Proposed Roads

All weather gravel road is to be provided along the embankment of main canals, laterals and sub-laterals at an intensity of about 20 meters of O & M roads for each hectare of service area based on the following criteria.

1. When a small canal runs parallel to an existing road within a center to center distance of 40 meters, the road embankment may be omitted.

2. Generally, the road embankment shall be placed at the service area except in existing canals where a road is already existing along the canal embankment in which case, the location of the existing road shall be maintained.

3. When both sides of the canal is serviced, the road shall be placed at the wider embankment of the existing canal.

4. If possible maintain operation road along same side of the canal from headgate to end to avoid vehicle/equipment switching from left to right embankment or vice versa.

5. Generally, the canal operating roads shall terminate at the furthest turnout of a canal. However, when a canal terminates near an existing road or another canal, a connecting road may be provided.

6. Bridges are to be provided along the O & M roads parallel with siphons where concrete pipe or box culverts are not economical. Bridges most commonly used are reinforced concrete deck girder (RCDG) type with 3.50 meter roadway width and 0.46 meter side walk on both sides.

7. Proposed Road Length
   Proposed road length are as follows;

Table 4D-9. List of Proposed Access & Service Roads

(a) Service Roads

1) Type A along the Main Canal

		(km)
Diversion weir to Hdgt. Lat. F	left side	8.580
Hdgt. Lat. H to Katipunan - Mahayag Provincial Road	left side	0.470
Katipunan Bo. Rd. to Dagohoy - San Miguel Natl. Road	right side	11.180
Mahayag Natl. Road to Malitbog Natl. Road	right side	2.670
Sub-total		22.900

2) Type A along the Lateral Canal

Lateral C-3		
Hdgt. Lat. C-3 to End Check	right side	2.100
Laeral N		
Hdgt. Lat. N-3 to Hdgt. Lat. N	left side	1.000
Lateral N-4		
Hdgt. N-4 to Hdgt. N-4a	left side	0.500
Lateral N-4a		
Hdgt. Lat. N-4a to End Check	left side	1.100
Sub-total		4.700

3) Type B along the Lateral Canal

Lateral A		
Hdgt. Lat. A to End Check	right side	2.290
Lateral B		
Estaca-Suba Bo. Rd. to End Check	right side	1.360
Lateral C		
Bagumbayan-Caluasan Prov. Road	right side	2.790
Lateral C-1		
Hdgt. Lat. C-1 to Hdgt. Lat. C-1a	right side	0.740
Hdgt. Lat. C-1a to End Check	right side	1.120
Lateral C-4b		
Hdgt. Lat. C-4b to End Check	left side	1.020

Lateral C-4		
Hdgt. Lat. C-4 to End Check	left side	2.380
Lateral C-5		
Hdgt. Lat. C-5 to Hdgt. Lat. C-6b	left side	2.090
Hdgt. Lat. C-5b to End Check Lat. C-5	right side	0.890
Lateral C-5b		
Hdgt. Lat. C-5b to End Check	left side	2.640
Lateral C-6		
Hdgt. Lat. C-6	right side	2.060
Lateral C-7		
Hdgt. Lat. C-7 to End Check	left side	2.100
Lateral D		
Hdgt. Lat. D to End Check	left side	1.840
Lateral E		
Hdgt. Lat. E to End Check	right side	3.260
Lateral F		
Hdgt. Lat. F to End Check	right side	1.900
Lateral F-1		
Hdgt. Lat. F-1 to End Check	left side	1.900
Lateral H		
Hdgt. Lat. H to End Check	right side	1.070
Lateral I		
Katipunan-Mahayag Prov. Road to End Check	right side	1.630
Lateral K		
Hdgt. Lat. K to End Check	right side	1.750
Lateral L		
Hdgt. Lat. L to End Check	right side	3.720
Lateral N		
Hdgt. Lat. N to Hdgt. Nat. N-3 and Hdgt. Lat. N-4 to End Check	left side	5.260
Lateral N-2		
Hdgt. Lat. N-2 to End Check	right side	2.020
Lateral N-4		
Hdgt. Lat. N-4a to End Check	left side	0.960
Lateral O		
Hdgt. Lat. O to End Check	left side	1.340

Lateral P		
Hdgt. Lat. P to End Check	right side	1.800
Lateral Q		
Hdgt. Lat. Q to End Check	right side	3.490
Lateral Q-1		
Hdgt. Lat. Q-1 to End Check	left side	1.600
Lateral S		
Hdgt. Lat. S to Hdgt. Lat. S-1	left side	0.230
Lateral S-1		
Hdgt. Lat. S-1 to End Check	left side	1.650
Main Drainage Canal 1		
National Road to Lat. D.C.-12		9.500
Sub-total		66.400
Total		94.000

(b) Access Roads

1) Type A Improvement of Provincial road

Katipunan-Mahayag	10.000
Bagumbayan-Caluasan	7.700
Sub-total	17.700

2) Type A New construction

Lateral C	
End Check Lat. C-3 to End Check Lat. N-4a	0.500
Sub-total	0.500

3) Type B Improvement of barrio road

Natl. Highway - Main Canal	0.400
Estaca - Suba, Estaca	2.000
Sub-total	2.400

4) Type B New construction

Lateral A	
End Check to Estaca - Suba Bo. Rd.	0.280
Lateral C-4b	
End Check to Int. C-7 Service Road	0.160

Lateral C-5b	
End Check to Natl. Road	0.210
Lateral C-6	
End Check to Lat. C-5b Service Road	0.200
Lateral D	
End Check Lat. D to End Check Lat. C-a	0.360
Lateral H	
End Check Lat. H to End Check Lat. F	0.400
Lateral K	
End Check to Provincial Road	0.090
Lateral L	
End Check Lat. L to End Check Lat. E	0.650
Lateral N	
End Check Lat. N to End Check Lat. Q-1	0.320
Lateral N-2	
End Check Lat. N-2 to End Check Lat. O	0.250
Lateral P	
End Check Lateral P to Prov. Road	0.080
Lateral Q	
End Check to Service Road Lat. S-1	0.300
Lateral Q-1	
End Check Lat. Q-1 to End Check Lat. L-5	0.400
Sub-total	3.700
Total	24.300
Grand Total	118.300

Proposed On-farm Development

A. Comparison of Terminal Water Supply System

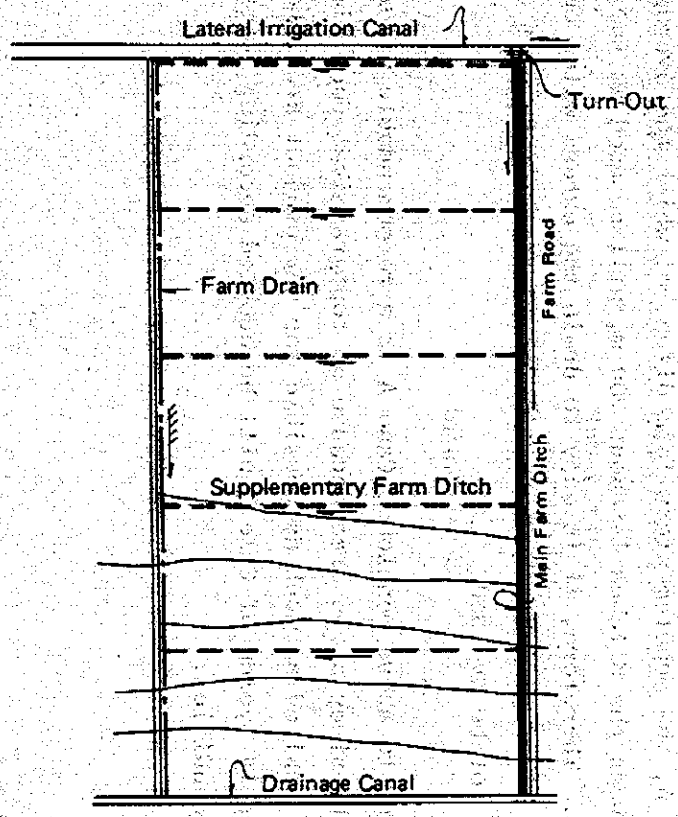
Generally, on-farm facilities in the flat area has no limitation factors about its alignment. However, in the steep slope area such as the project area which has the average land slope is about three percent, on-farm facilities should be carefully aligned. Because the construction cost will vary in accordance with increase of drop structures in the canal.

Two ways of the alignment as terminal water supply system will be considered, namely Case A and B, which is shown in Figure 4D-27. Both systems have unfavorable points for the water distribution system. A supplementary farm ditch is provided across the contour line in Case B. Therefore, in this lay-out of ditches in Case B, many drops will be needed than in Case A. However, in Case A, supplementary farm ditch is aligned along the contour line so drops will not be necessary. Therefore, economic point of view, Case A is more adovantageous than Case B.

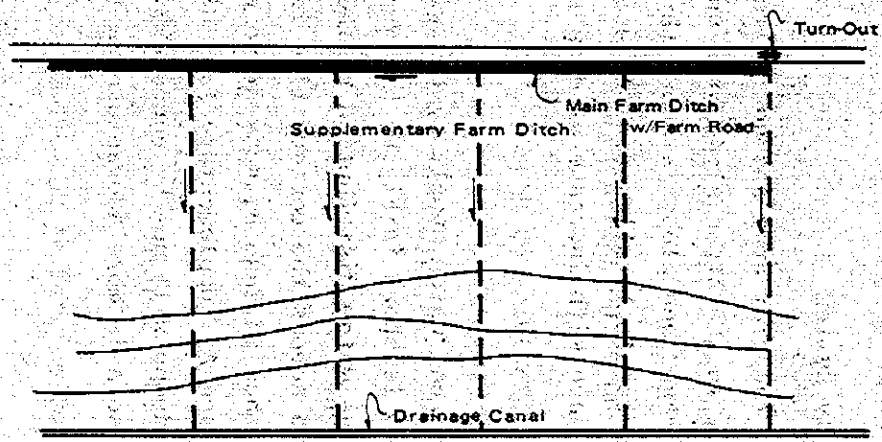
In Case A, the supplementary farm ditch, of which the average distance between the ditches is about 200 m, will be used as farm drain at same time. Therefore, it is easy to drain the excess water on the field in the flood period. However, in Case B the plot-to-plot drainage system could not be avoided.

According to above mentions, Case A is a recommendable water supply system for the steep slope area because of topographical conditions. So Case A is applied as much as possible for the project area, however the water supply system of Case B will be adopted according to the topographic condition.

FIGURE 4D-27. TYPICAL PLAN OF ON-FARM FACILITIES

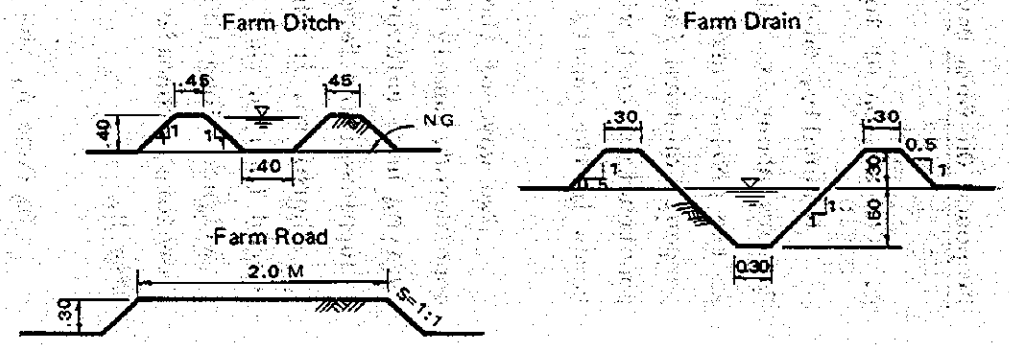


Case 'A'



Case 'B'

TYPICAL CROSS-SECTIONS



B. Land Terracing and Leveling

1. Physical and Economic Limitation for Terracing

There are certain minimum physical requirements which must be considered before attempting to terrace an area. If any one of such limitations exists, the terracing project should not be undertaken.

Once the decision is reached on the need of terracing a certain area, as a result of either population pressure, or for better use of land or for only erosion control purposes, the first consideration is the slope of the land.

Experiments conducted in the Ambuklao Watershed in Benguet and experiences gained in other areas indicate that the maximum slope of land which can be considered for terracing is fifty percent (or 26 degrees).1/ However, the width of plot become very narrow for the operation of farm machinery in the project. If the terracing has a purpose for only errosion control, the land could be terraced up to above percentage. But, the aim of terracing in the project is not only the errosion control but also the farm land development to produce paddy rice, so that the width of at least 10 m will be needed in the plot for effective operation of farm machinery. Therefore, the maximum slope of area is determined at three percent. The land having the slope up to this percentage can be terraced provided that 1) there is sufficient soil depth for terracing, 2) the height of riser does not exceed the maximum permissible height, and 3) there is enough width on the leveled area of terraces.

Second limitation is the soil condition of the area. Terraces should not be constructed on shallow soils of less than 30 cm and on too much stony soils.

1/ devided from Hand Book of Bench Terracing, prepared by Bureau of Soil.

Third limitation is the topography of the land to be terraced. For terracing purposes, areas with extremely unfavorable topography (too many ridges, gullies, depressions) even though the general slope of the land may be favorable, should be avoided.

Fourth limitation is the sub-soil and geological condition of the area. If many landslides are in evidence in or adjacent to the area due to geological conditions, terraces should not be constructed on such sites.

2. Dimension of Terraces

The maximum and minimum dimensions for the terracing would be based upon the following criteria;

(a) The maximum height of dike for terracing should not be over 1.0 m. (See Figure 4D-28, $h + h' \leq 1.0$ m)

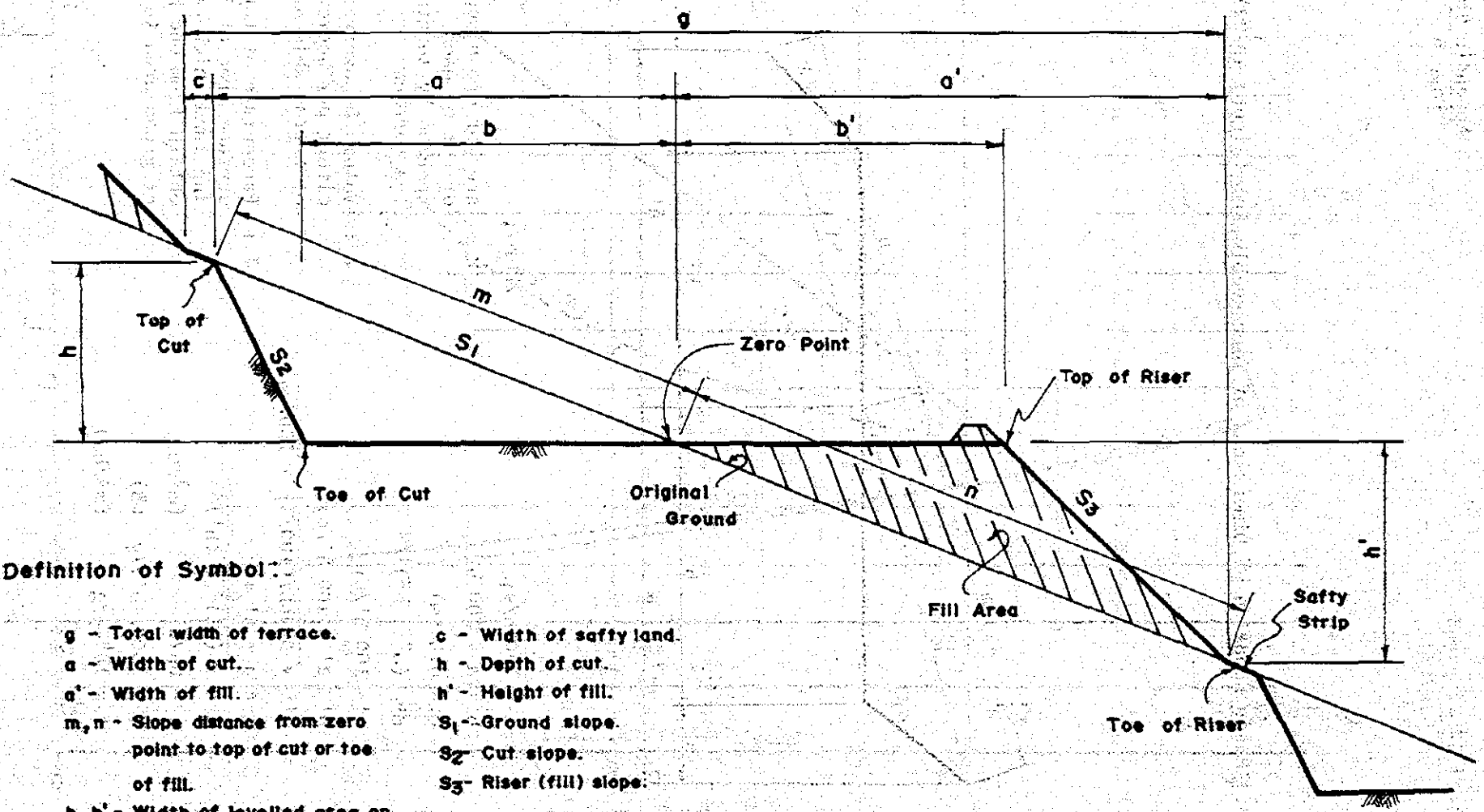
(b) The minimum and maximum widths of terrace should be five meters and 30 meters, respectively; considering that farm mechanization will be introduced in the project.
(See Figure 4D-28, $W = b + b'$)

(c) The riser slope for cut (S_2) and fill (S_3) required would be 1:1 depending on the stability of soils in the project area.

(d) The maximum length of one plot of paddy field should no be over 100 meters long.

The construction cost of terracing would be shouldered by the farmers.

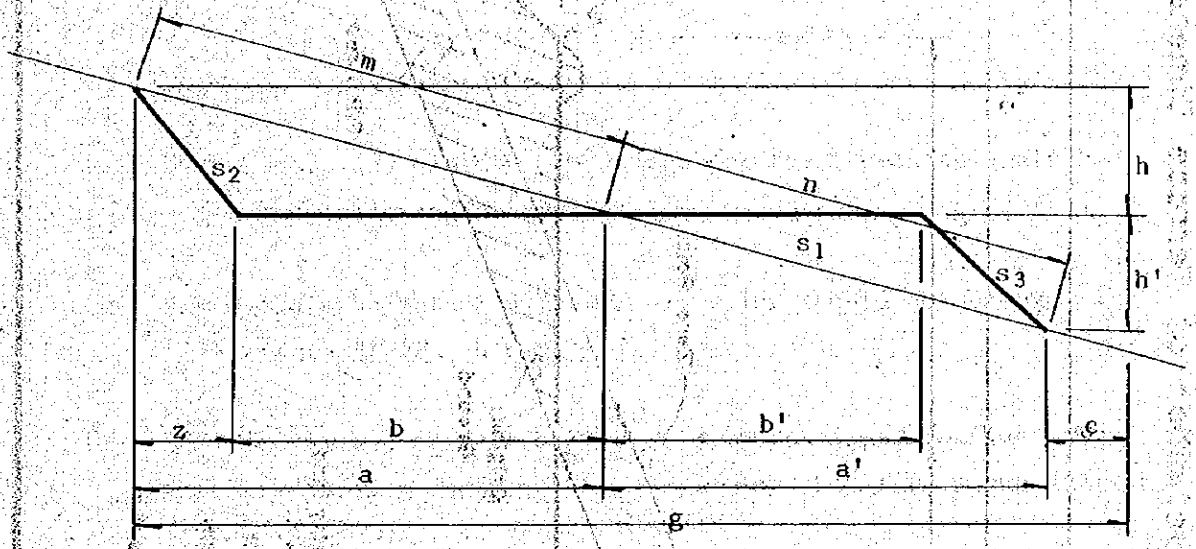
Figure 4D-28 **Location and Definition of Terrace Dimensions**



Definition of Symbol:

g - Total width of terrace.
a - Width of cut.
a' - Width of fill.
m, n - Slope distance from zero point to top of cut or toe of fill.
b, b' - Width of levelled area on cut or fill side.
c - Width of safty land.
h - Depth of cut.
h' - Height of fill.
S_1 - Ground slope.
S_2 - Cut slope.
S_3 - Riser (fill) slope.

