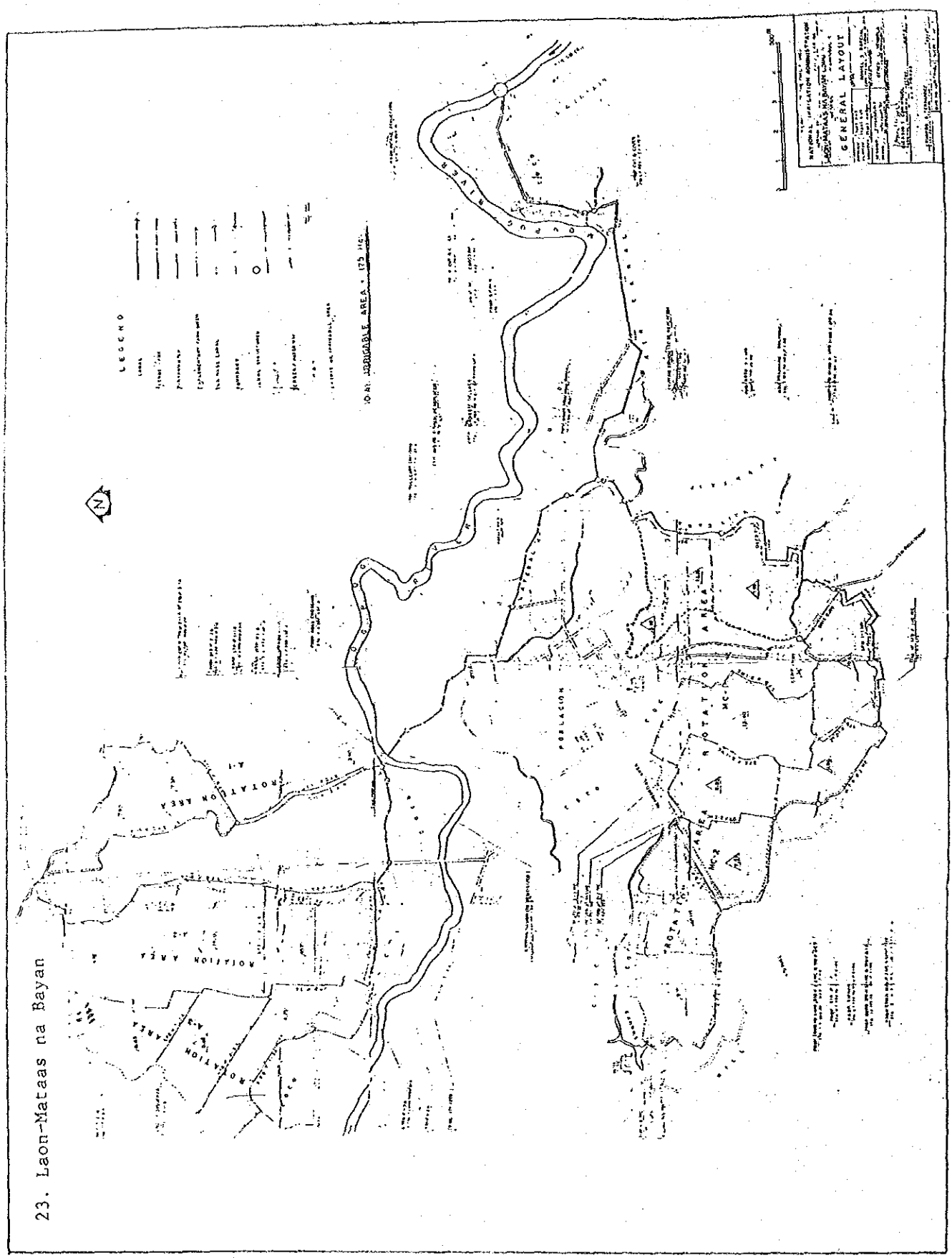
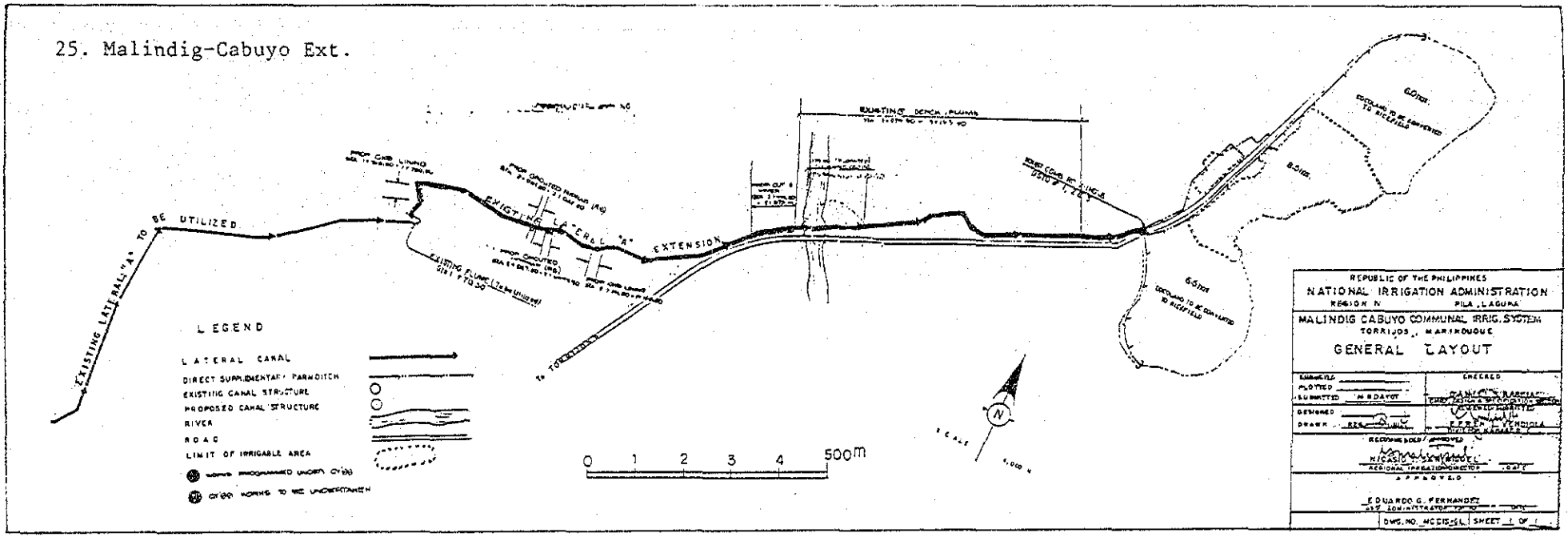


Figure F-1-8 General Layout of CIP by NIA(3)

25. Malindig-Cabuyo Ext.



27. Cabugao

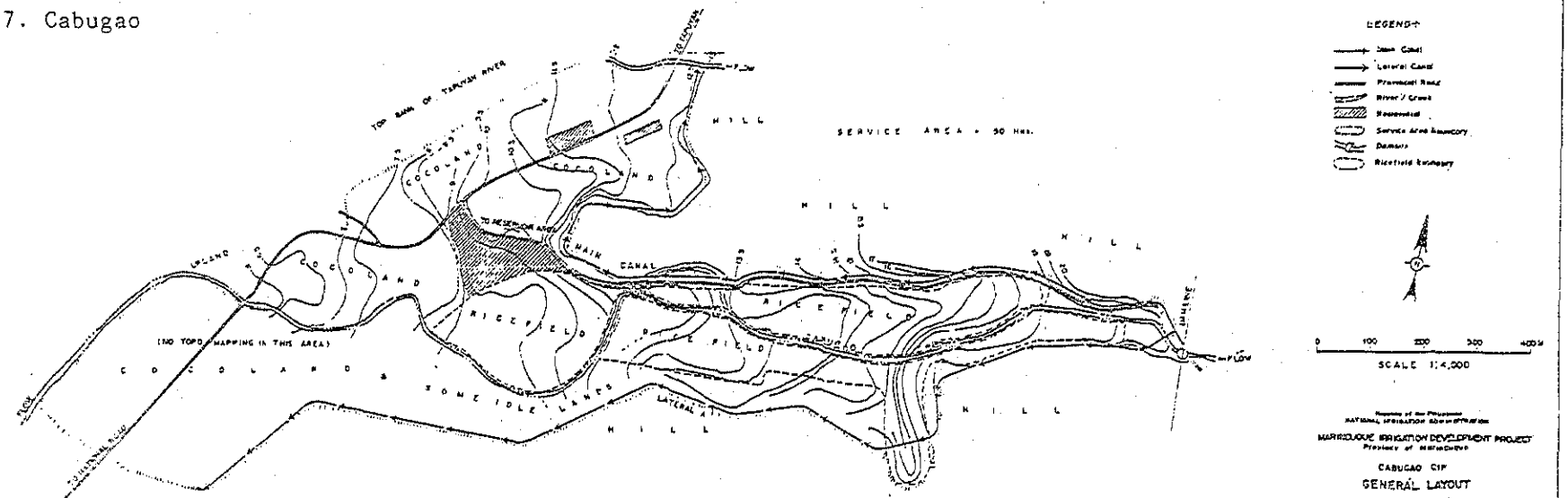


Figure F-1-8 General Layout of CIP by NIA(4)

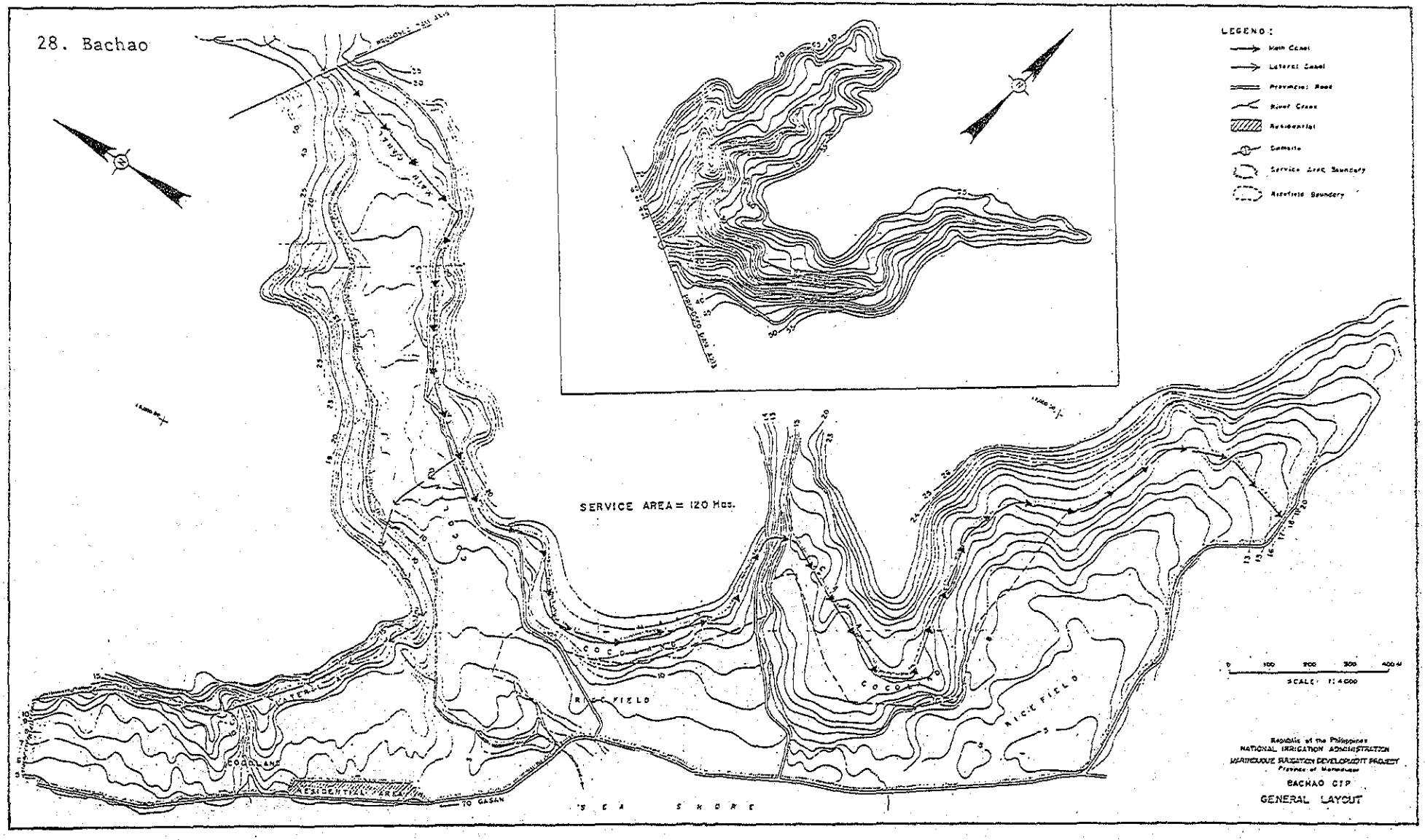
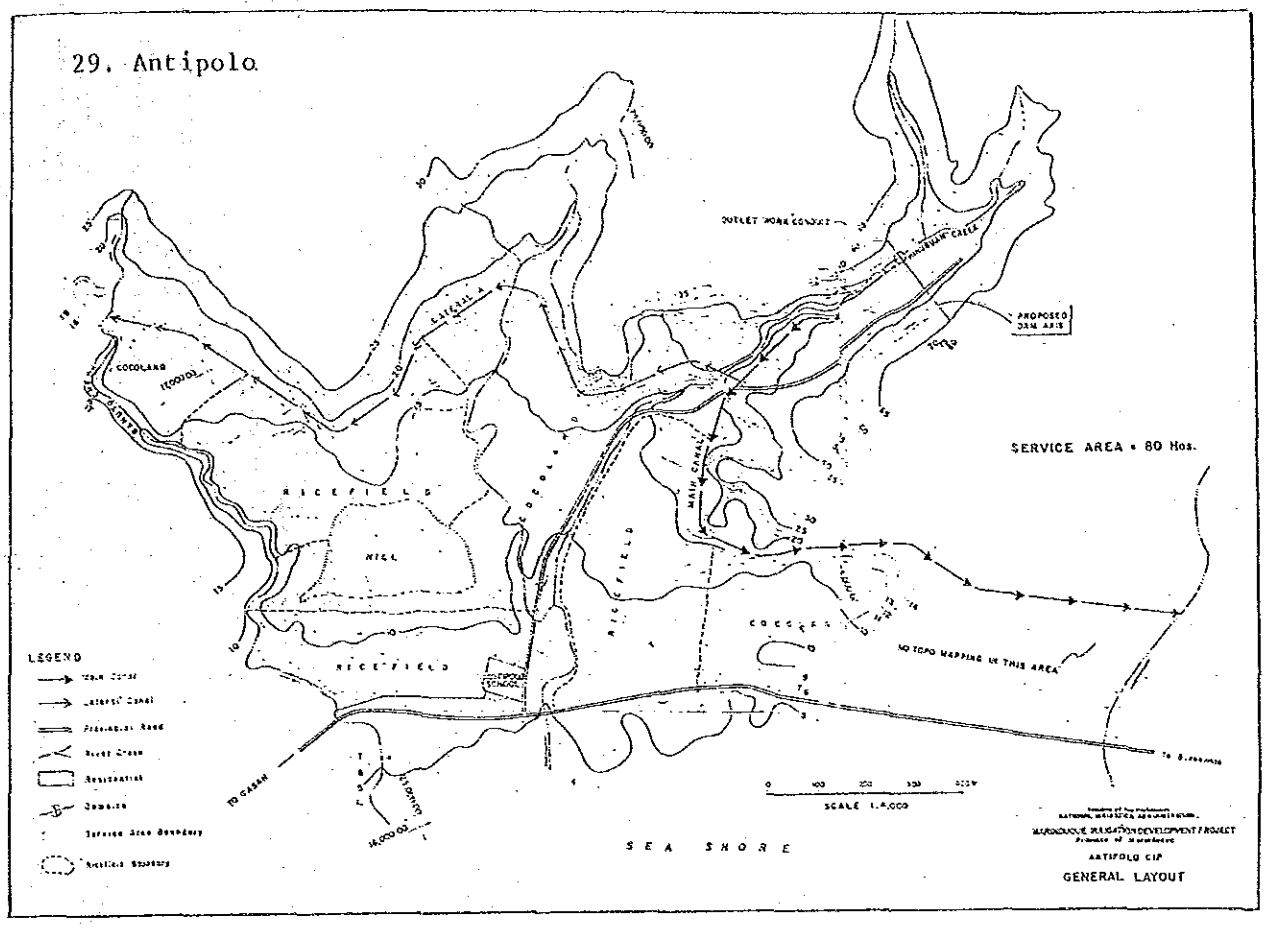