3. Basic Equation of Dimensions of Terraceable Area (Figure 4D-29)



$a = 100\,h/s_1$

$b = a - 100\,h/s_2$

$c = 0.3$ (m)

$m = (a^2 + b^2)^{1/2}$

$a' = 100\,h'/s_1$

$b' = a' - 100\,h'/s_3$

$h' = \sqrt{0.9bh/(100/s_1 - 100/s_3)}$

$g = a + a' + c$

$n = \sqrt{(a')^2 + (h')^2}$

$k = bh/2$ (m^3/m)

$J = 100(b+b')/g$ (%)

$\ell = 10^4 \cdot k/g$ (m^3/ha)

where;

k : Area of cross section of cut of each terrace by length of the terrace

ℓ : Volume of excavation either per hectare of terraceable area

J : Parcentage of total surface area of leveling land which can be obtain from one hectare of gross area terraced

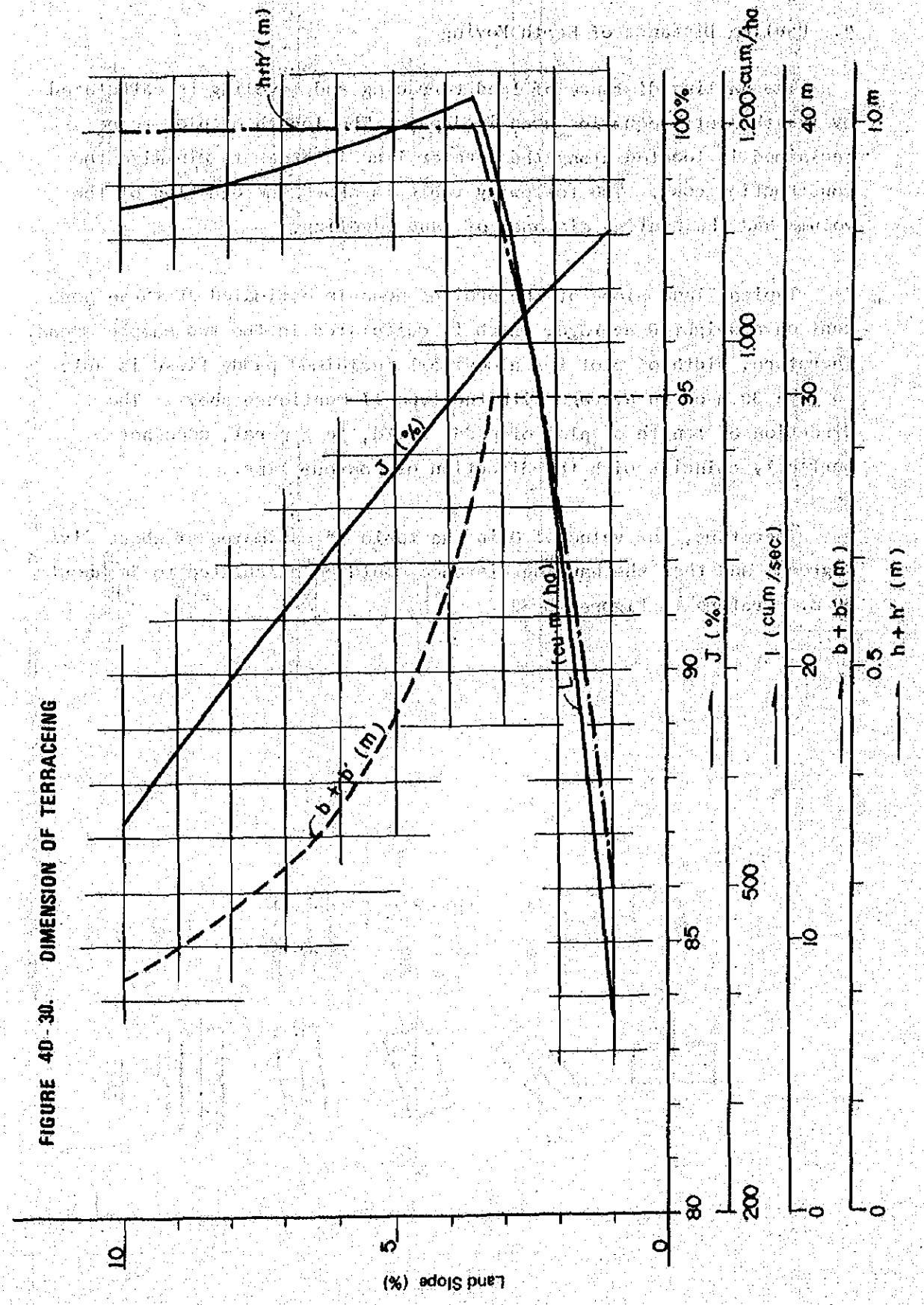


FIGURE 4D-30. DIMENSION OF TERRACEING

4. Hauling Distance of Earth Moving

The hauling distance of land terracing and leveling is calculated by the theoretic equation used in Japan. The length of plot to be reclaimed is located along the counter line in order to minimize the construction cost. The following table is shows the equation of the volume and the hauling distance of land leveling.

Typical land slope of the project area is estimated at three percent on a weighted average, which is calculated in the two sample areas. Therefore, width of plot for almost all reclaimed paddy field is able to give 30 m on an average with the type II mentioned above. The direction of length of plot of paddy field, in general, does not perfectly coincide with the direction of contour line.

Therefore, the value of Q in the table is estimated at about five degrees, and then the hauling distance could be calculated to be about 30 m. (refere to Figure 4D-32)

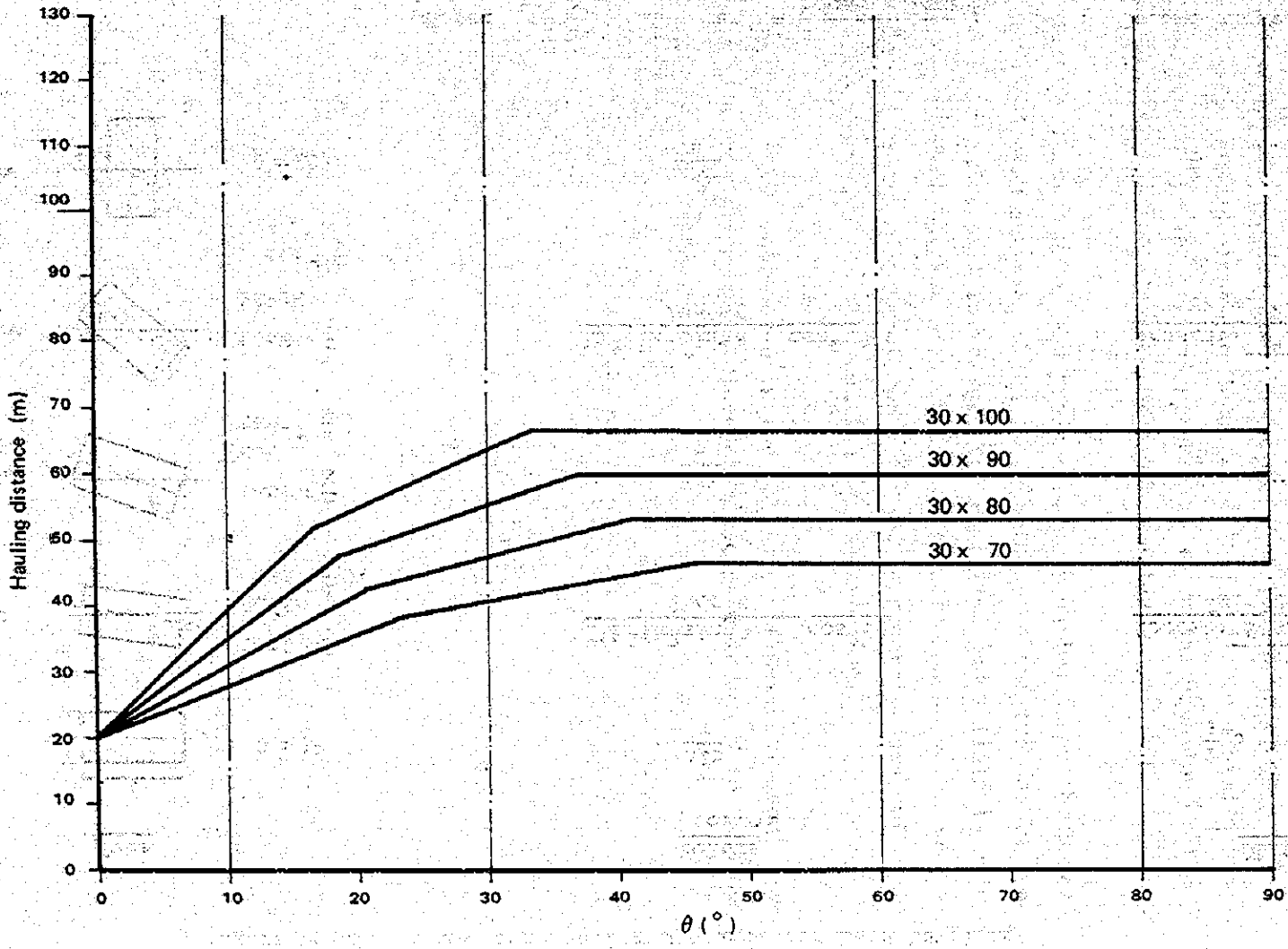
Figure 4D-31. Volume and Hauling Distance for Land Leveling

Type		Volume (cu.m)	Distance (m)
I	$\theta = 0°$	$-\frac{h\ell b}{4}$	$\frac{2}{3}b$
II	$\tan\theta < \frac{1}{k}$ $(0 \leqq \theta < \tan^{-1}\frac{1}{k})$	$\frac{Ikb^3(k^2\sin^2\theta + 3\cos^2\theta)}{24\cos\theta}$	$\frac{2b\cos\theta\sqrt{k^4\sin^2\theta + \cos^2\theta}}{k^2\sin^2\theta + 3\cos^2\theta}$
III	$\tan\theta = \frac{1}{k}$ $(\theta = \tan^{-1}\frac{1}{k})$	$\frac{h\ell b}{6}$	$\frac{1}{2}\sqrt{\ell^2 + b^2}$
IV	$\tan\theta > \frac{1}{k}$ $90° \geqq \theta > \tan^{-1}\frac{1}{k}$	$\frac{Ib^3(3k^2\sin^2\theta + \cos^2\theta)}{24\sin\theta}$	$\frac{2kb\sin\theta\sqrt{k^4\sin^2\theta + \cos^2\theta}}{3k^2\sin^2\theta + \cos^2\theta}$
V	$\theta = 90°$	$\frac{h\ell b}{4}$	$\frac{2}{3}\ell$

where; $k = \frac{\ell}{b}$ $I = \tan i = \frac{2h}{b\cos\theta + \ell\sin\theta}$ i : Ground slope (degree)

h : max. depth of excavation in a plot

FIGURE 4D - 32. APPROXIMATE HAULING DISTANCE FOR LAND LEVELING



C. On-farm Facilities

1. Layout of On-farm Facilities

Layout of the on-farm facilities was planned based the selected two sample areas in the project area, of which survey has been carried out by NIA in 1977. One sample area (Area "A") is located on the area served by lateral irrigation canal of N-2 near Barrio San Isidro and the other sample area (Area "B") is located on the area served by lateral irrigation canal of B near Barrio Estaça. The land use of these sample areas are shown in Table 4D-10.

Basic conseption for layout of on-farm facilities are as follows:

Farm ditches

(a) The average distance between supplementary farm ditches in a rotation area is about 200 m.

(b) Main and supplementary farm ditches should be located along tenant or lot boundaries and such location should be selected so that it can irrigate its service area at a minimum water surface in the farm ditch of 20 cm above the highest natural ground level in the area.

(c) There should be one supplementary farm ditch for each rotation unit. However, a common supplementary farm ditch for two adjacent rotation units may be constructed depending upon the topography.

(d) To have a permanent visual boundary between rotation units, the supplementary farm ditches should be located along sides of rotation units except when due to topography a farm ditch have to be located inside the rotation unit.

Farm drain

Farm drains are to be provided at the lowest portion of the service area.

Farm road

Farm roads are to be provided along the main farm ditch when needed.

Turnout

(a) The ideal location of a turnout is at the inlet of a check structure although in certain instances, when there is sufficient head and irrigable area is at the downstream side of the structure, it will be more economical to locate the turnout at the outlet of a road crossing provided with a check.

(b) When turnout is necessary further upstream of a check structure, its operating head is to be based on a water surface elevation equal to the checking height of the downstream.

Table 4D-10. Land Use within Sample Area

(unit: ha)

Item	Sample area "A"		Sample area "B"	
	Present	Proposed	Present	Proposed
Paddy field				
Rainfed	43	42	18	17
Irrigable 1/	-	92	-	81
Sub-total	43	134	18	98
Coconuts or bana area	24	24	2	2
Grass land	122	22 2/	106	18 2/
Others				
Residential area	3	3	0	0
Existing road	2	2	0	0
Right of way	-	9 3/	-	8 4/
Sub-total	5	14	0	8
Total	194	194	126	126

Note: 1/ converted from grass land
2/ high land
3/ consist of right of way for on-farm facilities (4 ha) and riser area (5 ha)
4/ consist of right of way for on-farm facilities (4 ha) and riser area (4 ha)

Table 4D-11. Land Slope Classification of Glassland

Item	Sample Area "A"		Sample Area "B"	
	Present	Proposed	Present	Proposed
Less than 1%	7	6	-	-
1 to 2%	32	29	20	18
2 to 3%	17	16	21	19
3 to 4%	12	11	19	17
4 to 5%	15	14	15	14
5 to 6%	6	6	6	6
6 to 8%	10	9	6	6
8 to 10%	1	1	1	1
More than 10% 1/	22	-	18	-
Total	122	92	106	81

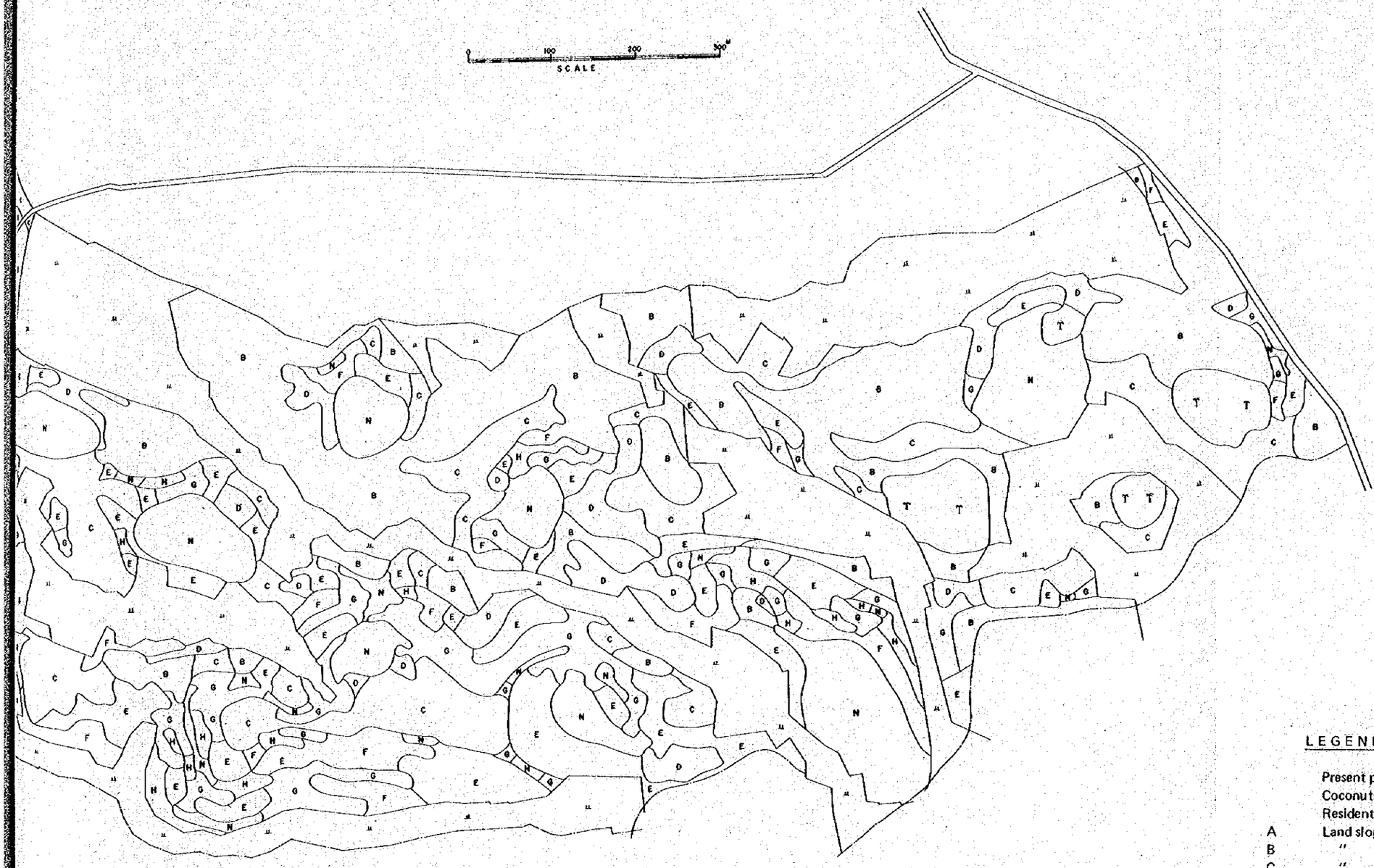
Note: 1/ including high land area estimated based on the land slope map of two Sample Areas (See Figure 4D-33 to 4D-35)

Table 4D-12. Area of Rotation Block in Sample Area

(Unit: ha)

Rotation Block No.	Rotation Units 1	2	3	4	5	Total	Remarks
Sample area "A"							
1	5.5	2.9	5.0	6.4	4.7	24.5	
2	2.1	8.7	7.4	5.0	5.0	28.2	
3	7.7	7.4	5.3	4.3	3.0	27.7	
4	10.1	6.5	3.7	5.0	9.3	34.6	
5	6.0	8.5	4.9	-		19.4	
Total						134.4	(say 134ha)
Sample area "B"							
1	5.2	5.2	5.5	5.1	5.6	26.6	
2	9.1	3.7	7.0	5.6	5.6	31.0	
3	2.9	3.6	3.7	3.6	3.5	17.3	
4	5.2	4.9	3.6	6.5	2.5	22.7	
Total						97.6	(say 98ha)