Figure F-1-8 General Layout of CIP by NIA(5)



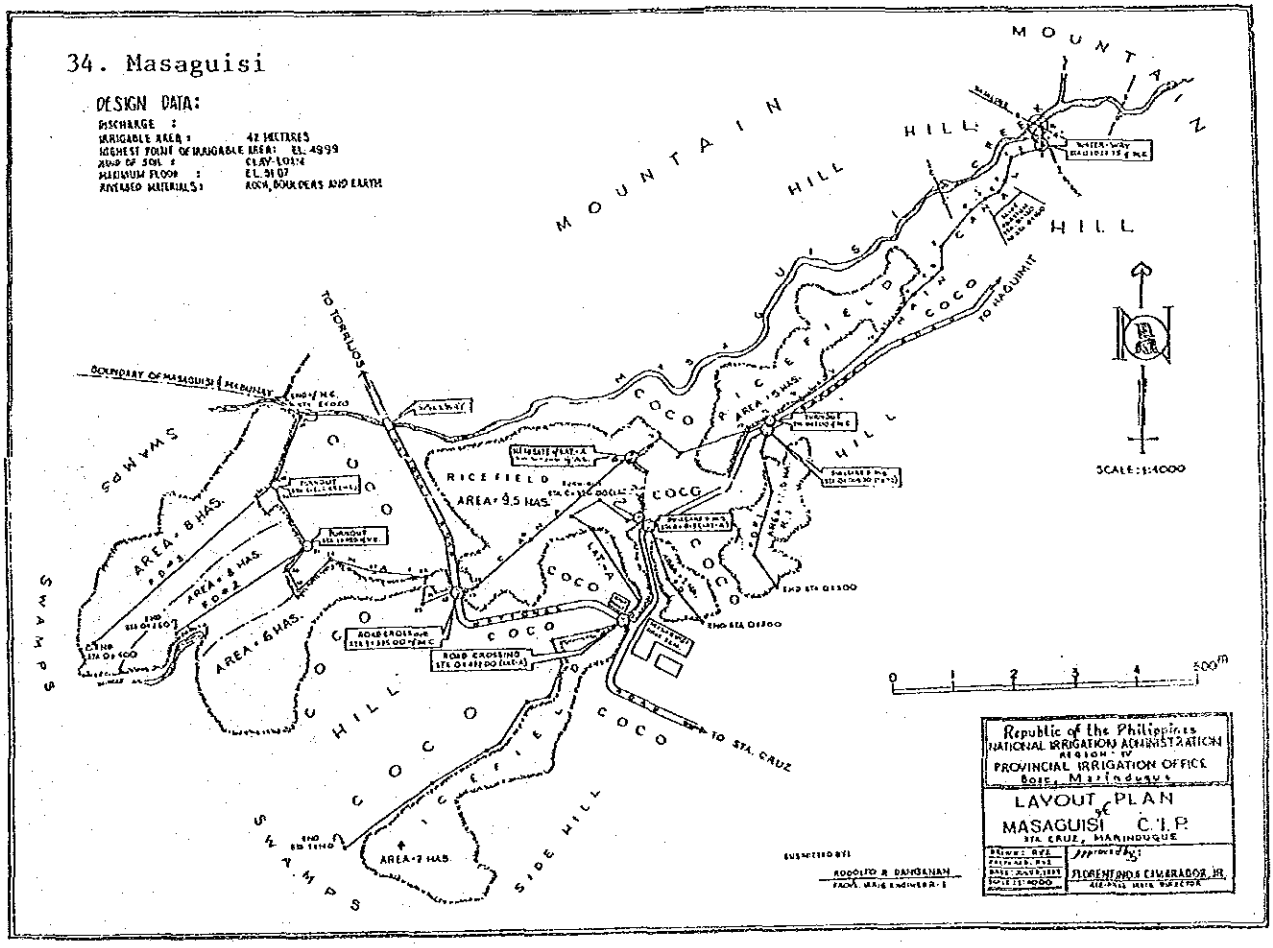
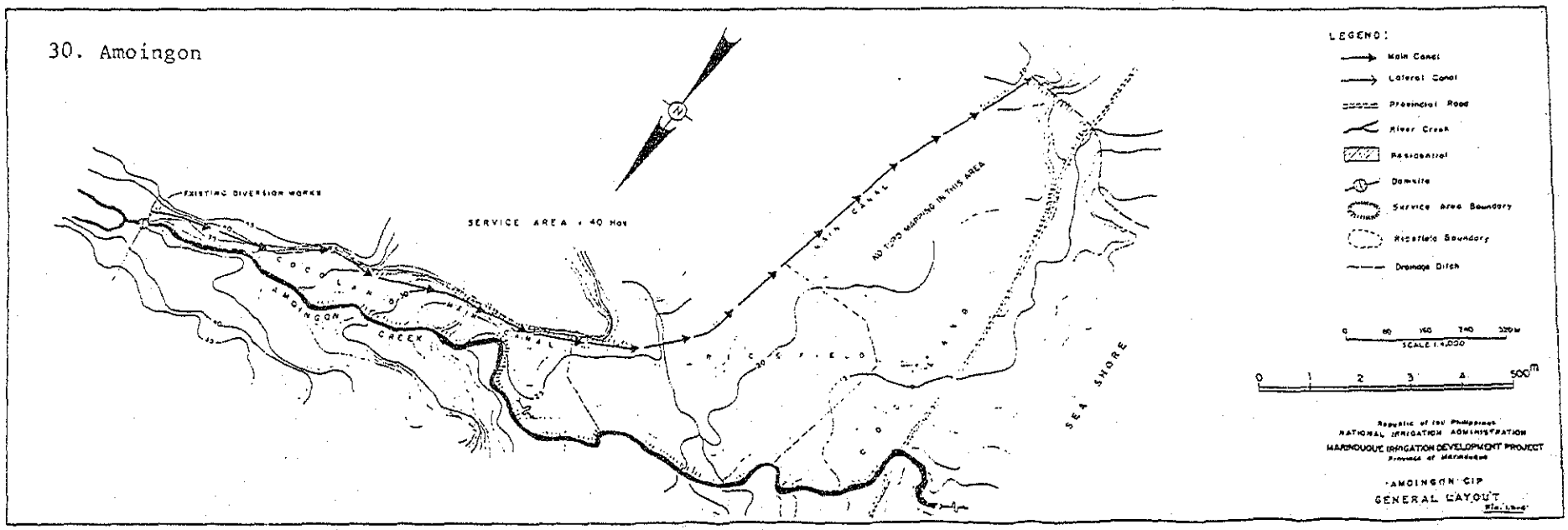


Figure F-1-8 General Layout of CIP by NIA(6)



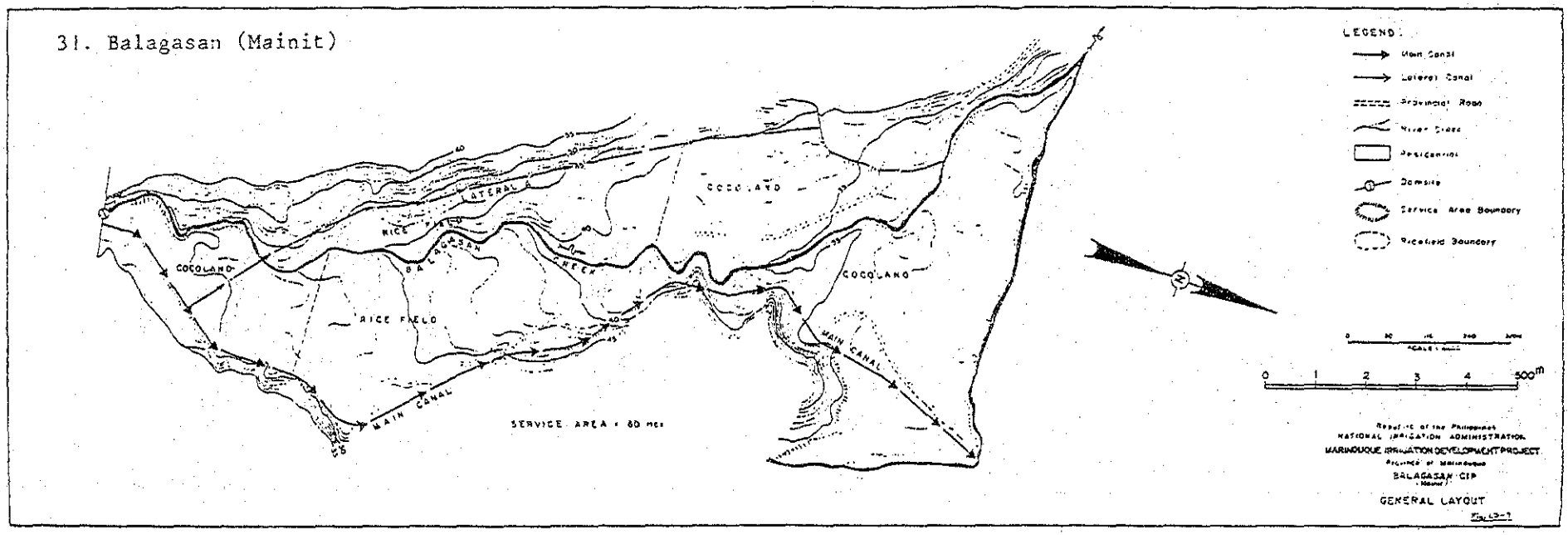


Figure F-1-8 General Layout of CIP by NIA(7)