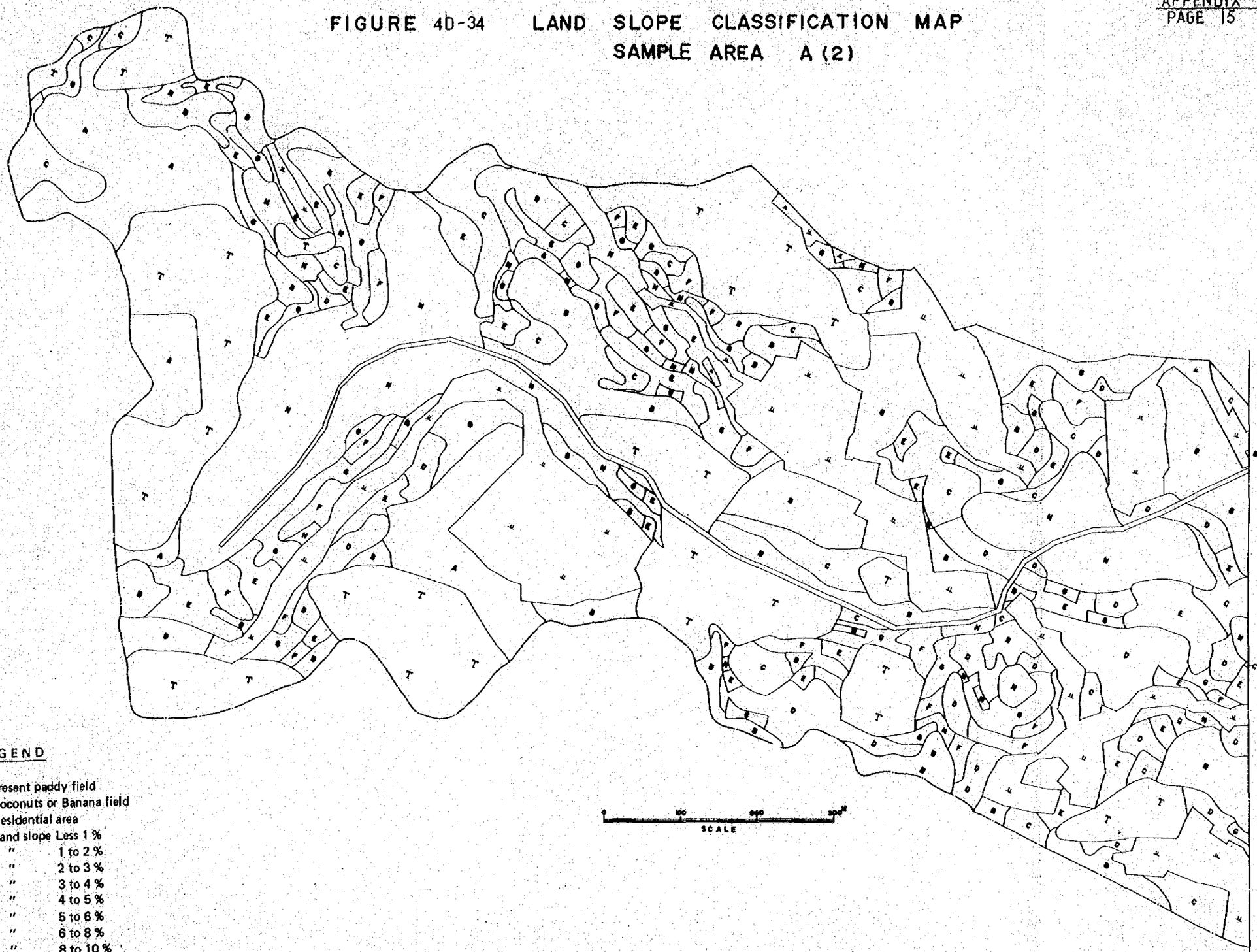
FIGURE 4D-33 LAND SLOPE CLASSIFICATION MAP
SAMPLE AREA A(1)



LEGEND

	Present paddy field
	Coconuts or Banana field
	Residential area
A	Land slope Less 1 %
B	" 1 to 2 %
C	" 2 to 3 %
D	" 3 to 4 %
E	" 4 to 5 %
F	" 5 to 6 %
G	" 6 to 8 %
H	" 8 to 10 %
N	Land slope more than 10% or highland area

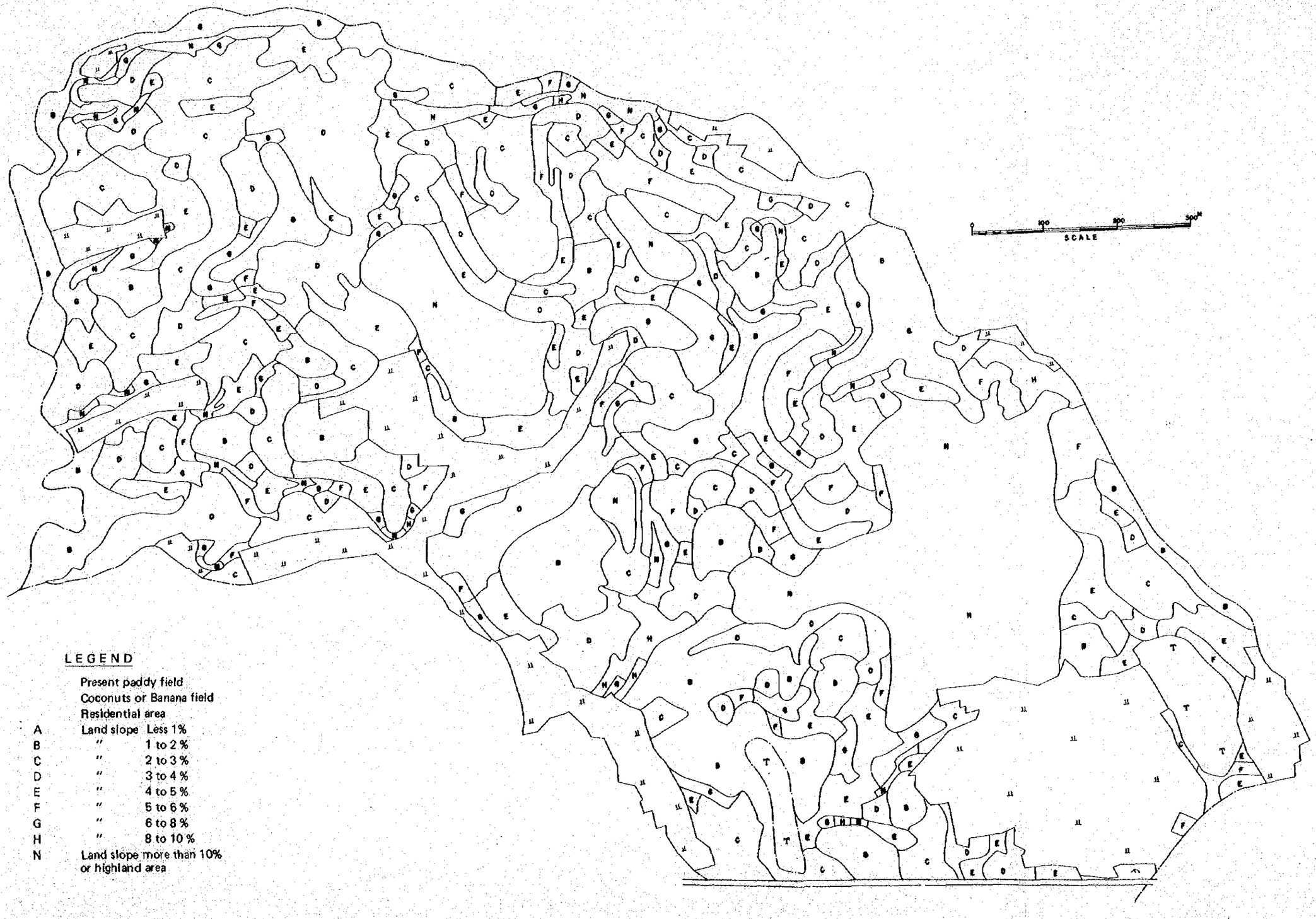
FIGURE 4D-34 LAND SLOPE CLASSIFICATION MAP
SAMPLE AREA A (2)



LEGEND

T Present paddy field
C Coconuts or Banana field
R Residential area
A Land slope Less 1 %
B " 1 to 2 %
C " 2 to 3 %
D " 3 to 4 %
E " 4 to 5 %
F " 5 to 6 %
G " 6 to 8 %
H " 8 to 10 %
N Land slope more than 10% or highland area

FIGURE 4D-35 LAND SLOPE CLASSIFICATION MAP
SAMPLE AREA B



2. On-farm Facilities and Functions

On-farm facilities and its functions are as follows:1/

(a) Turnout - Provided with a steel gate to control and regulate the flow of water to the farm ditches.

(b) Measuring Device - Constant head orifice

(c) Main Farm Ditch - Conveys water from the turnout to the supplementary farm ditches.

(d) Supplementary Farm Ditch - Conveys water from the main farm ditch to the paddy in a rotation unit.

(e) Division Box - To check water from the main farm ditch and divert it to the supplementary farm ditch.

(f) End Check - To prevent escape of irrigation water in the supplementary farm ditch to the drainage ditch when it is needed in the paddies or to release irrigation water from same when not needed.

(g) Farm Ditch Crossing - Provide access of farm equipment from farm road to the paddies in a rotation area. This is to be installed only on main farm ditches. On supplementary farm ditches, equipment are allowed to cut across.

(h) Farm Ditch Check and Drop - In steep slopes, this is necessary to limit the flow of water in the frame ditch within the non-scouring velocity.

(i) Farm Drain - Drain the paddy field when necessary and to pass on surface runoff during floods.

(j) Farm Road - To operate division box and transport agricultural inputs and outputs.

The quantity of the proposed on-farm facilities is shown in following Table 4D-13 and 4D-14. These quantities were estimated based on the sample layout of the on-farm facilities.

Table 4D-13. Quantity of On-farm Facilities

Rotation Block No.	Farm Ditch			Farm Drain (m)	Farm Road (m)	Related Structures (units)						
	MFD[1] (m)	SFD[2] (m)	Total (m)			Turn-out	Division Box	End Check	F.D.[3] Crossing	Drop MFD[1]	Drop SFD[2]	Drop Total
Sample Area "A"												
1	723	2,094	2,817	1,390	293	1	5	1	4	8	16	24
2	979	1,590	2,569	1,120	-	1	5	1	5	6	17	23
3	966	2,097	3,063	-	-	1	5	1	5	6	24	30
4	1,185	2,789	3,974	442	-	1	5	1	6	-	8	8
5	537	1,518	2,055	738	-	1	3	1	3	1	10	11
Sub-total	4,390	10,088	14,478	3,693	293	5	25	5	23	21	75	96
Sample Area "B"												
1	1,000	2,411	3,411	709	242	1	5	1	5	3	21	24
2	853	2,277	3,130	1,251	-	1	5	1	4	1	6	7
3	778	1,376	2,154	618	778	1	5	1	4	4	20	24
4	388	2,136	2,521	873	178	1	5	1	2	-	33	33
Sub-total	3,019	8,197	11,216	3,451	1,198	4	20	4	15	8	80	88
Total	7,409	18,285	25,694	7,144	1,491							
Intensity (m/ha)	(31.9)	(78.8)	(110.7)	(30.8)	(6.4)							

Note: 1/ Main farm ditch
2/ Supplementary farm ditch
3/ Farm ditch crossing

Table 4D-14. Proposed Length of On-farm Facilities

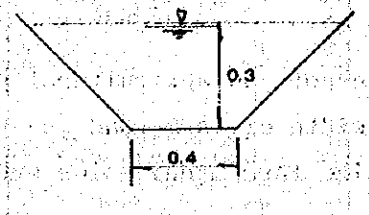
Rotation No.	Main Farm Ditch	Supplementary Farm Ditch: Rotation unit 1	2	3	4	5	Sub-total	Total	Farm Drain
Sample Area "A"									
1	723 (293)	661	180	330	598	325	2,094	2,817	1,390
2	979 (-)	82	215	468	477	348	1,590	2,569	1,123
3	966 (-)	455	560	440	375	267	2,097	3,063	-
4	1,185 (-)	480	482	692	345	790	2,789	3,974	442
5	537 (-)	267	597	654	-	- -	1,518	2,055	738
Total	4,390 (293)	1,945	2,034	2,584	1,795	1,730	10,088	14,478	3,693
Sample Area "B"									
1	1,000 (242)	416	637	406	346	606	2,411	3,411	709
2	853 (-)	718	436	363	355	405	2,277	3,130	1,251
3	778 (778)	357	226	316	147	330	1,376	2,154	618
4	388 (178)	148	582	443	482	478	2,133	2,521	873
Total	3,019 (1,198)	1,639	1,881	1,528	1,330	1,819	8,197	11,216	3,451

Note: Figure in parenthesis shows the length with farm road.

3. Design Criteria

Farm Ditches

Design capacity of farm ditch is 1.39 lit/sec/ha. The permissible velocity in the canal should not be more than 1.0 m/s based on the soil texture. Manning Formula's roughness "n" is 0.04 based on the NIA criteria. The maximum capacity of the farm ditch is calculated as follow;



A = 0.21 sq.m
P = 1.249 m
R = 0.168
$R^{2/3}$ = 0.305
Qmax = 0.210 cu.m/sec

So that, when the water depth of the farm ditch is 30 cm, the maximum irrigable area served by the farm ditch is about 150 ha. (0.210 cu.m/sec ÷ 1.39 ℓ/sec/ha ≒ 150 ha)

The maximum longitudinal slope is as follow,

$$V = R^{2/3} \cdot I^{1/2} \, \eta \qquad I = (\eta \cdot V / R^{2/3})^2$$

$$I = (0.04 \times 1.0/0.305)^2 = 1.72 \times 10^{-2} = 1/58$$

This farm ditch has a function of farm drain in Case "B", in which the maximum drainage area is estimated about 32 ha. (0.210 cu.m/sec ÷ 6.6 ℓ/sec/ha = 32 ha)

The area of the rotation unit is less than 11 ha so that the capacity of farm ditch is enough for irrigation and drainage when necessary.

Other dimensions of farm ditch are based on the NIA criteria, such as base width and side slope etc.

Farm Drain

The project area is mostly steep slope area, so that the excess water on the paddy field will be immediately drained to the down stream through the farm drain.

The high water level in flood period is determined as same as the ground of paddy field because it is no channel retarding. As the dimension of the cross section, the NIA criteria are adopted in consideration of the minimum construction size.

Farm Road

The farm road is also necessary to transport an agricultural products and input and output materials. The width of farm road is planned to be two meters, supposing small size farm machineries such as tractor (7 - 8 HP) can be passed.

Table 4E-1 Investment Cost of the Project (Financial Cost)

Description	Total		Foreign Currency		Local Currency	
	(₱ '000)	(US$ '000)	(₱ '000)	(US$ '000)	(₱ '000)	(US$ '000)
1. Civil Works 1/						
1-1. Preparation	602	(80)	183	(24)	419	(56)
1-2. Dam	39,067	(5,209)	19,264	(2,569)	19,803	(2,640)
1-3. Diversion Dam	20,701	(2,760)	11,814	(1,575)	8,887	(1,185)
1-4. Irrigation and Drainage Canals	20,502	(2,733)	4,262	(568)	16,239	(2,165)
1-5. On-farm	5,735	(765)	1,583	(211)	4,152	(554)
1-6. Roads	3,373	(450)	629	(84)	2,744	(366)
1-7. Hydro-power	13,499	(1,800)	11,040	(1,472)	2,459	(328)
1-8. Pre-Engineering	1,265	(169)			1,265	(169)
Sub-total	104,743	(13,966)	48,775	(6,503)	55,968	(7,463)
2. Land Acquisition and Compensation	6,475	(863)			6,475	(863)
3. Construction Equipment	51,762	(6,901)	51,250	(6,833)	512	(68)
4. Agricultural Development	1,519	(203)			1,519	(203)
5. Operation and Maintenance Cost	3,198	(426)			3,198	(426)
6. Project Facility	5,738	(765)	993	(132)	4,745	(633)
7. Project Administration (8%)	13,874	(1,850)	8,081	(1,077)	5,793	(773)
8. Consulting Services	8,943	(1,192)	7,599	(1,013)	1,344	(179)
Sub-total (1 to 8)	196,252	(26,166)	116,698	(15,558)	79,554	(10,608)
9. Contingency (15%)	29,438	(3,925)	17,505	(2,334)	11,933	(1,591)
Sub-total (1 to 9)	225,690	(30,091)	134,203	(17,892)	91,487	(12,199)
10. Price Escalation	101,660	(13,555)	55,070	(7,343)	46,590	(6,212)
Grand Total (1 to 10)	327,350	(43,646)	189,273	(25,235)	138,077	(18,411)
	(100%)		(58%)		(42%)	

Note: 1/ exclusive of depreciation cost of construction equipments.

1. Civil Works

Item	Description	Quantity	Unit	Rate (₱)	Total Cost (₱ '000)	Foreign Currency			Local Currency		
						Depreciation (₱ '000)	Material (₱ '000)	Total (₱ '000)	Fuel Repair & Material (₱ '000)	Labor (₱ '000)	Total (₱ '000)
1.	Civil Works										
	1-1. Preparation	L.S.			743	141	183	324	284	135	419
	1-2. Dam	L.S.			48,382	9,315	19,264	28,579	15,285	4,518	19,803
	1-3. Diversion Dam	L.S.			22,757	2,056	11,814	13,870	6,188	2,699	8,887
	1-4. Irrigation and Drainage Canals	L.S.			27,800	7,299	4,262	11,561	6,531	9,708	16,239
	1-5. On-farm	L.S.			9,469	3,734	1,583	5,317	1,863	2,289	4,152
	1-6. Roads	L.S.			8,281	4,908	629	5,537	964	1,780	2,744
	1-7. Hydro-power	L.S.			14,425	926	11,040	11,966	1,158	1,301	2,459
	1-8. Pre-Engineering	L.S.			1,265					1,265	1,265
	Total				133,122	28,379	48,775	77,154	32,273	23,695	55,968
					(US$17,749.6x10^3)			(US$10,287.2x10^3)			(US$7,462.4x10^3)

Item	Description	Quantity	Unit	Rate (₱)	Total Cost (₱ '000)	Foreign Currency (F.C.) Depreciation (₱ '000)	Material (₱ '000)	Total (₱ '000)	Local Currency (L.C.) Fuel Repair & Material (₱ '000)	Labor (₱ '000)	Total (₱ '000)
1-1.	Preparation										
	1-1-1. Dam										
	Road										
	Access Road	1,500	m	169.1	253	87	70	157	77	19	96
	Bridge	1	place	100,000	100				60	40	100
	Sub-total				353	87	70	157	137	59	196
	1-1-2. Diversion dams										
	Malinao diversion dam										
	care of river & diversion	1	set		252	32	82	114	93	45	138
	Wahig diversion dam										
	care of river & diversion	1	set		82	13	18	31	32	19	51
	Pamacsalan diversion dam										
	care of river & diversion	1	set		56	9	13	22	22	12	34
	Sub-total				390	54	113	167	147	76	223
	Total				743	141	183	324	284	135	419
					(US$99.1x10^3)			(US$43.2x10^3)			(US$55.9x10^3)
1-2.	Dam										
	1-2-1. Diversion										
	Open Excavation	9,500	cu.m	16.4	156	71	20	91	53	12	65
	Open Concrete	930	"	471	437	49	107	156	217	64	281
	Tunnel Excavation (without Support)	9,350	"	138.3	1,293	228	296	524	695	74	769
	" (with Support)	1,510	"	159.4	241	42	66	108	116	17	133
	Tunnels Concrete	2,757	"	501.7	1,384	214	425	639	656	89	745
	Back Grouting	119	"	649.6	77	1	12	13	61	3	64
	Deformed Bar	66	ton	4,000	264		132	132	132		132
	Support	102	set	2,639	269		170	170	99		99
	Stone Masonry	L.S.			7				3	4	7
	Sub-total				4,128	604	1,228	1,833	2,032	263	2,295
	1-2-2. Foundation										
	Stripping	31,500	cu.m	12.2	382	183	42	225	127	30	157
	Core trench	36,100	"	30.6	1,104	355	345	700	330	74	404
	Boring (Open)	29,100	m	67.8	1,973	391	879	1,270	301	402	703
	" (Adit)	24,000	"	74.6	1,790	355	795	1,150	273	362	640
	Grouting	53,100	"	123.8	6,572	605	3,923	4,528	1,449	595	2,044
	Adit Excavation	4,900	cu.m	138.3	678	120	155	275	364	39	403
	Adit Concrete	1,700	"	501.7	853	132	262	394	404	55	459
	Sub-total				13,352	2,141	6,401	8,542	3,248	1,562	4,810

Item	Description	Quantity	Unit	Rate (₱)	Total Cost (₱ '000)	Foreign Currency (F.C.) Depreciation (₱ '000)	Material (₱ '000)	Total (₱ '000)	Local Currency (L.C.) Fuel Repair & Material (₱ '000)	Labor (₱ '000)	Total (₱ '000)
1-2-3.	Dam Body										
	Impervious (Core)	91,000	cu.m	17.8	1,620	761	177	938	479	203	682
	Filter	34,000	"	14.1	480	267	22	289	140	51	191
	Pervious (Rock)	449,000	"	3.06	1,374	696	117	813	440	121	561
	Coffer dam	15,000	"	17.8	269	125	29	154	79	34	113
	Sub-total				3,741	1,849	345	2,194	1,138	409	1,547
1-2-4.	Spill Way										
	Common Excavation	43,500	cu.m	16.4	714	325	91	416	243	55	298
	Rock Excavation	316,900	"	28.66	9,082	2,712	3,350	6,062	2,523	497	3,020
	Concrete	14,700	"	471.1	6,925	773	1,690	2,463	3,437	1,025	4,462
	Deformed Bar	588	ton	4,000	2,352		1,176	1,176	1,176		1,176
	Gate	90	"	37,500	3,375		2,869	2,869	253	253	506
	Sub-total				22,448	3,810	9,176	12,986	7,632	1,830	9,462
1-2-5.	Intake Facility										
	Concrete	1,770	cu.m	471.1	833	93	203	296	414	123	537
	Deformed Bar	44	ton	4,000	176		88	88	88		88
	Penstock (Step Pipe)	75	"	9,000	675		574	574		101	101
	Cone Valve (700 m/m)	1	set		405		344	344		61	61
	Butter Fly Valve (700 m/m)	1	set		60		51	51		9	9
	Sub-total				2,149	93	1,260	1,353	502	294	796
1-2-6.	Left Bank (Above EL 250m)										
	Stripping	10,500	cu.m	12.2	127	61	14	75	42	10	52
	Rock Excavation	60,900	"	28.7	1,745	521	644	1,165	484	96	580
	Sub-total				1,872	582	658	1,240	526	106	632
1-2-7.	Road										
	Relocation Road	1,000	m	169.1	169	58	47	105	51	13	64
	Sub-total				169	58	47	105	51	13	64
1-2-8.	Temporary										
	Transportation Road (No.1)	1,500	m	169.1	253	87	70	157	77	19	96
	" (No.2)	1,500	"	169.1	253	87	70	157	77	19	96
	Sub-total				506	174	140	314	154	38	192
1-2-9.	Incidental Facility										
	Observation holes	4 holes 160	m	106.2	17	4	8	12	2	3	5
	Sub-total				17	4	8	12	2	3	5
	Total				48,382	9,315	19,264	28,579	15,285	4,518	19,803
					(US$6,450.9x10³)			(US$3,810.5x10³)			(US$2,640.4 x 10³)

Item	Description	Quantity	Unit	Rate (₱)	Total Cost (₱ '000)	Foreign Currency (F.C.) Depreciation (₱ '000)	Material (₱ '000)	Total (₱ '000)	Local Currency (L.C.) Fuel Repair & Material (₱ '000)	Labor (₱ '000)	Total (₱ '000)
1-3.	Diversion Dams										
	1-3-1. Malinao Diversion Dam										
	Earth Work										
	Excavation (Common)	20,200	cu.m	9.5	192	101	18	119	32	41	73
	Excavation (Indurated)	24,700	"	11.1	274	138	25	163	85	26	111
	Compaction fill	40,400	"	7.5	303	155	9	164	9	130	139
	Borrow fill	10,700	"	16.8	180	117	9	126	9	45	54
	Foundation										
	Boring	4,250	m	72	306	61	132	193	52	61	113
	Grouting	4,250	"	137	582	52	88	140	396	46	442
	Concrete "A" (3,000 Psi)	4,750	cu.m	503	2,389	239	621	860	1,123	406	1,529
	Concrete "C" (Mass conc.)	16,700	"	337	5,628	900	1,014	1,914	3,152	562	3,714
	Reinforcement Bar	381	ton	4,000	1,524		762	762	762		762
	Plain rip-rap	800	cu.m	169	135	59	7	66	8	61	69
	Sodding	1,000	sq.m	10	10	1		1	1	8	9
	Roller gate (2x13.00x7.00)	135	ton	37,500	5,063		4,557	4,557		506	506
	Roller gate (13.00x10.00)	96	"	37,500	3,600		3,240	3,240		360	360
	Head gate (3x1.5x1.5)	5	"	37,500	188		169	169		19	19
	Bridge (steel gater)	30	"	30,000	900		810	810		90	90
	Miscellaneous metal work	5	"	18,000	90	9	45	54	9	27	36
	Sub-total				21,364	1,832	11,506	13,338	5,638	2,388	8,026
	1-3-2. Wahig Diversion Dam										
	Earth Work										
	Excavation (common)	480	cu.m	7.2	3	1		1		2	2
	Excavation (indurated)	720	"	13	9	2		2	1	6	7
	Back fill	480	"	7.5	4	2		2		2	2
	Concrete "A" (3,000 Psi)	330	"	1,155	381	53	69	122	183	76	259
	Concrete "A" (2,400 Psi)	210	"	1,028	216	35	25	60	106	50	156
	Rubble masonry	160	"	429	69	14	6	20	25	24	49
	Plain rip-rap	80	"	169	14	6	1	7	1	6	7
	Grouted rip-rap	130	"	253	33	12	3	15	7	11	18
	Gravel blanket	100	"	150	15	9	1	10	1	4	5
	Sluice gate	1,730	kg	34	59		53	53		6	6
	Head gate	410	"	34	14		13	13		1	1
	Sub-total				817	134	171	305	324	188	512

Item	Description	Quantity	Unit	Rate (₱)	Total Cost (₱ '000)	Foreign Currency (F.C.) Depreciation (₱ '000)	Material (₱ '000)	Total (₱ '000)	Local Currency (L.C.) Fuel Repair & Material (₱ '000)	Labor (₱ '000)	Total (₱ '000)
	1-3-3. Pamacsalan Diversion Dam										
	Earth Work										
	Excavation (common)	480	cu.m	7.2	3	1		1		2	2
	Excavation (indurated)	320	"	13	4	1		1		3	3
	Back fill	160	"	7.5	1	1		1			
	Concrete "A" (3,000 Psi)	220	"	1,155	254	36	45	81	123	50	173
	Concrete "A" (2,400 Psi)	180	"	1,028	185	30	22	52	91	42	133
	Rubble masonry	45	"	429	19	4	2	6	7	6	13
	Plain rip-rap	50	"	169	8	4		4		4	4
	Grouted rip-rap	80	"	253	20	7	2	9	4	7	11
	Gravel blanket	65	"	150	10	6	1	7	1	2	3
	Sluice gate	1,300	kg	34	44		40	40		4	4
	Head gate	820	"	34	28		25	25		3	3
	Sub-total				576	90	137	227	226	123	349
	Total				22,757	2,056	11,814	13,870	6,188	2,699	8,887
					(US$3,034.2x10³)			(US$1,849.3x10³)			(US$1,184.9x10³)
	1-4. Irrigation & Drainage Canal										
	1-4-1. Main Canal										
	Earth Work										
	Ordinary excavation	393,000	cu.m	7.2	2,830	764	142	906	113	1,811	1,924
	Compaction fill	217,000	"	7.5	1,628	830	49	879	49	700	749
	Concrete lining	1,500	"	831	1,247	237	87	324	561	362	923
	Class "A" concrete	2,480	"	1,155	2,864	401	515	916	1,375	573	1,948
	Grouted rip-rap	2,500	"	253	633	234	51	285	127	221	348
	Sand and gravel under rip-rap	1,250	"	143	179	91	11	102	14	63	77
	Pipe work ϕ 48"	1,200	m	621	745	134	142	276	320	149	469
	Check gate & installation	30	ton	34,000	1,020		918	918		102	102
	Miscellaneous metal work	6	"	18,000	108		54	54	43	11	54
	Sub-total				11,254	2,691	1,969	4,660	2,602	3,992	6,594
	1-4-2. Lateral Canal										
	Earth Work										
	Ordinary excavation	259,000	cu.m	7.2	1,865	504	93	597	75	1,193	1,269
	Compaction fill	132,000	"	7.5	990	505	30	535	30	425	455
	Concrete lining	850	"	831	706	134	50	184	318	204	522
	Class "A" concrete	1,900	"	1,155	2,191	307	394	701	1,052	438	1,490
	Grouted rip-rap	2,000	"	253	506	187	41	228	101	177	278
	Sand and gravel under rip-rap	1,000	"	143	143	73	9	82	11	50	61
	Pipe workϕ 36 "	1,800	m	430	774	139	147	286	341	147	488
	Head gate and installation	25	ton	34,000	850		765	765		85	85
	Miscelleous metal work	5	"	18,000	90		45	45	36	9	45
	Sub-total				8,115	1,849	1,574	3,423	1,964	2,728	4,692

Item	Description	Quantity	Unit	Rate (₱)	Total Cost (₱ '000)	Foreign Currency (F.C.) Depreciation (₱ '000)	Material (₱ '000)	Total (₱ '000)	Local Currency (L.C.) Fuel Repair & Material (₱ '000)	Labor (₱ '000)	Total (₱ '0000)
	1-4-3. Sub Lateral										
	Earth Work										
	Ordinary excavation	2,000	cu.m	7.2	14	3	1	4	1	9	10
	Compaction fill	2,000	"	7.5	15	7	1	8	1	6	7
	Compaction fill with borrow	63,000	"	16.8	1,058	688	53	741	53	264	317
	Concrete lining	450	"	831	374	71	26	97	168	109	277
	Class "A" concrete	550	"	1,155	635	89	114	203	305	127	432
	Grouted rip-rap	600	"	253	152	56	12	68	31	53	84
	Sand and gravel under rip-rap	300	"	143	43	22	3	25	3	15	18
	Pipe work ϕ 24"	1,250	"	257	321	58	58	116	138	67	205
	Miscellaneous metal work	5	ton	18,000	90		45	45	36	9	45
	Sub-total				2,702	994	313	1,307	736	659	1,395
	1-4-4. Main drainage canals										
	Ordinary excavation	157,100	cu.m	7.2	1,131	305	57	362	45	724	769
	Mass Concrete	580	"	561	325	75	26	101	152	72	224
	Grouted rip-rap	1,660	"	253	420	155	34	189	84	147	231
	Drainage inlet	60	unit	450	27	4	5	9	12	6	18
	Sand and gravel bedding under rip-rap	800	cu.m	143	114	58	7	65	9	40	49
	Sub-total				2,017	597	129	726	302	989	1,291
	1-4-5. Lateral drainage canals										
	Ordinary excavation	99,900	cu.m	7.2	719	194	36	230	29	460	489
	Mass Concrete	2,140	"	561	1,201	276	96	372	565	264	829
	Grouted rip-rap	4,900	"	253	1,240	459	99	558	248	434	682
	Sand & gravel bedding under rip-rap	2,450	"	143	350	178	21	199	28	123	151
	Drainage inlets	260	unit	450	117	18	22	40	54	23	77
	Compacted fill	11,300	cu.m	7.5	85	43	3	46	3	36	39
	Sub-total				3,710	1,168	277	1,445	927	1,340	2,267
	Total				27,800 (US$3,706.7x10^3)	7,299	4,262	11,561 (US$1,541.4x10^3)	6,531	9,708	16,239 (US$2,165.3x10^3)
	1-5. On-Farm										
	1-5-1. On-farm facilities										
	for paddy field (rainfed)	1,011	ha	910	920	201	213	414	261	245	506
	for grass land, etc.	3,870	"	2,209	8,549	3,533	1,370	4,903	1,602	2,044	3,646
	Total	4,881	"		9,468 (US$1,262.5x10^3)	3,734	1,583	5,317 (US$708.9x10^3)	1,863	2,289	4,152 (US$553.6x10^3)

Item	Description	Quantity	Unit	Rate (₱)	Total Cost (₱ '000)	Foreign Currency (F.C.) Depreciation (₱ '000)	Material (₱ '000)	Total (₱ '000)	Local Currency (L.C.) Fuel Repair & Material (₱ '000)	Labor (₱ '000)	Total (₱ '000)
1-6.	Roads										
	Earth Work										
	Compaction fill	349,000	cu.m	7.5	2,618	1,335	79	1,414	79	1,125	1,204
	Gravel or selected material surfacing	144,000	"	30	4,320	3,370	259	3,629	302	389	691
	Class "A" concrete	620	cu.m	1,155	716	100	129	229	344	143	487
	Mass concrete	350	"	561	196	45	16	61	92	43	135
	Pipe work ø 30"	1,000	m	341	341	58	65	123	147	71	218
	Miscellaneous metal work	5	ton	18,000	90		81	81		9	9
	Total				8,281	4,908	625	5,537	964	1,780	2,744
					(US$1,104.1x10³)			(US$738.2x10³)			(US$364.9x10³)
1-7.	Hydro-power										
	1-7-1. Turbine and generator	2	set	4,871,000	9,742		9,742	9,742			
	1-7-2. Crane	1	set		121		121	121			
	1-7-3. Electric works	L.S.			1,290	112	478	590	281	419	700
	1-7-4. CIF and delivery to site	L.S.			1,047	644		644	15	388	403
	1-7-5. Civil works										
	Excavation (Common)	4,000	cu.m	16	65	30	8	38	22	5	27
	Excavation (Rock)	2,000	"	30	60	20	19	39	17	4	21
	Concrete	960	"	471	452	50	110	160	224	68	292
	Deformed bar	31	ton	4,000	62		31	31	31		31
	Penstock (ℓ = 60m ø 24")	9	"	9,000	81		61	61		20	20
	Crane assenble	1	set		36					36	36
	Electric water supply & drainage	L.S.			119				95	24	119
	Sub-total				875	100	229	329	389	157	546
	1-7-6. Trans-mission line	20	km	67,500	1,350	70	470	540	473	337	810
	Total				14,425	926	11,040	11,966	1,158	1,301	2,459
					(US$1,923.3x10³)			(US$1,595.4x10³)			(US$327.9x10³)

Item	Description	Quantity	Unit	Rate F.C. (₱)	Rate L.C. (₱)	Amount F.C. (₱'000)	Amount L.C. (₱'000)
1-8.	Pre-Engineering						
1-8-1.	Survey Works						
	Topographical Survey						
	Pamacsalan dam site (600m x 600m)	36	ha		200		7
	Malinao diversion dam site (1,000m x 200m)	20	ha		200		4
	Profile survey						
	Pamacsalan dam						
	Dam axis	1,200	m		1.0		1
	Spillway	450	m		1.0		1
	Diversion tunnel	600	m		1.0		1
	Access and relocation road	2,500	m		1.0		3
	Malinao diversion dam	1,600	m		1.0		2
	Irrigation and drainage canals	229,100	m		0.8		183
	Cross section survey						
	Pamacsalan dam						
	Dam axis (11sections x 250m)	2,750	m		1.0		3
	Access and relocation road (63sections x 40m)	2,520	m		1.0		3
	Malinao diversion dam (40sections x 200m)	8,000	m		1.0		8
	Irrigation and drainage canals (5,728sections x 50m)	286,400	m		0.8		229
	Sub-total						445
1-8-2.	Geological Investi Investigation						
	Pamascalan dam						
	Seismic exploration	L.S.					5
	Electric resistivity survey	L.S.					2
	Bore hole drilling						
	Dam site	260	m		500		130
	Abutments	750	m		500		375
	Spillway	60	m		400		24
	Diversion tunnel	60	m		400		24
	Quarry site	40	m		400		16
	Aggregate	60	m		300		18
	Malinao diversion dam						
	Diversion dam site	180	m		500		90
	Sub-total						684
1-8-3.	Material Investigation						
	Pamacsalan dam						
	Aggregate pite	L.S.					18
	Insitu test	L.S.					4
	Laboratory test	L.S.					10
	Malinao diversion dam						
	Laboratory test	L.S.					4
	Sub-total						36
1-8-4.	Soil Survey	L.S.					100
	Sub-total						100
	Total						1,265
							(US$168.6x10^3)

2. Land Acquisition and Compensation

Item	Description	Quantity	Unit	Rate F.C. (₱)	Rate L.C. (₱)	Amount F.C. (₱ '000)	Amount L.C. (₱ '000)
2-1. Land Acquisition							
2-1-1. Civil Works							
	Irrigation canal 1/						
	Main canal (lower area)	65.0	ha		10,000		650
	Lateral canal (lower area)	68.6	ha		10,000		686
	Sub-lateral canal (lower area)	24.4	ha		10,000		244
	Wahig canal (upper area)	17.4	ha		10,000		174
	Pamacsalan canal (upper area)	4.8	ha		10,000		48
	Sub-total						1,802
	Drainage Canal						
	Main canal (lower area)	6.7	ha		10,000		67
	Lateral canal (lower area)	15.9	ha		10,000		159
	Sub-total						226
	On-farm						
	Farm ditch	119.7	ha		10,000		1,197
	Farm road	9.2	ha		10,000		92
	Farm drain	47.9	ha		10,000		479
	Sub-total						1,768
2-1-2. Agricultural Development							
	Working station	0.5	ha		10,000		5
	Sub-total						5
2-1-3. Project Administration & Facilities							
	Main project office	0.5	ha		10,000		5
	Operation Office	0.1	ha		10,000		1
	Housing	0.9	ha		10,000		9
	Sub-total						15

1/ including the right of way for service and access roads.