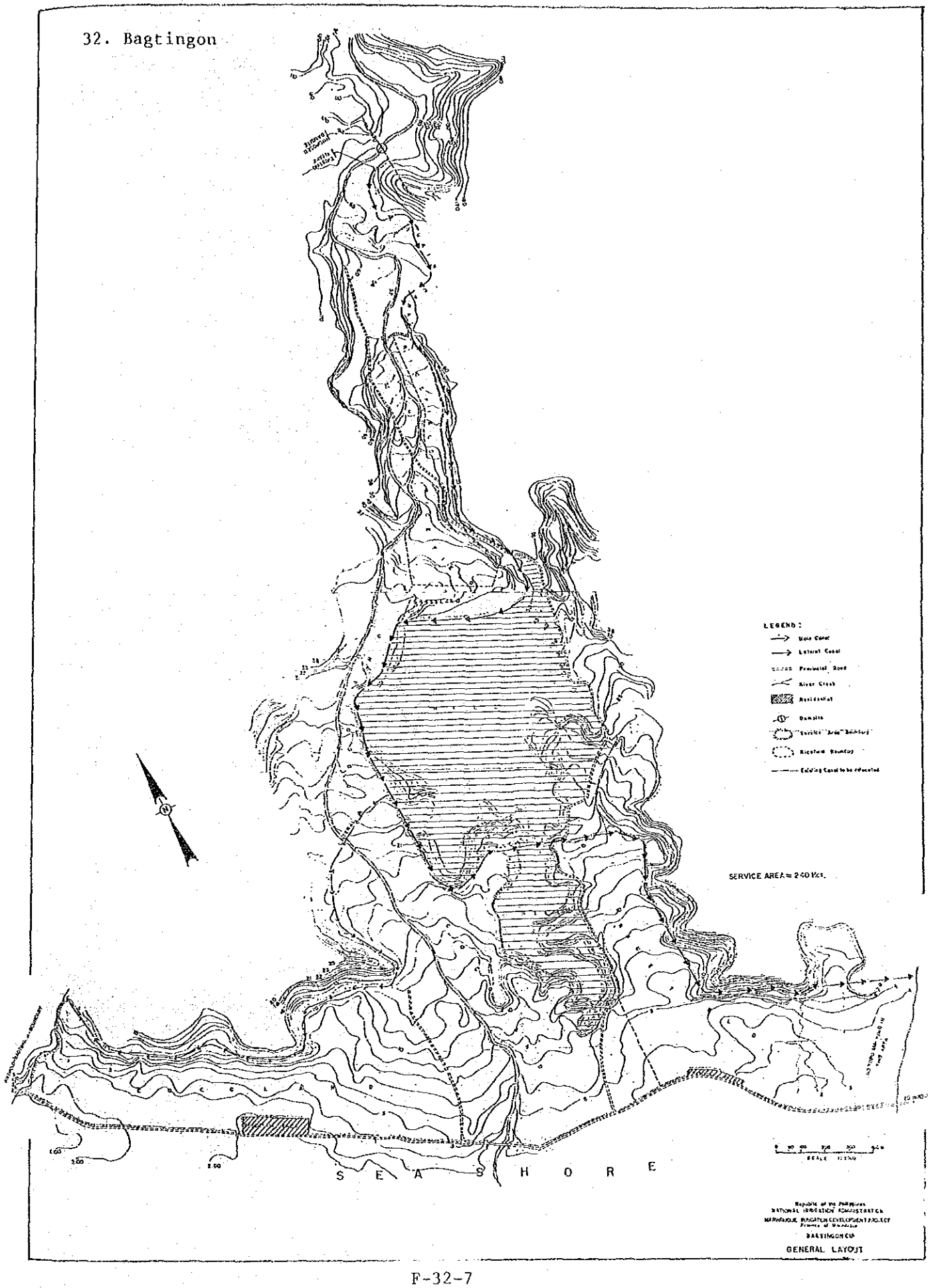
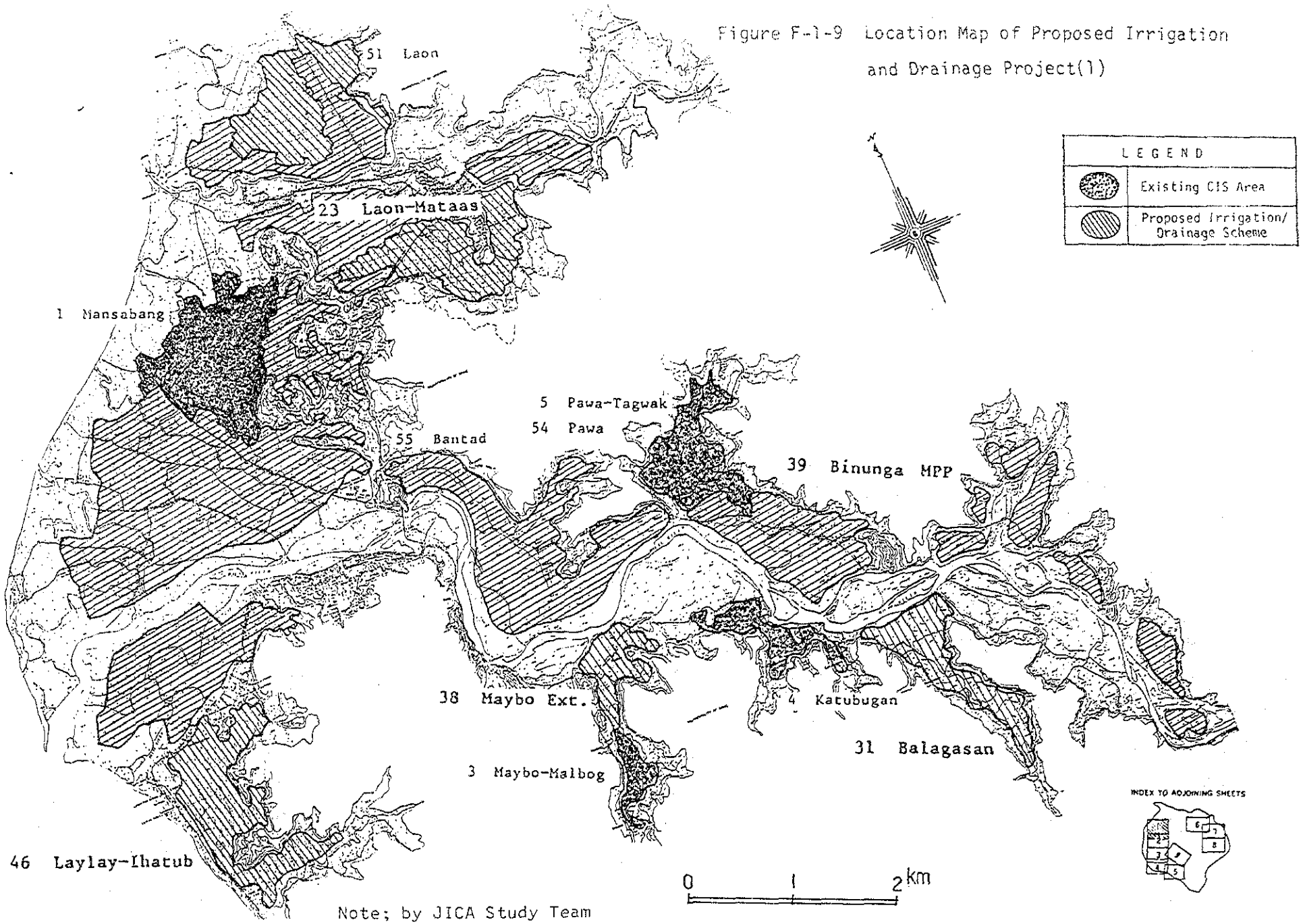
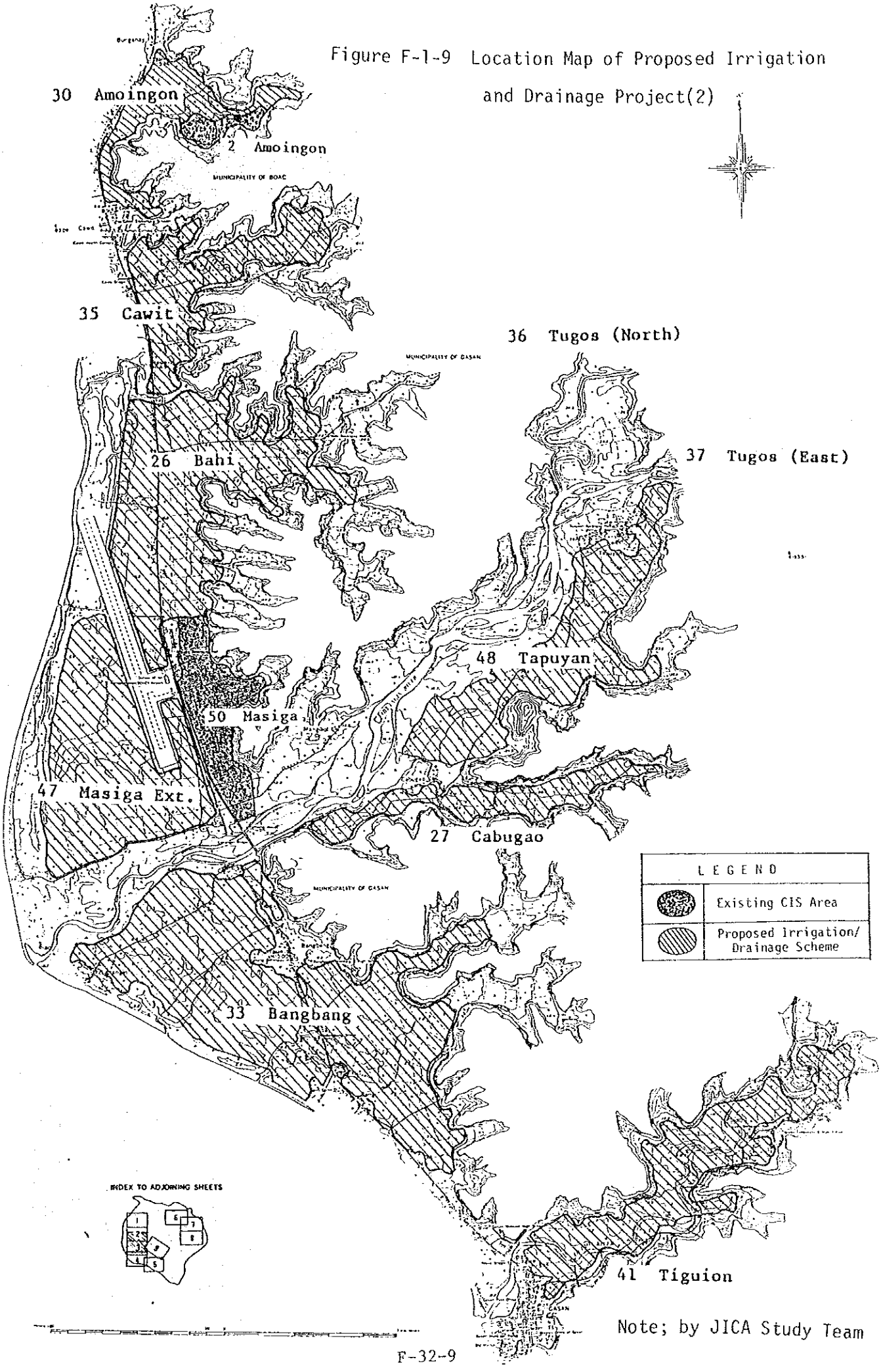


Figure F-1-9 Location Map of Proposed Irrigation and Drainage Project(1)



Note; by JICA Study Team

Figure F-1-9 Location Map of Proposed Irrigation and Drainage Project(2)



Note; by JICA Study Team

Figure F-1-9 Location Map of Proposed Irrigation and Drainage Project(3)

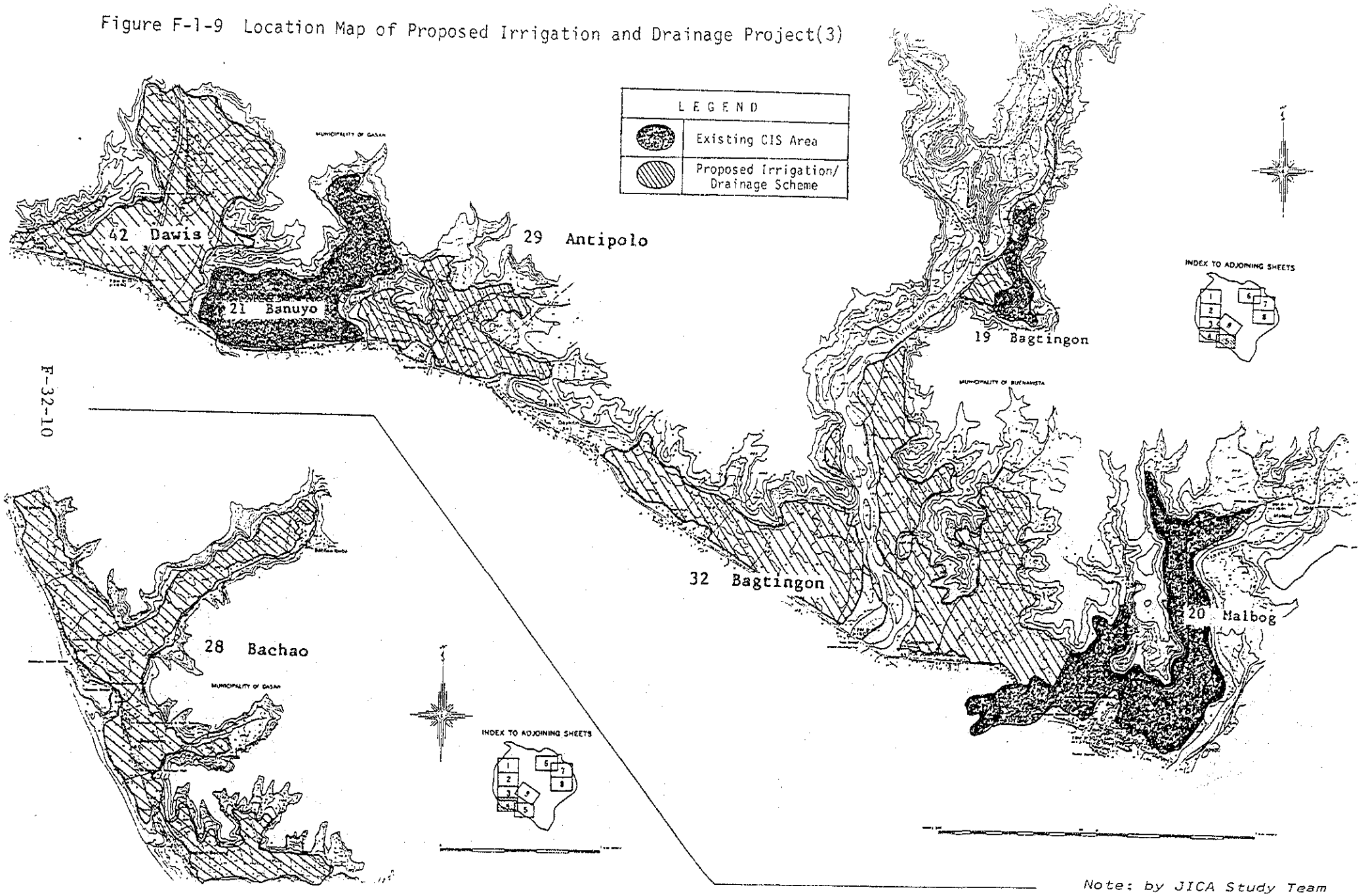
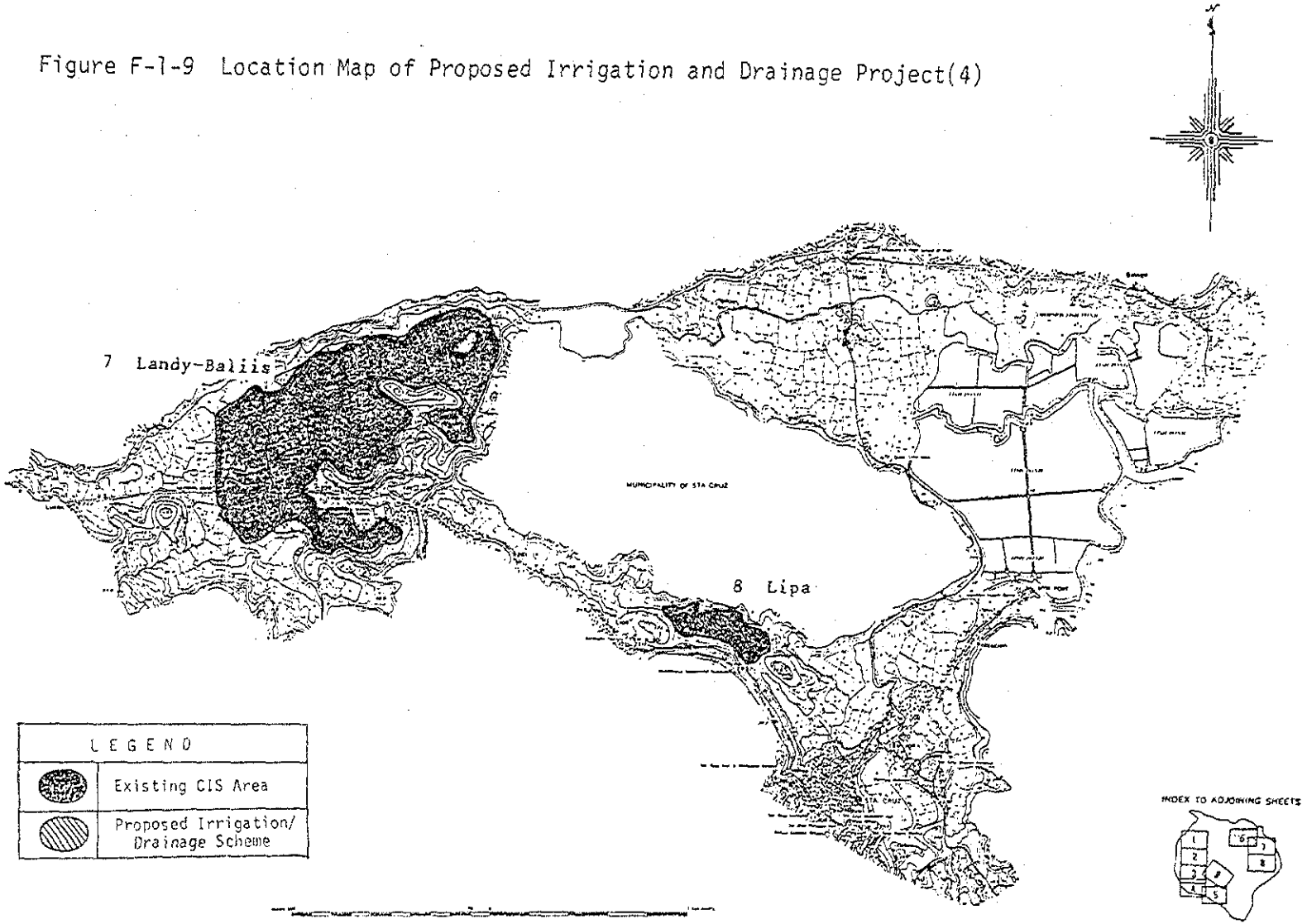
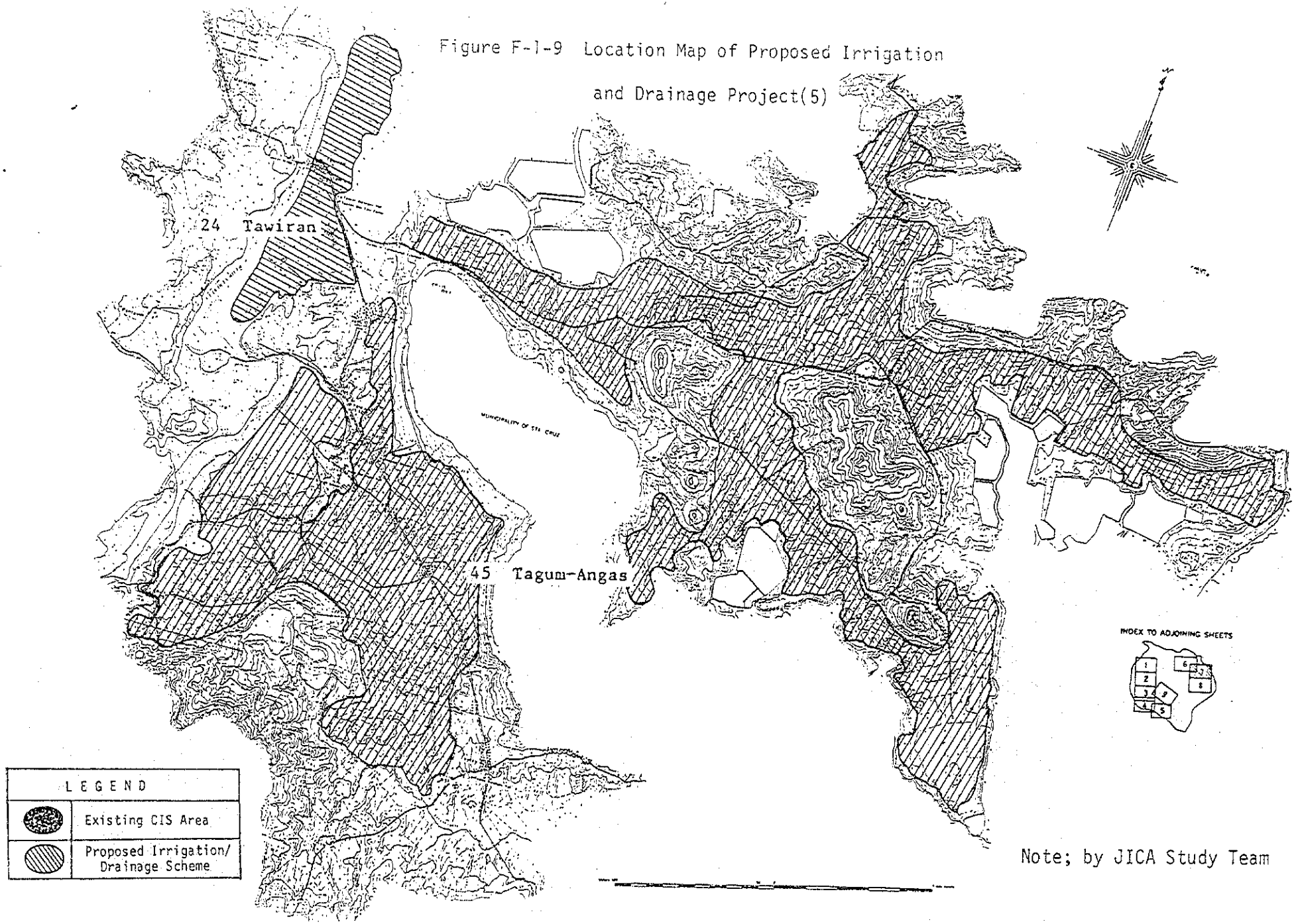