Item	Description	Quantity	Unit	Rate F.C. (₱)	Rate L.C. (₱)	Amount F.C. (₱ '000)	Amount L.C. (₱ '000)
2-2. Land Compensation							
2-2-1. Compensation Cost for Pamacsalan Reservoir							
	Land						
	Irrigated paddy field	44.05	ha		15,000		661
	Rainfed paddy field	6.35	ha		5,000		32
	Coconut	57.15 x 60trees	ha		50		171
	Grass land and forest	97.88	ha		550		54
	Building						
	Housing	45	house		16,200		729
	Housing site	45 x 300	m^2		2.67		36
	Crops						
	Irrigated paddy field	44.50	ha		1,911		191
	Rainfed paddy field	6.35	ha		1,031		6
	Coconut	57.15	ha		397		23
	Corn	80.0	ha		115		9
	Sub-total						1,912
2-2-2. Compensation cost for Malinao Reservoir							
	Land						
	Irrigated paddy field	19.09	ha		15,000		286
	Grass land and forest	73.28	ha		550		40
	Building						
	Housing	20	house		16,200		324
	Housing site	20 x 300	m^2		2.67		16
	Crops						
	Irrigated paddy	19.09	ha		2,157		42
	Corn	73.28 x 0.6 x 17	ha		525		39
	Sub-total						747
	Total						6,475
							(US$863.3x10^3)

3. Construction Equipment

Equipment	Spec.	Number	Unit Price (₱ '000)	Amount (₱ '000)	Remarks
Bulldozer	11ton 90Ps	6	367	2,202	
Bulldozer	16ton 140Ps	1	525	525	
Bulldozer	22ton 180Ps	18	652	11,736	
Front end loader	1.4 m^3	6	382	2,292	
Front end loader	1.8 m^3	1	502	502	
Front end loader	2.2 m^3	2	697	1,394	
Dump truck	6 ton	12	120	1,440	
Dump truck	8 ton	12	150	1,800	
Dump truck	11 ton	19	240	4,560	
Back hoe	0.6 m^3	4	548	2,192	
Tire roller	8.5 - 20ton	6	270	1,620	
Motor grader	4.0 m	2	530	1,060	
Air compressor	110 Ps	4	109	436	
Diesel generator	100 KVA	4	94	376	
Diesel generator	30 KVA	1	8	8	
Crushing & Screening Plant	40 ton/hr	1	2,400	2,400	
Mixing plant	30 m^3/hr	1	846	846	
Truck mixer	3.0 m^3	5	279	1,395	
Vibrator	5.0 Ps	17	4	68	with engine
Blower	400mm 2x15KW	1	75	75	
Leg drill	2.7 m^3/min	10	5	50	
Crower drill	10 m^3/min	1	190	190	
Tamping roller	10 ton	1	262	262	
Vibrating roller	2.5 ton	1	148	148	
Vibrating roller	10 ton	1	456	456	pulling type
Boring machine		10	46	460	
Grout pump		5	66	330	with mixer
Pump	100mm 11KW	1	24	24	
Pump	125mm 15KW	1	35	35	
Rocker shovel	0.4 m^3	1	441	441	
Concrete pump car	40 m^3/hr	1	522	522	

Equipment	Spec.	Number	Unit Price (₱ '000)	Amount (₱ '000)	Remarks
Pick up truck	4 ton	8	90	720	
Stake truck	6 ton	4	150	600	with crane 1.5ton
Water truck	10,000 ℓ	2	150	300	
Fuel truck	8,000 ℓ	1	165	165	
Truck-tractor & trailer	25 ton	1	625	625	
Concrete pot mixer	0.3 m^3	10	37	370	
Portable belt conveyer	L = 7m	6	5	30	with engine
Concrete conveyer	L = 15m 5Ps	1	26	26	with engine
Lammer	90 kg	10	6	60	
Welder	20 KVA	1	19	19	
Lubricating car		1	360	360	
Repair workshop		1	460	460	
Utility jeep		16	75	1,200	
Station wagon		4	100	400	
Motor cycle	90 cc	40	6	240	
Weeder cutter		30	3	90	
Laboratory equipment		1	1,000	1,000	
Radio tranciver (Mobil station)		20	4	80	
Spair parts				4,660	
Transportation				512	
Total				51,762	
				(F.C. 51,250)	
				(L.C. 512)	

4. Agricultural Development

Item	Description	Quantity	Unit	Rate F.C. (₱)	Rate L.C. (₱)	Amount F.C. (₱ '000)	Amount L.C. (₱ '000)
4-1.	Cadustral survey	L.S.					565
4-2.	Establishment cost of irrigators association	L.S.					54
4-3.	Communication system to farmers	24	barrio		6,250		150
4-4.	Working station Warehouse for palay	1,500(500x3)	m^2		500		750
	Total						1,519
							(US$202.5x10^3)

5. Operation and Maintenance Cost

5-1.	Salary and Wage						
	Main project office	710,000x0.5					355
	Malinao diversion dam	L.S.					43
5-2.	Equipment Operation						
	Depreciation cost						
	Main project office	535,000x0.5					268
	Malinao diversion dam	L.S.					34
	Fuel and oil cost	88,000x0.5					44
5-3.	Materials and Supply						
	Irrigation, drainage and road	330,000x0.5					165
	Building	L.S.					98
	Others	L.S.					112
5-4.	Administration and General Expenditure	398x0.4					159
	Sub-total						1,279
	Total	1,279,000 x 2.5 years = 3,197,500					3,198
							(US$426.4x10^3)

6. Project Facility

Item	Description	Quantity	Unit	Rate F.C. (₱)	Rate L.C. (₱)	Amount F.C. (₱'000)	Amount L.C. (₱'000)
6-1. Building and Faniture							
	Building						
	Main project office	1,500	m^2		500		750
	Operation Office	250	m^2		400		100
	Housing						
	Government staff	750	m^2		500		375
	Guest house	200	m^2		500		100
	Equipment shed	3,000	m^2		200		600
	Furniture	L.S.					150
	Sub-total						2,075
6-2. Equipment							
	Office equipment						
	Leveling instrument with staff and steel tape	2	set	12,000		24	
	Transit with staff and tape	2	set	12,000		24	
	Current meter	1	set	4,000		4	
	Miscellaneous tools and equipment	L.S.		75,000		75	
	Other equipment						
	Radio tranciever	3	set	50,000	10,000	150	30
	Wireless telephone	1	set	160,000	40,000	160	40
	Wireless telephone	2	set	90,000	22,000	180	44
	Emergency correspondence	1	set	15,000			15
	Observation instrument for dam body	L.S.		170,000	30,000	170	30
	Water level gage for dam body	2	set	37,000	15,000	37	15
	Meteorological equipment	L.S.		34,000	16,000	34	16
	Seismic resistivity equipment	1	set	75,000		75	75
	Jack for bearing capacity	1	set	15,000		15	15
	Electric Processing equipment	1	set	45,000		45	45
	Sub-total					993	2,670
	Total					993	4,745
						(US$132.4x10^3)	(US$632.7x10^3)

8. Consulting Services

Item	Description	Quantity	Unit	Rate F.C. (₱)	Rate L.C. (₱)	Amount F.C. (₱'000)	Amount L.C. (₱'000)
8-1.	Foreign Exchange Cost						
	Final Design						
	Consultant's remuneration	43	mon-month	52,500		2,258	
	International travel expense	10	trip	5,700		57	
	Miscellaneous & communication	L.S.				23	
	Sub-total					2,338	
	Construction Supervision						
	Consultant's remuneration	96	mon-month	52,500		5,040	
	International travel expense	12	trip	5,700		68	
	Miscellaneous & communication	L.S.				153	
	Sub-total					5,261	
8-2.	Local Currency Cost						
	Final Design						
	Local transportation	30	trip	550			17
	Consultants per diem	1,290	day	220			284
	Sub-total						301
	Construction Supervision						
	Local transportation	60	trip	550			28
	Consultants per diem	2,880	day	220			634
	Housing and furniture	L.S.					381
	Sub-total						1,043
	Total					7,599	1,344
						(US$1,013.2x10^3)	(US$179.2x10^3)

Table 4E-2 Labor and Material Cost

1. Labor Cost

Laborer	Unit	Cost (₱)
	day	15.62
Worker	"	23.89
Forman (common)	"	23.89
Forman (construction)	"	24.87
Chief worker	"	21.28
Operator of vehicle	"	20.07
Assistant of vehicle	"	15.62
Operator of heavy equipment	"	23.89
Assistant of heavy equipment	"	21.28
Mason	"	21.28
Carpenter	"	21.28
Smith	"	21.28
Painter	"	21.28
Welder	"	23.89
Asphalt worker	"	15.62
Watcher	"	20.07
Head carpenter	"	23.89
Head smith	"	23.89
Head welder	"	24.87

2. Material Cost

Description	Unit	Cost (₱) F.C.	L.C.	Total	Remarks
Portland Cement	ton	93	409	502	dam site cost
Sand	m^3	55	13	68	"
Gravel	"	40	20	60	"
Deformed bar	ton	2,000	2,037	4,037	"
Dinamite	kg	-	10	10	"
ANFO	"	4	-	4	"
Gasoline	kℓ	850	900	1,750	"
Diesel fuel	"	620	680	1,300	"

Source: Project Development Department, NIA

Table 4E-3 Unit Cost for On-farm Development Cost

Item	Description	Quantity	Unit	Rate (₱)	Total Cost (₱)	Foreign Currency			Local Currency		
						Depreciation (₱)	Material (₱)	Total (₱)	Fuel Repair & Material (₱)	Labor (₱)	Total (₱)
(1)	Earth Works										
	Excavation	3,157	cu.m	7.2	22,730	12,047	2,046	14,093	4,773	3,884	8,637
	Embankment (Compacted	3,590	"	7.5	26,925	13,732	808	14,540	808	11,577	12,385
	Embankment (Normal)	5,860	"	4.4	25,784	6,188	1,289	7,477	1,031	17,276	18,307
	Back fill (Compacted)	22	"	7.5	165	84	5	89	5	71	76
	Back fill (Normal)	2	"	4.4	8	2		2		6	6
	Sub-total				75,612	32,053	4,148	36,201	6,617	32,794	39,411
(2)	Concrete Works										
	Class "A" concrete	25	cu.m	1,155	28,875	2,887	7,508	10,395	13,571	4,904	18,480
	Grouted Riprap	70	"	253	17,710	6,553	1,417	7,970	3,542	6,198	9,740
	Sub-total				46,585	9,440	8,925	18,365	17,113	11,107	28,220
(3)	Materials										
	RC Pipe ø 12" ℓ=1.0^{m}	188	pc	138	25,944	4,670	4,410	9,080	10,896	5,968	16,864
	Slide Steel gate	18	"	3,500	63,000		31,500	31,500	25,200	6,300	31,500
	Sub-total				88,944	4,670	35,910	40,580	36,096	12,268	48,364
	Land leveling 2/	158,600	cu.m	1.9	301,340	165,737	33,147	198,884	36,162	66,294	102,456
	Sub-total				301,340	165,737	33,147	198,884	36,162	66,294	102,456
	Total				512,481	211,900	82,130	294,030	95,988	122,463	218,451
	for paddy field (Rainfed)				211,141	46,200	48,983	95,146	59,826	56,169	115,995
	(per ha 1/)				(910)	(199)	(211)	(410)	(258)	(242)	(500)
	for grass land etc.				512,481	211,900	82,130	294,030	95,988	122,463	218,451
	(per ha 1/)				(2,209)	(913)	(354)	(1,267)	(414)	(528)	(942)

Note: 1/ The total irrigable area of sample area is 232 ha which consists of sample area "A" (134 ha) and sample area "B" (98 ha)

2/ for area to be reclaimed, such as grass land, upland field etc.

Table 4E-4 Investment Cost of the Project (including Depreciation Cost)

Description	Total		Foreign Currency		Local Currency	
	(₱ '000)	(US$ '000)	(₱ '000)	(US$ '000)	(₱ '000)	(US$ '000)
1. Civil Works						
1-1. Preparation	743	(99)	324	(43)	419	(56)
1-2. Dam	48,382	(6,451)	28,579	(3,811)	19,803	(2,640)
1-3. Diversion Dam	22,757	(3,034)	13,870	(1,849)	8,887	(1,185)
1-4. Irrigation and Drainage Canals	27,870	(3,707)	11,561	(1,542)	16,239	(2,165)
1-5. On-farm	9,469	(1,263)	5,317	(709)	4,152	(554)
1-6. Roads	8,281	(1,104)	5,537	(738)	2,744	(366)
1-7. Hydro-power	14,425	(1,924)	11,966	(1,596)	2,459	(328)
1-8. Pre-Engineering	1,265	(169)	-	-	1,265	(169)
Sub-total	133,122	(17,751)	77,154	(10,288)	55,968	(7,463)
2. Land Acquisition and Compensation	6,475	(873)	-	-	6,475	(863)
3. Construction Equipment	-	-	-	-	-	-
4. Agricultural Development	1,159	(203)	-	-	1,519	(203)
5. Operation and Maintenance Cost	3,198	(426)	-	-	3,198	(426)
6. Project Facility	5,738	(765)	993	(132)	4,745	(633)
7. Project Administration (8%)	12,004	(1,600)	6,252	(834)	5,752	(766)
8. Consulting Services	8,943	(1,192)	7,599	(1,013)	1,344	(179)
Sub-total (1 to 8)	170,999	(22,800)	91,998	(12,267)	79,001	(10,533)
9. Contingency (15%)	25,650	(3,420)	13,800	(1,840)	11,850	(1,580)
Grand Total (1 to 9)	196,649	(26,220)	105,798	(14,107)	90,851	(12,113)
W/ Hdro-power	196,649	(26,220)	105,798	(14,107)	90,851	(12,113)
(- do - per ha)	(₱36,964)	(US$4,929)	(₱19,887)	(US$2,652)	(₱17,077)	(US$2,277)
W/O Hdro-power	178,733	(23,831)	90,935	(12,124)	87,798	(11,707)
(- do - per ha)	(₱33,596)	(US$4,480)	(₱17,093)	(US$2,279)	(₱16,503)	(US$2,201)

Note: This table includes the depreciation cost of construction equipments and excludes the construction equipment cost and price escation.

Table 4E-5 Disbursement Schedule

Description	Total			1st Year (Jan. '79 - Dec. '79)			2nd Year (Jan. '80 - Dec, '80)			3rd Year (Jan. '81 - Dec. '81)			4th Year (Jan. '82- - Dec. '82)		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Civil Works	48,770	55,960	104,730	-	1,010	1,010	-	250	250	10,140	5,570	15,710	5,690	12,830	18,520
1-1. Preparation	180	420	600							80	140	220	70	200	270
1-2. Dam	19,270	19,800	39,070										2,480	3,980	6,460
1-3. Diversion Dam	11,810	8,890	20,700							10,060	5,430	15,490	1,440	2,600	4,040
1-4. Irrigation and Drainage Canals	4,260	16,240	20,500										1,110	4,220	5,330
1-5. On-farm	1,580	4,150	5,730										430	1,120	1,550
1-6. Roads	630	2,740	3,370										160	710	870
1-7. Hydro-power	11,040	2,460	13,500												
1-8. Pre-Engineering	-	1,260	1,260	-	1,010	1,010	-	250	250	-	-	-	-	-	-
2. Land Acquisition and Compensation	-	6,470	6,470	-	-	-	-	-	-		3,640	3,640	-	990	990
3. Construction Equipment	51,250	510	51,760							51,250	510	51,760	-	-	-
4. Agricultural Development	-	1,520	1,520	-	-	-	-	260	260	-	260	260	-	260	260
5. Operation and Maintenance Cost	-	3,200	3,200	-	-	-	-	-	-	-	-	-	-	-	-
6. Project Facility	990	4,750	5,740	990	2,370	3,360	-	2,380	2,380	-	-	-	-	-	-
7. Project Administration (8%)	8,080	5,790	13,870	80	270	350	-	230	230	4,920	790	5,710	450	1,130	1,580
8. Consulting Services	7,600	1,340	8,940	760	30	890	1,750	310	2,060	840	160	1,000	1,440	250	1,690
Sub-total (1 to 8)	116,690	79,560	196,250	1,830	3,780	5,610	1,750	3,430	5,180	67,150	10,930	78,080	7,580	15,460	23,040
9. Contingency (15%)	17,510	11,930	29,440	270	570	840	260	520	780	10,070	1,640	11,710	1,140	2,320	3,460
Sub-total (1 to 9)	134,200	91,490	225,690	2,100	4,350	6,450	2,010	3,950	5,960	77,200	12,570	89,790	8,720	17,780	26,500
10. Price Escalation	55,070	46,590	101,660	260	540	800	430	840	1,270	23,940	3,900	27,840	3,620	7,380	11,000
Grand Total (1 to 10)	189,270	138,080	327,350	2,360	4,890	7,250	2,440	4,790	7,230	101,160	16,470	117,630	12,340	25,160	37,500

(Unit: ₱ '000)

4th Year (Jan. '82 - Dec. '82)			5th Year (Jan. '83 - Dec. '83)			6th Year (Jan. '84 - Dec. '84)			7th Year (Jan. '85 - Dec. '85)		
F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
5,690	12,830	18,520	16,310	11,060	27,370	11,850	15,780	27,630	4,780	9,460	14,240
70	200	270	-	-	-	30	80	110	-	-	-
2,480	3,980	6,460	4,260	3,870	8,130	9,380	7,480	16,860	3,150	4,470	7,620
1,440	2,600	4,040	-	-	-	310	860	1,170	-	-	-
1,110	4,220	5,330	1,110	4,220	5,330	1,280	4,870	6,150	760	2,930	3,690
430	1,120	1,550	440	1,160	1,600	430	1,120	1,550	280	750	1,030
160	710	870	160	710	870	190	820	1,010	120	500	620
			10,340	1,100	11,400	230	550	780	470	810	1,280
-	-	-	-	-	-	-	-	-	-	-	-
-	990	990	-	1,140	1,140	-	700	700	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	260	260	-	260	260	-	260	260	-	220	220
-	-	-	-	1,280	1,280	-	1,280	1,280	-	640	640
-	-	-	-	-	-	-	-	-	-	-	-
450	1,130	1,580	1,300	1,100	2,400	950	1,440	2,390	380	830	1,210
1,440	250	1,690	1,440	250	1,690	1,290	230	1,520	80	10	90
7,580	15,460	23,040	19,050	15,090	34,140	14,090	19,710	33,800	5,240	11,160	16,400
1,140	2,320	3,460	2,870	2,250	5,120	2,110	2,960	5,070	790	1,670	2,460
8,720	17,780	26,500	21,920	17,340	39,260	16,200	22,670	38,870	6,030	12,830	18,860
3,620	7,380	11,000	11,570	9,160	20,730	10,530	14,740	25,270	4,720	10,030	14,750
12,340	25,160	37,500	33,490	26,500	59,990	26,730	37,410	64,140	10,750	22,860	33,610

Compensation

Basic plan for compensation for the farmers to be submerged.

1. Scope of farmers to be compensationed:

Such farmers living in the reservoir area of Pamacsalan Dam are about 45 households, most of which have their houses above full water surface without direct sinking of them. But they will be enforced to immigrate to other land due to the sinking of their farms which are the base of their production.

Such farmers in the reservoir area of Malino diversion dam are about 20 household, whose houses don't sink and the condition is quite similar with above.

2. Cases of immigration of farmers:

CASE 1. Imigration of them to farms to be newly reclaimed in the Project area.

CASE 2. Participation of them to the resettlement project schemed by Department of Agrarian Reform

CASE 3. Immigration of them to city quitting own farm

In CASE 1, some reconciliation by the related administration office is necessary to obtain landowner's approval. Whether they will be a land owner farmer or a tenant farmer will be decided upon their mutual will.

In CASE 2, the procurement cost of land will be chiepper than that in CASE 1. A Farming size of 5 ha/household is considered to be favorable for immigrated farmer. For provision of needed fund the help by the Government will be easier to receive for them.

In CASE 3, Be careful that great pit halls will be waiting for

ones without firm mind and well preparation for new life and there have been many sad examples in the past.

At present, an immigration plan by the Department of Agrarian Reform is under processing as one of Bohol integrated development plan. If the sinking farmers are agree to join it, it will be a good chance for them.

3. Displacement cost items

The cost items to be considered when the Government positively want to immigrate them into a planned immigration land as in CASE 2 are as follow:

1) Land consolidation cost at immigrated land
   a) Leveling field and road construction
   b) House building
   c) Drinking water facility
2) Reclamation of paddy and irrigation facility
3) Transplace cost (the total expence to be needed from present site to immigration site including living expence compensation unit the completion of one's immigration.)

By our investigation these cost could not be learned so that in this study the compensation shall be estimated in accordance with following system, when the farmers is taken to select CASE 1 or CASE 2.

4. Compensation cost items:

1) The compensation for procurement of farm land
2) The compensation for procurement of house
3) The compensation during quitting period of farm

Decrease of income and fixed expense (taxes, depreciation).

5. Schedule:

Pamacsalam dam will be closed by Jun. of 1985 and the water from the dam will be available from the dry season in 1985. Then the Palay will be cropped by the wet season in 1984.

If the Case I is chosen, the compensation for harvesting in the dry season in 1984 will be needed. Malinao diversion dam will be completed by December 1982 so that the farming at the paddy field to be sinked is expected by the wet season in 1982.

The sinking farmers chosen the CASE 1 will obtain their replace land during the period from 1983 to 1984. Therefore at least one year's compensation will be needed.

6. Resettlement Project by Department Agrarian Reform:

By the information at the Tagbilaran office of that Department, they say that they have an immigration plan at Bohol Province as follow:

The illegal settlers of 2,191 household in the government owned land of about 20,000 ha are scattering over the area of following Municipalities; Jetafe, Talibon, Trinidad, Buenavista, Dagohoy, Danao and San Migel etc. They are planning to make them a full owner farmer alloting a hand of 5 ha/household to them.

The person who are the object of this project are one's without farming lnad and with sincerity in personnal.

The groups of person who are chosen consist of 3 kinds as follows;

1) Inhabitants within the noticed area (above mentioned 2,191 households)

2) Inhabitants in such towns concerned this resettlement project.

3) Inhabitant who will be influenced by the irrigation project of NIA or other development project

Table 4E-6 Properties to be Compensated

		Reservoir of Pamacsalan Dam (ha)	Reservoir of Malinao Diversion Dam (ha)
1. Land			
Paddy:	Irrigated	44.50	19.09
	Rainfed	6.35	-
	Sub-total	50.85	19.09
Coconuts field		57.15	-
Grasslands and forest		97.88	73.28
Grand total		205.88	92.37
2. House building		45 house	20 house
3. Farm income during quitting period of farm		one season of palay	two season of palay

Note: 1. Area of lands were surveyed by NIA, LRED. A great parts of grass lands in Pamacsalan Dam are upland fields according to the information from the barrio captain. Then a price of grass lands was used as cassava lands.