Figure F-1-9 Location Map of Proposed Irrigation and Drainage Project(4)



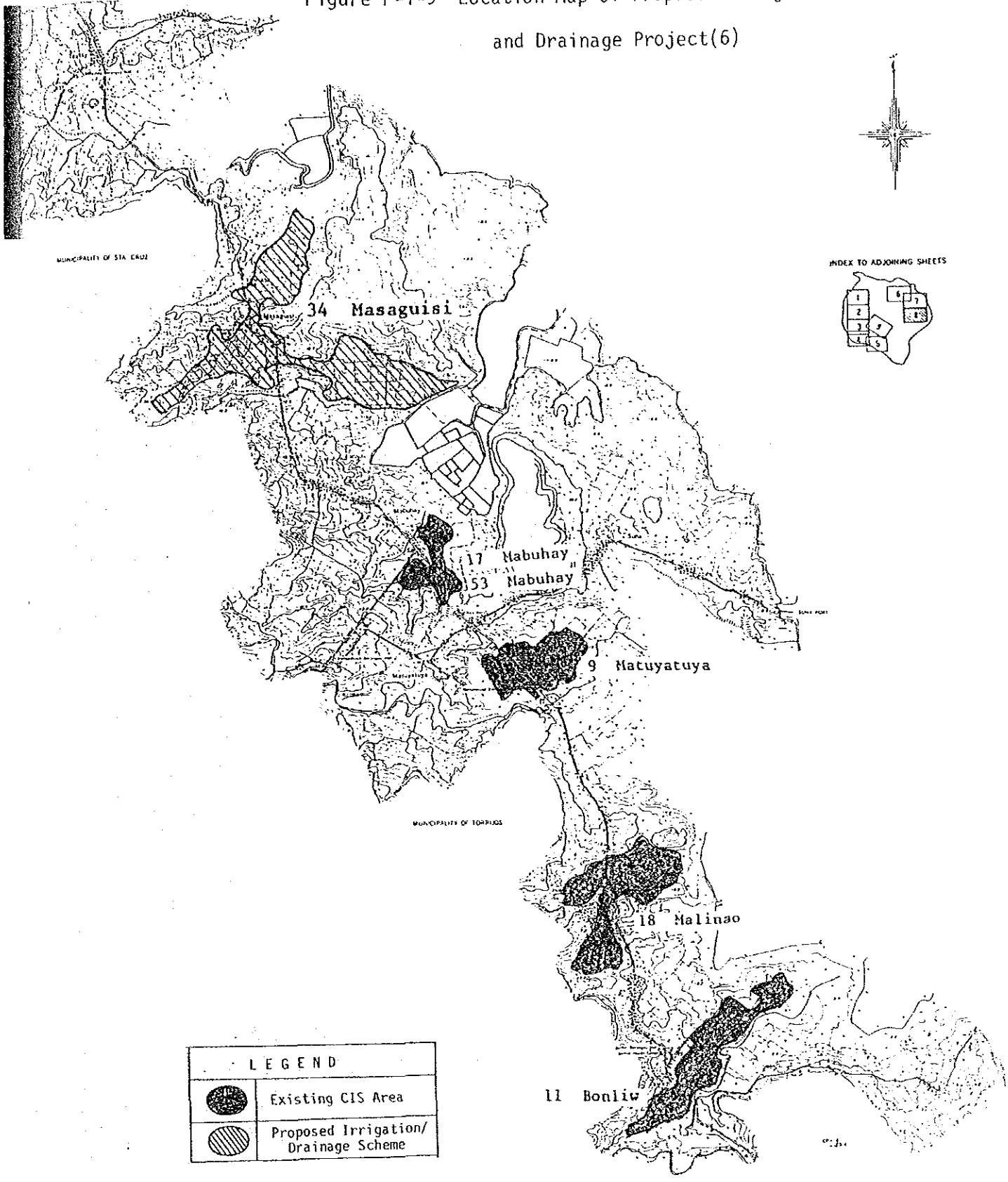
Note; by JICA Study Team

Figure F-1-9 Location Map of Proposed Irrigation and Drainage Project(5)



Note; by JICA Study Team

Figure F-1-9 Location Map of Proposed Irrigation and Drainage Project(6)



Note; by JICA Study Team

Figure F-1-9 Location Map of Proposed Irrigation and Drainage Project(7)