2. Livestocks were not estimated as compensation cost because of the re-using on the new field.

FIGURE 4E-1 **LAND USE MAP OF PAMACSALAN RESERVOIR AREA**

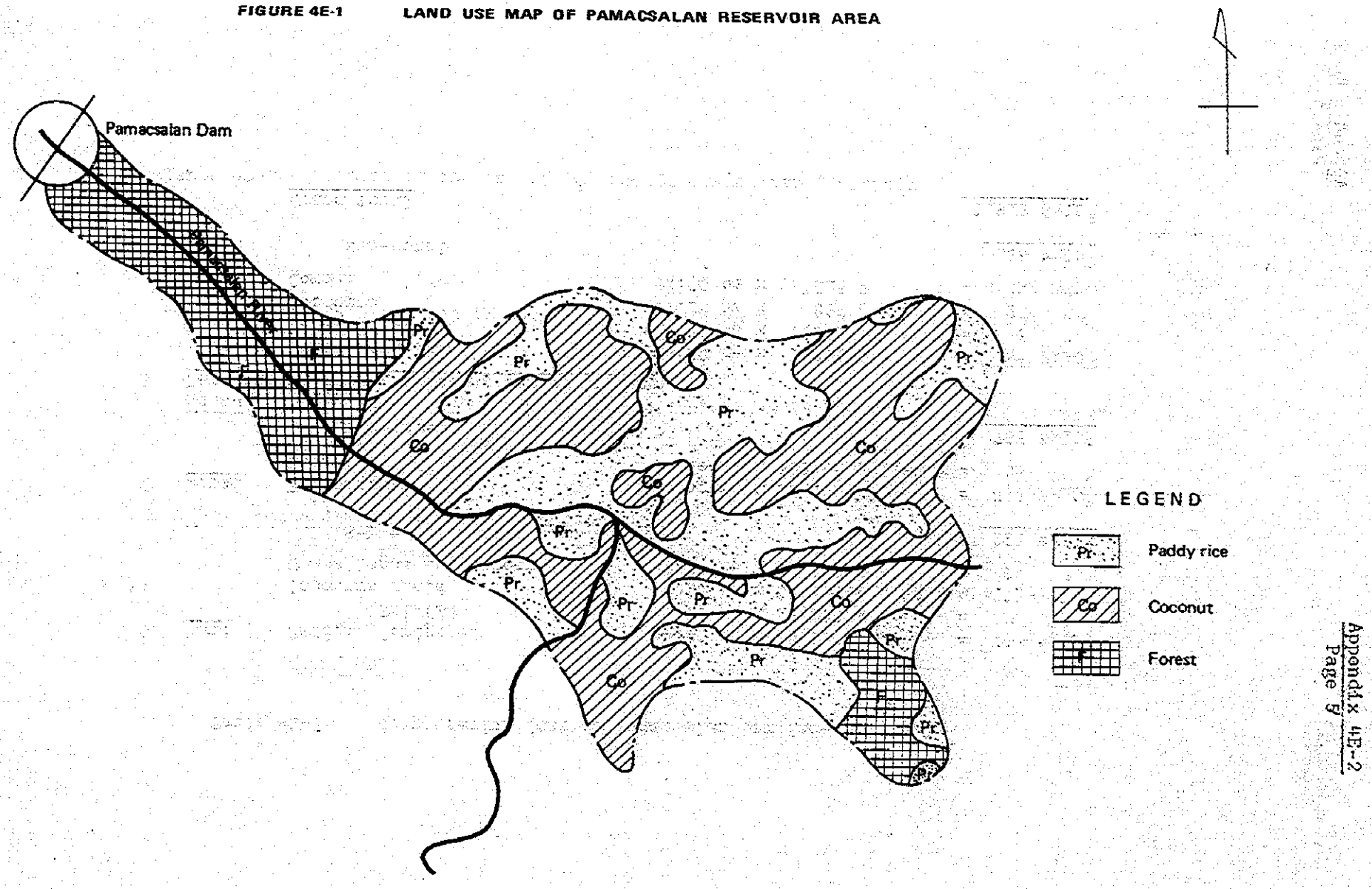


Table 4E-7 Compensation Cost of Pamacsalan Dam Reservoir

1. Land	Paddy: Irrigated	44.50 ha x 16,500 ₱	=	734	₱x10^3
	Rainfed	6.35 ha x 5,000 ₱	=	32	"
	Coconuts field	57.15 ha x 60 trees x 50 ₱	=	171	"
	Grass lands and forest	97.88 ha x 550 ₱	=	54	"
	Sub-total			991	₱x10^3
2. House	Buildings	45 house x 16,200 ₱	=	729	₱x10^3
	Lots	45 house x 300 m^2 x 2.67 ₱	=	36	"
	Sub-total			765	₱x10^3
3. Farm income during quitting period of farm					
	Palay irrigated	44.50 ha x 1,911 ₱	=	85	Px10^3
	Palay rainfed	6.35 ha x 1,031 ₱	=	6	"
	Coconuts	57.15 ha x 397 ₱	=	23	"
	Corn	80.00 ha x 525 ₱	=	42	"
	Sub-total			156	₱x10^3
	Grand total			1,912	₱x10^3

Table 4E-8 Compensation Cost of Malinao Diversion Dam Reservoir

1. Land	Paddy: Irrigated	19.09 ha x 15,000 ₱	=	286 ₱x10^3
	Grass lands and forest	73.28 ha x 550 ₱	=	40 "
	Sub-total			326 ₱x10^3
2. House	Building	20 house x 16,200 ₱	=	324 ₱x10^3
	Lots	20 house x 300 m^2 x 2.67 ₱	=	16 "
	Sub-total			340 ₱x10^3
3. Farm income during quitting period of farm				
	Palay irrigated	19.09 ha x 2,157 ₱	=	42 ₱x10^3
	Corn	73.28 ha x 0.6 x 1.7 x 525 ₱	=	39 "
	Sub-total			81 ₱x10^3
	Grand Total			747 ₱x10^3

Alternative Cost Estimation

In estimating the project cost, following unit cost divided into two proportions of foreign and local procurements have been used;

Item	Foreign Procurement (%)	Local Procurement (%)
Cement (Portland)	20	80
Cement (P.S. Slag)	80	20
Fuel Oil	50	50
Deformed bar	50	50
Explosive (Dynamite)	-	100
Explosive (A.N.F.O)	100	-
Fuse, & Cap	100	-
Bit & Rod	100	-

However, as the afternatives, following three cases of unit costs are used for estimation of the project cast, and their results are summarized in Table 4E-9 to Table 4E-11.

Item	Foreign Procurement (%)	Local Procurement (%)
a) Case 1		
Cement	0	100
Oil	100	0
Deformed bar	50	50
b) Case 2		
Cement	0	100
Oil	100	0
Deformed bar	100	0
c) Case 3		
Cement	0	100
Oil	50	50
Deformed bar	50	50

Table 4E-9. Investment Cost of the Project (Financial Cost)
(Case 1)

	Description	Foreign Currency		Local Currency		Total	
		(₱ '000)	($'000)	(₱'000)	($'000)	(₱'000)	($'000)
1.	Civil Works	51,802	(6,907)	52,941	(7,059)	104,743	(13,966)
	1-1. Preparation	183	(24)	419	(56)	602	(80)
	1-2. Dam	20,931	(27,911)	18,136	(2,418)	39,067	(5,209)
	1-3. Diversion Dam	11,821	(1,576)	8,880	(1,184)	20,701	(2,760)
	1-4. Irrigation and Drainage Canals	4,757	(634)	15,744	(2,099)	20,501	(2,733)
	1-5. On-farm	2,348	(313)	3,387	(452)	5,735	(765)
	1-6. Roads	729	(97)	2,644	(353)	3,373	(450)
	1-7. Hydro-power	11,033	(1,471)	2,466	(329)	13,499	(1,800)
	1-8. Pre-Engineering	-	-	1,265	(169)	1,265	(169)
2.	Land Acquisition and Compensation	-	-	6,475	(863)	6,475	(863)
3.	Construction	51,250	(6,833)	512	(68)	51,762	(6,901)
4.	Agricultural Development	-	-	1,519	(203)	1,519	(203)
5.	Operation and Maintenance Cost	-	-	3,198	(426)	3,198	(426)
6.	Project Facility	993	(132)	4,745	(633)	5,738	(765)
7.	Project Administration (8%)	8,323	(1,110)	5,551	(740)	13,874	(1,850)
8.	Consulting Services	7,599	(1,013)	1,344	(179)	8,943	(1,192)
	Sub-total (1 to 8)	119,967	(15,995)	76,285	(10,171)	196,252	(26,166)
9.	Contingency (15%)	17,995	(2,399)	11,443	(1,526)	29,438	(3,925)
	Total	137,962	(18,395)	87,728	(11,696)	225,690	(30,091)

Table 4E-10. Investment Cost of the Project (Financial Cost)

(Case 2)

Description	Foreign Currency		Local Currency		Total	
	(₱'000)	($'000)	(₱'000)	($'000)	(₱'000)	($'000)
1. Civil Works	55,777	(7,437)	48,966	(6,529)	104,743	(13,966)
1-1. Preparation	183	(24)	419	(56)	602	(80)
1-2. Dam	22,327	(2,977)	16,740	(2,232)	39,067	(5,209)
1-3. Diversion Dam	12,606	(1,681)	8,095	(1,079)	20,701	(2,760)
1-4. Irrigation and Drainage Canals	5,856	(781)	14,645	(1,952)	20,501	(2,733)
1-5. On-farm	2,495	(333)	3,240	(432)	5,735	(765)
1-6. Roads	1,215	(162)	2,158	(288)	3,373	(450)
1-7. Hydro-power	11,095	(1,479)	2,404	(321)	13,499	(1,800)
1-8. Pre-Engineering	-	-	1,265	(169)	1,265	(169)
2. Land Acquisition and Compensation	-	-	6,475	(863)	6,475	(863)
3. Construction Equipment	51,250	(6,833)	512	(68)	51,762	(6,901)
4. Agricultural Development	-	-	1,519	(203)	1,519	(203)
5. Operation and Maintenance Cost	-	-	3,198	(426)	3,198	(426)
6. Project Facility	993	(132)	4,745	(633)	5,738	(765)
7. Project Administration (8%)	8,641	(1,152)	5,233	(698)	13,874	(1,850)
8. Consulting Services	7,599	(1,013)	1,344	(179)	8,943	(1,192)
Sub-total (1 to 8)	124,260	(16,567)	71,992	(9,599)	196,252	(26,166)
9. Contingency (15%)	18,639	(2,486)	10,798	(1,439)	29,438	(3,925)
Total	142,900	(19,053)	82,790	(11,038)	225,690	(30,091)

Table 4E-11. Investment Cost of the Project (Financial Cost)
(Case 3)

Description	Foreign Currency (₱'000)	Foreign Currency ($'000)	Local Currency (₱'000)	Local Currency ($'000)	Total (₱'000)	Total ($'000)
1. Civil Works	46,329	(6,177)	58,414	(7,789)	104,743	(13,966)
1-1. Preparation	183	(24)	419	(56)	602	(80)
1-2. Dam	18,305	(2,441)	20,762	(2,768)	39,067	(5,209)
1-3. Diversion Dam	11,059	(1,475)	9,642	(1,285)	20,701	(2,760)
1-4. Irrigation and Drainage Canals	3,678	(490)	16,823	(2,243)	20,501	(2,733)
1-5. On-farm	1,524	(203)	4,211	(562)	5,735	(765)
1-6. Roads	578	(77)	2,795	(373)	3,373	(450)
1-7. Hydro-power	11,002	(1,467)	2,497	(333)	13,499	(1,800)
1-8. Pre-Engineering	-	-	1,265	(169)	1,265	(169)
2. Land Acquisition and Compensation	-	-	6,475	(863)	6,475	(863)
3. Construction Equipment	51,250	(6,833)	512	(68)	51,762	(6,901)
4. Agricultural Development	-	-	1,519	(203)	1,519	(203)
5. Operation and Maintenance Cost	-	-	3,198	(426)	3,198	(426)
6. Project Facility	993	(132)	4,745	(633)	5,738	(765)
7. Project Administration (8%)	7,885	(1,051)	5,989	(799)	13,874	(1,850)
8. Consulting Services	7,599	(1,013)	1,344	(179)	8,943	(1,192)
Sub-total (1 to 8)	114,056	(15,207)	82,196	(10,959)	196,252	(26,166)
9. Contingency (15%)	17,109	(2,281)	12,329	(1,644)	29,438	(3,925)
Total	131,165	(17,488)	94,525	(12,603)	225,690	(30,091)

CHAPTER V. PROJECT IMPLEMENTATION AND OPERATION

Construction Planning of Major Civil Works

A. Pamacsalan Dam

(1) Workable Days for Construction Works

It is known that construction of fill-type dam is quite affected by the meteorological and seasonal conditions especially by rainfall. Actual workable days for the embankment works vary with kind of the embankment materials surface impervious, semi pervious materials and rock. In constructing of center core fill-type dam, it is usually required to embank various kind of the materials at the same elevation. Delay of impervious zone embankments which would be affected by weather might cause to delay the works for other zones of the dam embankments. Consequently planning of construction works should be made taking into consideration the workable days which would be affected by the seasonal conditions.

Workable days for the construction works were enumerated based upon the rainfall data for the period of 10 years from 1967 to 1976 (see Table 5A - 1). From this table, the workable days for impervious zone embankments of the Pamacsalan dam is estimated at 176 days per annum. And even in the wet season, 11 to 16 days of workable days exist. Therefore, monthly workable days could be considered; 15 days for impervious zone embankment and 25 days for other zones of embankments, concrete placing and earth works on average.

The daily working hours are decided at eight hours for normal works and seven hours for equipment operation considering the adjustment of equipments before operation.

(2) Construction Schedule

Judging from the above mentioned workable days, the construction works would be executed with heavy construction equipments. The construction schedule is planned after due consideration of various conditions such as proposed construction method, expected production rates

Table 5A-1 Workable Days for Construction Works

Description	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Total	Monthly Average Workable days
Impervious material	12	14	18	22	21	11	13	16	11	12	12	14	176	15
Pervious material Concrete works Earth works	25	25	25	25	25	25	25	25	25	25	25	25	300	25

Note: Workable days was computed by using the daily rainfall data observed at Dagohoy raingauge station for 10 years (1967 - 1976), and the criteria for estimation of workable days are as follows:

Impervious material embankment:

Less than 1.0 mm	Workable
1.1 to 10.0 mm	Non-workable on that day
10.1 to 30.0 mm	Non-workable two days
30.1 to 50.0 mm	Non-workable for three days
More than 50.1 mm	Non-workable for four days

of equipments and plants, and Figure 5A - 1 indicates the proposed construction schedule for Pamacsalan dam.

(3) Construction Equipment

Necessary construction equipments for the construction of Pamacsalan dam are estimated based upon the expected workable days and construction schedule. The proposed equipments and vehicles will be loaded in Tagbilaran, and then delivered to the construction site by trailers or trucks. To transport these equipments and vehicles to the site, improvement of the existing roads and bridges together with access roads should be completed prior to the commencement of construction works.

(4) Interest and Repair Cost of Construction Equipment

The interest and repair costs of construction equipments are estimated by the following method;

a) Interest

$$I = C \times P \times (A + B + E + F)$$

where; I: interest
C: Purchase price of equipment
P: Percentage of original cost

Useful Life (Year)	Percentage of Purchase Price
2	75.00
3	66.67
4	62.50
5	60.00
6	58.33
7	57.14
8	56.25
9	55.55
10	55.00

A: Percentage of interest 7%
B: Percentage of insurance 1%
E: Percentage of tax 0
F: Percentage of storage 2%

FIGURE 5A-1 CONSTRUCTION SCHEDULE FOR PAMACSALAN DAM

Discription	Q'ty
1. Construction Works for Whole Project	
2. Diversion Tunnel	**(L=385 m)**
Excavation	10,860 m^3
Concrete	2,760 "
3. Foundation Works	
Stripping	31,500 m^3
Core trench	36,100 "
Grouting	53,100 "
4. Dam Body	
Core	91,000 m^3
Filter	34,000 "
Rock	449,000 "
Coffer dam	15,000 "
5. Spill Way	
Common excavation	43,500 m^3
Rock excavation	316,900 "
Concrete	14,700 "
Gate	3 sets
6. Intake Facility	
Concrete	1,770 m^3
Cone Valve	1 set
Butterfly Valve	1 set
7. Left Abutment	
Stripping	10,500 m^3
Rock excavation	60,900 "
8. Road	
Relocation road	1,000 m
Access road	1,500 "

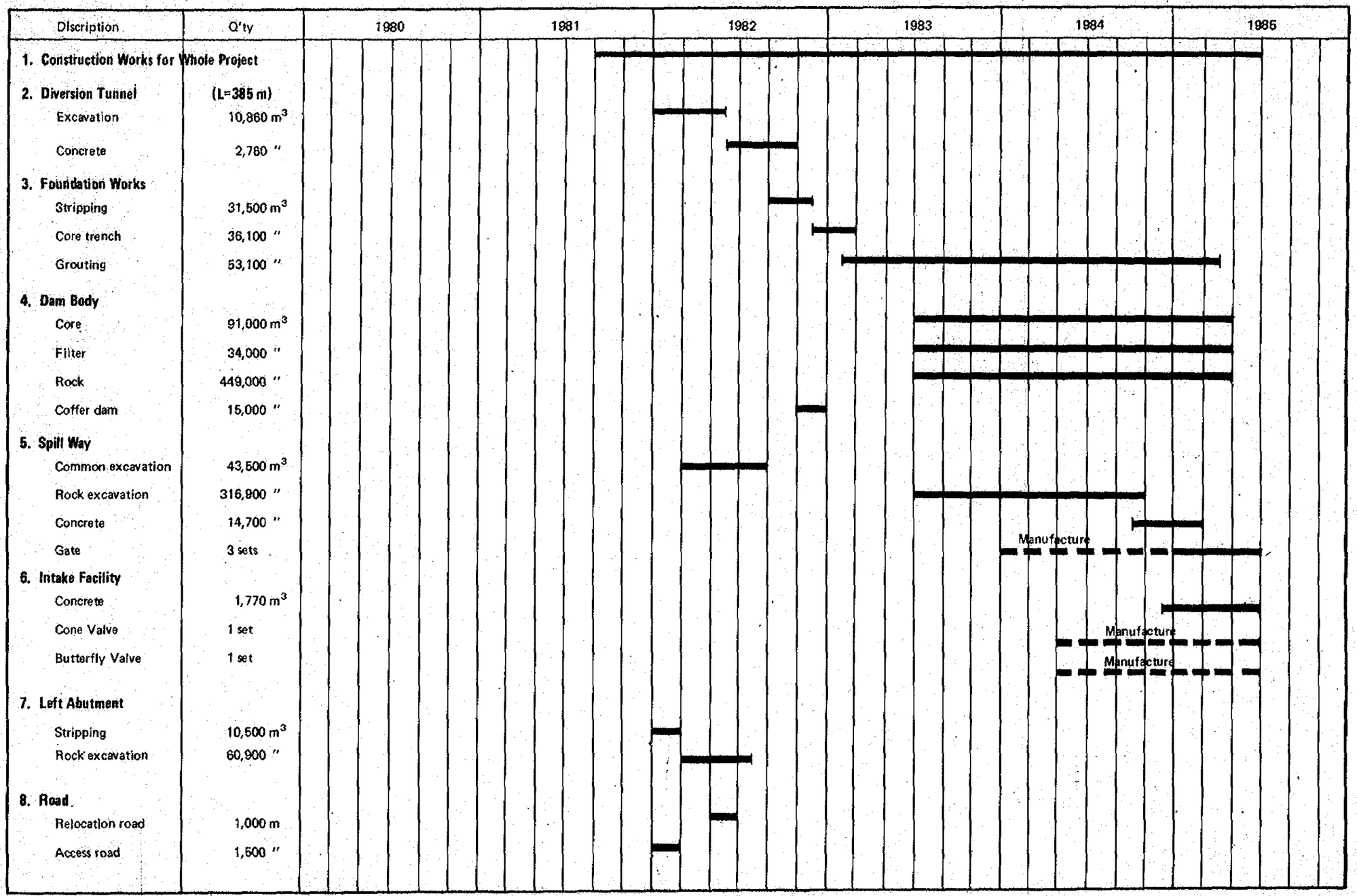


Table 5A-2 List of Required Construction Equipment

Equipment	Specification	Numbers
Bulldozer	22 ton	2
Bulldozer	16 ton	1
Bulldozer	11 ton	6
Front-end-Loader	2.2 m^3	2
Front-end-Loader	1.8 m^3	1
Front-end-Loader	1.4 m^3	3
Dump truck	11 ton	11
Dump truck	8 ton	6
Dump truck	6 ton	11
Air Compressor	110 PS	4
Diesel generator	100 KVA	4
Diesel generator	30 KVA	1
Crushing & Screening Plant	40 t/hr	1
Mixing plant	30 m^3/hr	1
Truck mixer	3.0 m^3	3
Concrete pump car	40 m^3/hr	1
Vibrator	Engine type 5PS	5
Rocker shovel	0.4 m^3	1
Blower	400 m/m 15KWx2	1
Leg drill	air-2.7 m^3/min	10
Crawler drill	air 10 m /min	1
Tamping roller	10 ton	1
Vibrating roller	2.5 ton	1
Vibrating (pulling)	10 ton	1
Boring machine		10
Grout-pump	w/mixer	5
Motergrader	4.0 m	1
Tractor trailer	25 ton	1
Pump	100 m/m 11 KW	1
Pump	125 m/m 15 KW	1

Table 5A-3 Quantity of Construction Works

Description	Quantity
1. Dam	
1-1. Diversion Tunnel	
Common excavation	9,500 m^3
Open concrete	930 "
Tunnel excavation	10,860 "
Tunnel concrete	2,760 "
1-2. Foundation	
Stripping	31,500 m^3
Coretrench	36,100 "
Grouting	53,100 m
1-3. Dam body	
Impervious material	91,000 m^3
Filter	34,000 "
Pervious material	449,000 "
Cofferdam	15,000 "
1-4. Spill Way	
Common excavation	43,500 m^3
Rock excavation	316,900 "
Concrete	14,700 "
Gate	3 sets
1-5. Intake Facilities	
Concrete works	1,770 m^3
Penstock	1 set
Core Valve	1 "
Butterfly Valve	1 "
1-6. Left Excavation (above EL 255.0m)	
Stripping	10,500 m^3
Rock excavation	60,900 "
1-7. Roads	
Access road	1,500 m
Relocation road	1,000 "

b) Minor repair cost

$$M = C \times H$$

where: M: minor repair cost
C: purchase price of equipment
H: percentage of depreciation 30%

Depreciation (D)

$$D = (C - S)/Y$$

D: depreciation cost
C: perchase price of equipment
S: salvage value of the unit price 10%
Y: average life of equipment (year or hour)

B. Malinao Diversion Dam

(1) Construction Shcedule

The construction schedule of the Malinao diversion dam is decided considering the protection from flood and construction cost of coffer-dam for alternation of the water course. The concrete works of dam body will be carried out for four months from February to May in extending two years, and the excavation and grouting of base for dam body which should be finished before the concrete works will be constructed untill the end of January in each year.

Construction of Malinao diversion dam will be started from October in FY 1980, and completed at the end of FY 1982, as shown in Figure 5A-2.

(2) Construction Equipment

Necessary construction equipments for the construction of Malinao diversion dam are estimated based upon the construction schedule and work volumes. (See Table 5A - 4) Most of the equipment and vehicles will be loaded in Tagbilaran, and then delivered to the construction site.

FIGURE 5A-2 CONSTRUCTION SCHEDULE OF MALINAO DIVERSION DAM

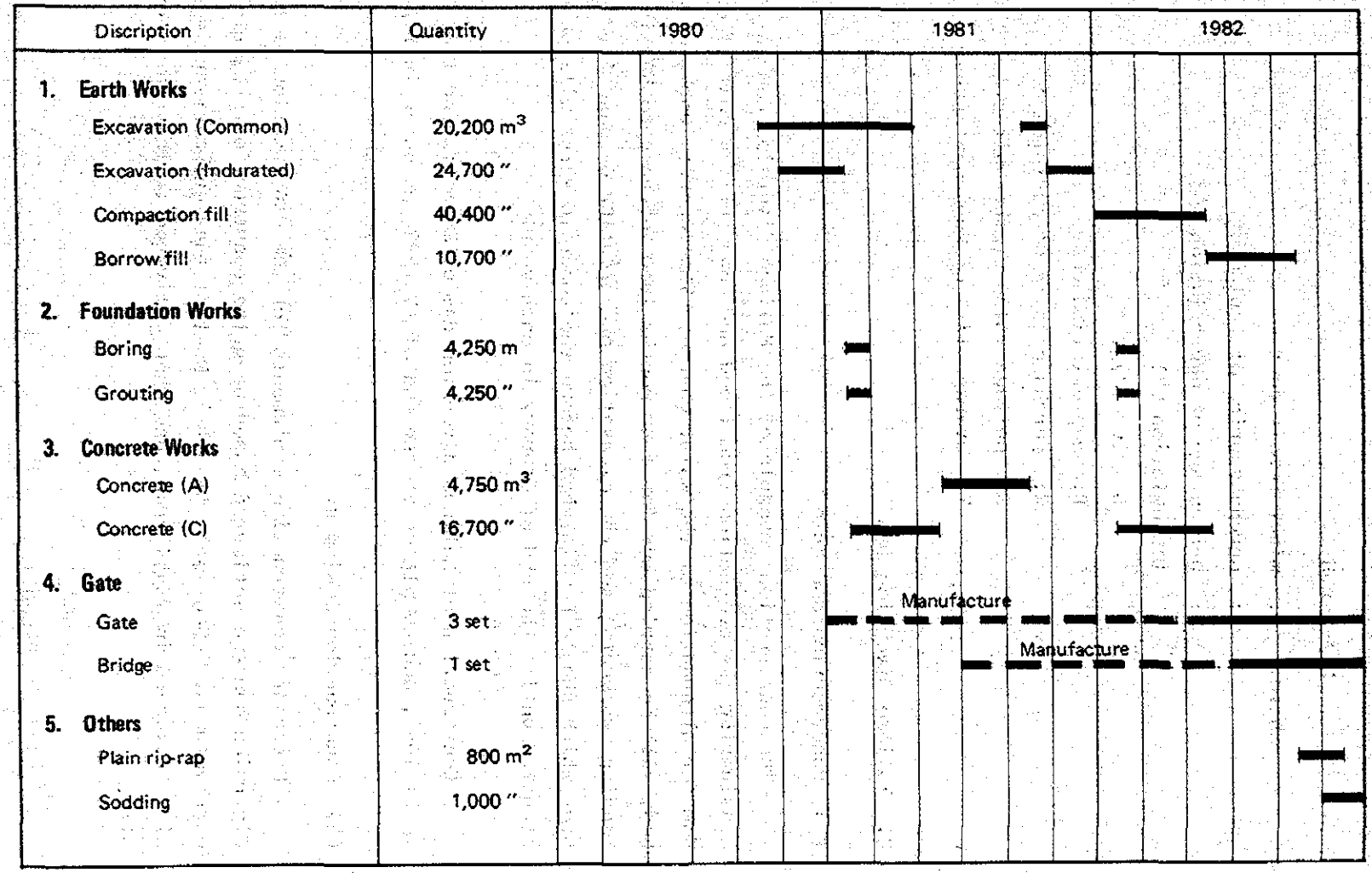


Table 5A-4. List of Required Construction Equipment

Equipment	Specification	Quantity
Bulldozer	11 ton	3
Bulldozer	16 ton	1
Crawler-tractor-mounted shovel	1.4 m^3	3
Dump truck	6 ton	11
Air compressor	110 PS	2
Diesel generator	100 KVA	4
"	30 KVA	1
Crushing & Screening plant	30 t/h	1
Concrete Mixing Plant	30 m^3/h	1
Truck mixer	3.0 m^3	3
Vibrator	Engine type 5PS	4
Leg drill	air 2.7 m^3/min	6
Vibrating roller	10 ton	1
Tracter(to two the vibrating roller)	11 ton	1
Boring machine		2
Grout pump w/mixer		1

Table 5A-5. Quantity at Construction Works

Description	Quantity
1. Earth works	
Excavation (common)	20,200 m^3
Excavation (indurated)	24,700 "
Compaction-fill	40,400 "
Borrow-fill	10,700 "
2. Foundation & Concrete	
Boring	4,250 m
Grouting	4,250 "
Concrete A (3,000 psi)	4,750 "
Concrete B (Mass. Con.)	16,700 "
Deformed bar	381 ton
Plain riprap	800 m^3
Sodding	1,000 m^2
3. Gate	
Sluice gate (2 x 13.00 x 7.00)	135 ton
" (1 x 13.00 x 10.00)	96 "
Bridge (steel gater)	30 "
Head gate (3 x 1.50 x 1.50)	5 "

C. Irrigation and Drainage Canal

(1) Construction Schedule

The construction of irrigation and drainage canal will be started from FY1982 on the same schedule of on-farm development, and will be completed in FY1985. Yearly construction of irrigation or drainage canals including those of the upper area are as shown below;

Construction Schedule of Irrigation and Drainage Canal

Year	Irrigation Canal			Drainage Canal	
	Main (m)	Lateral (m)	Sub-lateral (m)	Main (m)	Lateral (m)
1982	5,300	14,230	15,720	12,800	6,000
1983	7,300	13,780	4,260	-	23,000
1984	3,700	11,720 (13,880)	8,360	5,000	18,400
1985	11,060	6,460 (4,050)	11,520	-	22,000
Total	27,360	64,120	39,860	17,800	69,400

(2) Construction Equipment

Necessary construction equipments for the construction of irrigation and drainage canals are estimated as follows, based on the construction schedule and work volumes.

Table 5A-6. List of Required Construction Equipment for Irrigation and Drainage Canals

Equipment	Specification	Quantity
Bulldozer	11 ton	2
Bulldozer	2 ton	4
Dump truck	6 ton	5
"	8 ton	6
Back hoe	0.6 m^3	4
Tire roller	8.5 ∿ 20 ton	4
Front-end-lorder		2
Concrete pot mixer	0.3 m^3	10
Portable belt conveyer	L = 7 m	6
Lammer	90 kg	10

Table 5A-7. List of Required Construction Equipment for Road Construction

Equipment	Specification	Quantity
Bulldozer	22 ton	3
Dump truck	11 ton	10
Front-end-loader	0.6 m^3	1
Motor grader	4 m	2
Tire roller	8.5 ∿ 20 ton	

D. On-farm Development

(1) Construction Schedule

Lower Area

On-farm development of the lower area will be started from FY 1982 which corresponds to just one year late from the commencement of the diversion dam, and will be completed in FY 1985. Yearly on-farm development areas to be reclaimed is decided as shown below through the study on expectable irrigation water after completion of the diversion dam.

On-farm Development Area in Lower Area

Year	Area to be reclaimed (ha)	Cropping Area (ha)	
		Wet Season	Dry Season
1982	1,365		1,365
1983	1,392	1,365	2,757
1984	1,198	2,757	2,757
1985	845	2,757	4,800
Total	4,800		

As is seen in the above table, the area of about 2,760 ha will be planted by the 2nd paddy crop (dry season paddy) from October in 1983, but the cropping area which could be irrigated by the constructed diversion dam will not be increased up to the 1st paddy crop (wet season paddy) due to lack of irrigation water, although the reclamation area will be increased year by year. However, after implementation of Pamacsalan dam in June 1985, the reclaimed area of 4,800 ha will be fully used for the 2nd paddy crop.

Yearly extent of reclamation area from 1982 to 1985 is shown in Figure 5A-3 and Table 5A-8.

Upper Area

Since the upper area is situated at an independent areas without relation to the proposed Malinao diversion dam, the construction of

farm land development of the area, which consists of almost rehabilitation of existing irrigation and drainage systems, is scheduled to be carried out in 1984 for the Wahig upper area and in 1985 for the Pamacsalan upper area.

(2) Construction Equipment

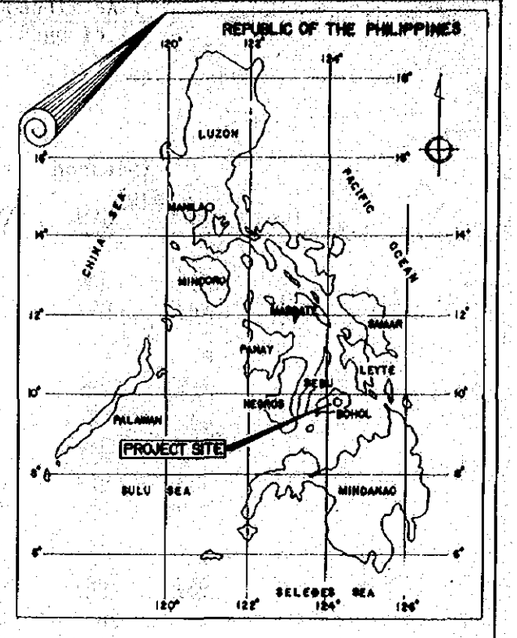
Necessary construction equipments for the construction of the farm land development are estimated as follows, based upon the construction schedule and work volumes.

List of Construction Equipment

Equipment	Specification	Quantity
Bulldozer	22 ton	9
Dump truck	6 ton	1
Back hoe	0.6 m^3	1

FIGURE 5A-3

ON-FARM DEVELOPMENT SCHEDULE



LEGEND

- Proposed Main Canal
- Proposed Lateral & Sub-lateral Canal
- Improvement of Main Drainage Canal
- Improvement of Lateral Drainage Canal
- Proposed Lateral Drainage Canal
- Proposed Service Road
- Improvement of Provincial or Barrio Road
- Proposed Dam
- Proposed Diversion Dam
- Proposed Power Plant

- 1982
- 1983
- 1984
- 1985

Table 5A-8. Yearly Construction Schedule of On-farm Development

(Unit: hectare)

Area	Present Land Category		1982 W/O 1/	1982 W/ 2/	1983 W/O	1983 W/	1984 W/O	1984 W/	1985 W/O	1985 W/	Total W/O	Total W/
Upper Area												
Wahig	Cultivated	Irrigated Paddy					264	256			264	256
		Rainfed Paddy					83	82			83	82
		Upland Field-A 3/					-	-			-	-
		Upland Field-B 4/					3	3			3	3
		Sub-total					350	341			350	341
	Un-cultivated	Grass Land					66	59			66	59
	Sub-total						416	400			416	400
Pamacsalan	Cultivated	Irrigated Paddy							130	111	130	111
		Rainfed Paddy							9	9	9	9
		Upland Field-A							-	-	-	-
		Upland Field-B							-	-	-	-
		Sub-total							139	120	139	120
	Un-cultivated	Grass Land							-	-	-	-
	Sub-total								139	120	139	120
Sub-total	Cultivated	Irrigated Paddy					264	256	130	111	394	367
		Rainfed Paddy					83	82	9	9	92	91
		Upland Field-A					-	-	-	-	-	-
		Upland Field-B					3	3	-	-	3	3
		Sub-total					350	341	139	120	489	461
	Un-cultivated	Grass Land					66	59	-	-	66	59
	Sub-total						416	400	139	120	555	520
Lower Area	Cultivated	Irrigated Paddy	47	46	12	11	7	7	8	8	74	72
		Rainfed Paddy	395	376	164	156	156	148	253	240	968	920
		Upland Field-A	-	-	39	34	84	71	164	139	287	244
		Upland Field-B	51	43	4	4	114	97	51	43	220	187
		Sub-total	493	465	219	205	361	323	476	430	1,549	1,423
	Un-cultivated	Grass Land	1,059	900	1,397	1,187	1,029	875	488	415	3,973	3,377
	Sub-total		1,552	1,365	1,616	1,392	1,390	1,198	964	845	5,522	4,800
Total	Cultivated	Irrigated Paddy	47	46	12	11	271	263	138	119	468	439
		Rainfed Paddy	395	376	164	156	239	230	262	249	1,060	1,011
		Upland Field-A	-	-	39	34	84	71	164	139	287	244
		Upland Field-B	51	43	4	4	117	100	51	43	223	190
		Sub-total	493	465	219	205	711	664	615	550	2,038	1,884
	Un-cultivated	Grass Land	1,059	900	1,397	1,187	1,095	934	488	415	4,039	3,436
	Total		1,552	1,365	1,616	1,392	1,806	1,598	1,103	965	6,077	5,320

Note: 1/: without project
2/: with project
3/: upland rice
4/: corn, cassava etc.

The ratio of project facilities to the area before construction is as follows, but in the upper area 19 ha which is the areas to be submerged by the proposed Malinao diversion dam is included in the project facility area.

Irrigated Paddy	: 0.02	Upland Field-B	: 0.15
Rainfed Paddy	: 0.05	Grass Land	: 0.15
Upland Field-A	: 0.15		

Additional Investigation (Pre-Engineering Works)

I. Survey and Investigation for Civil Works

A. Pamacsalan Dam

Additional topographical, geological and embankment materials investigations for the proposed Pamacsalan dam will be needed at both field and laboratory in order to obtain sufficient data prior to preparation of the more detailed design works.

An outline of the main items of recommendable investigations are shown in the following and locations are drawn in Figure 5B-1.

1. Topographical Survey

- Detailed topographic survey of dam and related structure areas shall be carried out with grid method of twenty meters interval, and main survey points shall be kept with good condition.

- Profile along the dam axis and center line of related structures, and cross sections for dam axis with twenty meters interval shall be made.

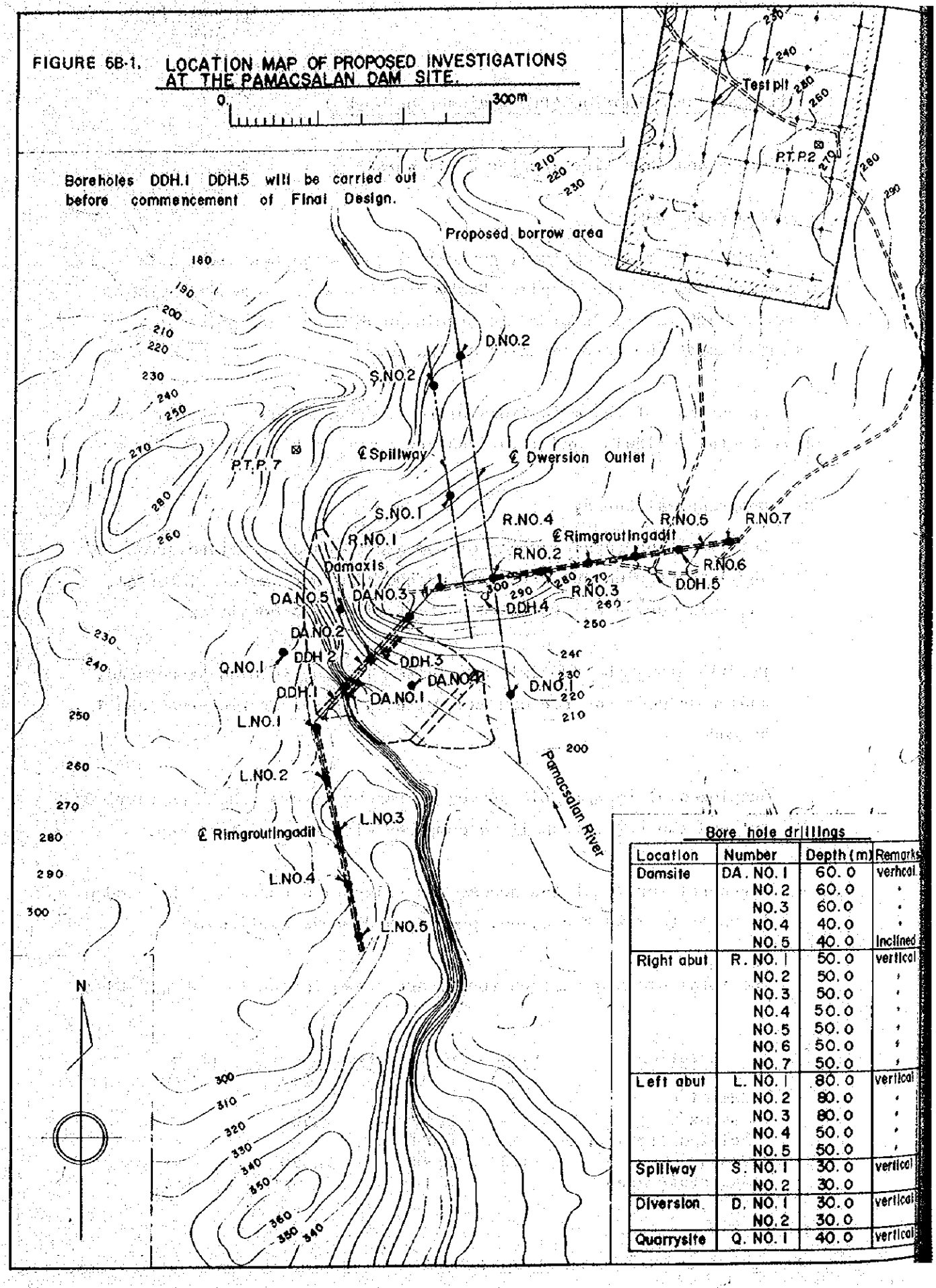
- Supplemental topographic survey of reservoir area shall be carried out and the results shall be compared with the existing map.

- A general survey of the access and relocation roads will be needed in order to make the plane, profile and cross sections.

The total amounts of each survey are shown in the following table;

Location	Plane (ha)	Profile (m)	Cross Section (m)	Check (m)
Dam site	36	-	-	-
Dam axis	-	1,200	2,750	-
Related structures	-	1,050	-	-
Roads	1.3	2,500	2,520	-
Reservoir area	-	-	-	50

FIGURE 5B-1. LOCATION MAP OF PROPOSED INVESTIGATIONS AT THE PAMACSALAN DAM SITE.



Bore hole drillings

Location	Number	Depth (m)	Remarks
Damsite	DA. NO. 1	60. 0	verhcal
	NO. 2	60. 0	"
	NO. 3	60. 0	"
	NO. 4	40. 0	"
	NO. 5	40. 0	Inclined
Right abut	R. NO. 1	50. 0	vertical
	NO. 2	50. 0	"
	NO. 3	50. 0	"
	NO. 4	50. 0	"
	NO. 5	50. 0	"
	NO. 6	50. 0	"
	NO. 7	50. 0	"
Left abut	L. NO. 1	80. 0	vertical
	NO. 2	80. 0	"
	NO. 3	80. 0	"
	NO. 4	50. 0	"
	NO. 5	50. 0	"
Spillway	S. NO. 1	30. 0	vertical
	NO. 2	30. 0	
Diversion	D. NO. 1	30. 0	vertical
	NO. 2	30. 0	
Quarrysite	Q. NO. 1	40. 0	vertical

2. Geological Investigation

(a) Seismic Exploration

Prospecting in bore holes shall be performed along the dam axis and center line of rim grouting in order to grasp the geological structure and location of sink holes and Karstic cavities. Also prospecting on ground surface is recommended along the river course, center line of spillway and diversion tunnel. These investigations will be performed by Consultant's Engineering Geologist and Counterparts with the prepared equipment during design stage and measurement length of the prospecting for each site is recommended as follows;

Prospecting Method	Damsite (km)	Abutments (km)	Spillway (km)	Diversion (km)
On ground	0.2	-	0.6	0.6
In bore holes	-	0.7	-	-

(b) Electric Resistivity Survey

Electrical prospecting with specific resistivity method should be carried out along the dam axis, center line of rim grouting and related structures in order to obtain the underground condition by analysing information of the geoelectrical difference between layers. This survey will be performed by Consultant's Engineering Geologist and Counterparts with the prepared equipment during the design stage and measurement length of the prospecting for each site is recommended as follows:

Damsite (km)	Abutments (km)	Spillway (km)	Diversion (km)
0.2	0.7	0.4	0.4

(c) Bore Hole Drilling

- Five bore holes of two slight angle inclined and three vertical are recommended around dam site with coring and water-pressure test.

- Twelve bore holes with fifty meters interval are recommended along the center line of rim grouting for the prospecting in bore holes. The depth will be desirable down to reach the alternation of sandstone and shale through the limestone formation, however it will not be exceeded about eight meters and total length of drilling can be expected about seven hundreds and fifty meters.

- Four bore holes for the spillway and diversion structures are recommended at the entrance and outlet portions with vertical for a depth of thirty meters in each.

- Since the quarry site for rock material will be selected above dam crest portion at both abutment, the data of core-borings at the dam site and both abutment can be utilized as the quarry site data. Therefore, one bore hole is recommended at the left abutment with vertical down to reach the dam crest for a depth of forty meters.

- Symmetrically distributed six bore holes are recommended near the Manaba river mouth with vertical for a depth of ten meters in each. Total length of bore hole drillings at the each site are shown in following table.

Dam site (nos.-m)	Abutments (nos.-m)	Spillway (nos.-m)	Diversion (nos.-m)	Quarry site (nos.-m)	Aggregate (nos.-m)
5-260	12-750	2-60	2-60	1-40	6-60

3. Material Investigation

(a) Rock Quarry

Some blasting at the out crops will be desired to grasp experiment explosive and characteristic of the quarried rock. Samples of blasted rock and boring core should be sent to the laboratory for the soil tests.

(b) Borrow Area (Impervious Materials)

Exploratory pits with fifty meters interval grid are recommended to obtain the total amount of available materials and to gather all the needed samples for soil tests. The grid will be extended on the hilly slope of the right abutment from the downstream around existing test pit No.2. The digging depth will be necessary to reach the bed rock or coarse material in bottom, it will not be exceeded about five meters. The total number of pits will be established during the investigation, however it can be expected a total of about thirty holes. Samples should be collected from each pit at various depth, especially where some change in textures seems to appear.

(c) Aggregate pit

Two exploratory pits will be digged to gather all the needed samples for concrete aggregate tests near the Manaba river mouth. Also digging of four exploratory pits will be performed along the Pamacsalan river banks at the upstream of damsite to confirm the amount of available deposited gravel and cobble, and to smaple for concrete aggregate tests. The digging depth of all exploratory pits will not be exceeded about three meters.

(d) Insitu Test

Insitu bed-rock tests such as shearing and plate loading test should be carried out in the exploratory adits at the both dam abutment in order to obtain the bearing capacity, shearing resistance, modulus of elasticity and modulus of deformation for the bedrock. Insitu tests will be performed by Consultant's Engineering Geologist and Counterparts with prepared equipment during the design stage. Test embankment with full scale is desirable to obtain the most suitable compaction method and compacted properties of impervious clay, transition materials and shell rock, however these tests may be difficult to carry out during the design stage.

(6) Laboratory Test

Laboratory tests shall be performed on smaples from the different borrow areas. The physical tests are required for promising sampled materials and dynamic tests with large scale testing equipment are also recommended for typical samples. A detail test programs will be established during the progress of investigations, however it can be expected as shown in the following table. Laboratory tests will be performed by Consultant's Soil Mechanical Engineer and Counterparts with prepared equipment during the design stage.

Laboratory Tests for Dam Construction

Items	Impervious Materials (samples)	Transition[2] Materials (samples)	Rock Materials (samples)	Concrete Aggregate (samples)
a) Physical Test				
Specific Gravity	20	9	7	4
Moisture Content	20	9	7	-
Grain Size Analysis	20	9	2[3]	4
Atterberg Limit	20	-	-	-
b) Dynamic Test[1]				
Compaction	10	9	7	-
Triaxial Compression	10	9	7	-
Direct Shear	10	9	7	-
Consolidation	10	-	-	-
Permeability	10	-	-	-
c) Rock Test				
Absorption	-	-	5	4
Los Angeles Abrasion	-	-	5	4
Sulphate Soundness	-	-	5	4
Compressive Strength	-	-	5	-

Note:
[1] tests shall be performed with large scale testing equipment
[2] mixed with fine materials and blasted rock materials in three proportions
[3] blasted rock materials

B. Malinao Diversion Dam

1. Topographical Survey

- Detail topographic survey of the proposed diversion dam shall be carried out with grid method of forty meters interval.

- Profile along river at the proposed site and dam axis and also cross sections for these sites shall be made with 40 meter interval.

The total amounts of each survey are shown in the following table.

Location	Plane (ha)	Profile (m)	Cross Section (m)
Diversion Site	20	-	-
Dam axis and longitudinal section	-	1,600	8,000 (40 sec x 200m)

2. Geological Investigation

- Two bore holes of vertical drilling with 30 meters at the river bed of the proposed diversion site and two drillings at each abutment of it are recommended with coring and water-pressured test.

3. Materials Imvestigation

As same as the laboratory test in case of dam construction, the laboratory tests such as physical test, dynamic test and rock test shall be performed on smaples. A detail total programs will be established during the progress of investigations, however, it can be expected as shown in the following table.

Laboratory Tests for Diversion Dam Construction

Items	Impervious Materials (samples)	Concrete Aggregate (samples)
a) Physical Test		
Specific Gravity	4	2
Moisture Content	4	-
Grain Size Analysis	4	2
Atterberg Limit	4	-
b) Dynamic Test		
Compaction	2	-
Triaxial Compression	2	-
Direct Shear	2	-
Consolidation	2	-
Permeability	2	-
c) Rock Test		
Absorption	-	2
Los Angeles Abrasion	-	2
Sulphate Soundness	-	2
Compressive Strength	-	-

C. Irrigation and Drainage Canals

The profile and cross section surveys for the proposed main, lateral and sub-lateral irrigation and drainage canals shall be performed for the detail design of the canals and related facilities. The following table shows the proposed length of survey.

Item	Profile (km)	Cross Section (km)
Irrigation Canal	131.3	164.2 (3,283 sec x 50 m)
Drainage Canal	97.8	122.2 (2,445 sec x 50 m)

II. Hydrological Observation

- The punctual observation of meteorology and hydrology by the newly installed raingauges and water level gauges is very important to justfy the project in the final design stage, so that such observations shall be conducted.

- Sediment sampling is necessary to estimate the sedimentation in the proposed dam. Especially, sediment sampling during high flood is needed.

III. Agricultural Survey

A. Soil Survey

- Soil survey and chemical analysis shall be made at sample spots in the whole Project Area which is selected at every 30 - 50 ha and land classification map indicating land capability and soil suitability for crops to be introduced shall be prepared based on the result of survey.

B. Cadastral Survey

- Cadastral survey covering the whole Project Area shall be implemented at the early stage of the construction, and the present status of land tenure shall be clear for smooth execution of organization of compact farming systems to be introduced after the completion of on-farm development.

Operation and Maintenance Cost

A. Irrigation

1. Salaries and Wages

Items	No. of Personnel	Salary per Annum (₱)	Total Salary per Annum (₱ '000)
Main Project Office			
Irrigation Superintendent	1	16,130	16.1
Asst. irrigation supt.	2	12,360	27.9
Agriculturist	1	12,360	12.4
Administrative officer	1	9,410	9.4
Supervising water management Technologist	2	8,270	16.5
Water management technicians	12	7,190	86.3
Dichtenders	60	5,110	306.6
Instrumentman	1	7,190	7.2
Casher I	1	8,270	8.3
Accounting clerk I	1	6,320	6.3
Store keeper II	1	5,910	5.9
Clerk II	1	5,910	5.9
Clerk I	1	5,510	5.5
Bill collector	2	6,320	12.6
Billing clerk	2	5,910	11.8
Seculity guard	3	5,910	17.7
Janitor	1	4,440	4.4
Driver	8	5,910	47.3
Heavy equipment operator	4	7,190	28.8
Auto mechanician	1	5,910	5.9
Survey aide	2	5,510	11.0
Sub-total			653.8
Incentive allowance 1/12 x 653.8 + 1.2 =			55.7
Casual employees for repair works (60day per year)			

a. Cons't foreman	1 x 25 = 25	
b. Mason foreman	1 x 25 = 25	
c. Skilled labor	8 x 21 = 168	
d. Laborers	20 x 16 = 320	
	538	0.5

Pamacsalan Dam and
Malinao Diversion Dam Operation Office

Pamacsalan Dam:			
Superintendent	1	16,130	16.1
Mechanical engineer	1	12,360	12.4
Gate Keeper	1	7,190	7.2
Electrical engineer	1	12,360	12.4
Driver	1	5,910	5.9
Janitor	1	5,910	5.9
Watchman	6	5,910	35.5
Sub-total			138.6
Malinao Diversion Dam:			
Mechanical engineer	1	12,360	12.4
Gate Keeper	1	7,190	7.2
Driver	1	5,910	5.9
Watchman	3	5,910	17.7
Sub-total			43.2
Total			891.8 ≒ 892
			(US$118,900)

2. Equipment Operations

a). Depreciation Cost

Machinaries	Quantity	Unit Cost (P)	Total Cost (₱ '000)	Depreciation Cost (₱ '000)
Main Project Office				
Dump truck (8 ton)	2	150,000	300	30
Truck, Flatbed 6ton	1	110,000	110	11
Station Wagon 4 x 4	1	100,000	100	10
Jeep Utility Vehicle 4 x 4	5	75,000	375	68
Motorcycle, 90cc	40	9,000	360	81
Mixer, concrete, 0.3cu.m	2	37,000	74	8
Water pump, 2-4" size	2	8,000	16	2
Weed cutter	30	3,000	90	27
Radio transciever	3	60,000	180	18
Meteorological station	2	15,000	30	3
Leveling instlement with staff and steel tape	2	12,000	24	3
Transit with staff and tape	2	12,000	24	3
Current meter	1	4,000	4	1
Miscellaneous tools and equipment	L.S.		75	11
Wireless telephone	1	200,000	200	30
Wireless telephone	2	112,000	224	34
Emergency correspondence	1	15,000	15	2
Front end loader (1.4 cu.m)	1	382,000	382	38
Motor grader (ℓ = 4.0m)	1	530,000	530	53
Tractor crawler (16ton)	1	525,000	525	53
Spare part (10%)	L.S.			49
Sub-total				535
Pamacsalan Dam and Malinao Diversion Dam				
Pamacsalan dam:				
Jeep, utility vehicle	1	75,000	75	14
Motor vehicle	1	9,000	9	3

Machinaries	Quantity	Unit Cost (P)	Total Cost (₱ '000)	Depreciation Cost (₱ '000)
Malinao diversion dam:				
Jeep, utility vehicle	1	75,000	75	14
Motor vehicle	1	9,000	9	3
Sub-total				34

b) Fuel and Oil Cost

₱16.55 x 5,320ha = ₱88,046 — 88

Total: — 657

(US$87,600)

3. Materials and Supplies

a) Irrigation, drainage and Road Systems

Excavation of irrigation and drainage canal,

2.0m x 0.1m x 189.28m x ₱4.7/m^3 = ₱177.92 — 178

Gravel pavement of roads

3.5m x 0.02m x 118,300m x ₱18.5/m^3 = ₱153,200 — 153

Sub-total — 331

b) Building

Main Project Office

1,500m^2 x ₱600/m^2 x 4% = ₱36,000 — 36

Operaton Office

250m^2 x ₱500/m^2 x 4% = ₱ 5,000 — 5

Housing

Government Staff 750m^2 x ₱600/m^2 x 4% = ₱18,000 — 18

Guest house 200m^2 x ₱600/m^2 x 4% = ₱ 4,800 — 5

Consultants 320m^2 x ₱800/m^2 x 4% = ₱10,240 — 10

Equipment shed 3,000m^2 x ₱200/m^2 x 4% = ₱24,000 — 24

Sub-total — 98

c) Others

₱429,000 x 40% ≒ ₱172,000	172
Sub-total	172
Total	601
	(US$80,100)

4. Administration and General Expenditures

₱891,800 x 30% = ₱267,540	268
	(US$35,700)

B. Hydro-Power

	No. of Personel	Salary per Annum (₱)	Total Salary per Annum (₱ '000)
1. Salary and Wage			
Mechanical engineer	1	9,410	9.4
Electrical engineer	1	6,320	6.3
Mechanical operator	6	5,910	35.5
Electrical operator	3	5,910	17.7
Sub-total			68.9 ≒ 69

2. Power plant $14,425 \times 10^3 \times 1.15 \times 0.02 =$ 331

3. Allocated cost of Pamacsalan dam and Malinao diversion dam

$294.5 \times 10 \times 0.085 =$ 25

Total 425

Terms of Reference for the consultant's Services

1. Objectives

The purpose of the consultant's services is to assist the Government in the effective implementation of the Integrated Agricultural Development Project in the Project Area.

The Consultant's services are divided into 3 phases as follows:

(1) The final detailed designs of the Project as well as the preparation of tender documents. It would cover about 43 man-months periods starting in June 1979. Highly qualified experts will be engaged including irrigation engineers, (team leader), engineering geologist, soil mechanical engineer, hydrogist, design engineers, and economist.

(2) Construction supervision and training of local counterparts personnel in all phases of project activities. The service period extend over 61 man-months from January 1981 to February 1985. The required experts would be project engineers, and engineering geologist.

(3) A plan of Agri-institutional establishment covering all agricultural institutional development program and training. It would cover about 35 man-months. Highly qualified experts will be engaged including a agronomist, agri-institutional expert and water and farm management expoert.

2. Specific Terms of Reference

The consultants will provide a team to undertake the followings of the consultant's services.

(a) To assist the prepation of detailed design, cost estimates, specifications and tender documents for civil works and for procurement of operation and maintenance equipments, construction machineries, construction materials and other goods and instruments necessary for the project;

(b) To assist BIADP in the supervision of construction works under the project.

(c) To assist and advise the Project Manager in preparing monthly construction schedule and work records;

(d) To assist the relevant Government agencies to prepare agri-institutional establishment program which will include provision for:

(i) effective education of farmers in the project area through intensive demonstration and other means to enable them to adopt new cropping systems, diversify crops, use improved varieties of crops and improve cultivation practices;

(ii) strengthening of existing farmer's organizations and establishment of new organizations, of local farmers for the effective channelling of agricultural services;

(iii) adequate supply of agricultural credit and production requisites to these farmers as required for the recommended system of intensive cropping; and

(e) To train local counterpart personnel in all phases of project activites.

3. Expertise

(a) Senior Irrigation Engineer with sufficient experience in the planning, design, and operation and maintenance of irrigation and drainage system and with sufficient seniority to function as team leader.

(b) Design Engineer with sufficient experience in the planning, design and construction of the dam, diversion dams, and hydropower.

(c) Engineering Geologist with sufficient experience in the geological investigation for the major structures such as dam, diversion dam, canal structures, bridge and etc.

(d) Soil Mechanical Engineer with sufficient experience for soil mechanical investigation and test and stability analysis of dam and foundation by applying computer.

(e) Hydrogist with sufficient experience in evaluation the climatical and hydrological data and also analysing run-off discharge and reservoir operation.

(f) Agronomist with sufficient experience in the crop and soil management under paddy irrigation and upland crops at the farm level as well as in agricultural supporting services for integrated agriculture.

(g) Agri-institutional Expert with broad experience in the agricultural supporting services for integrated agriculture.

(h) Economist with sufficient experience in the establishment of farm budgets, marketing and credit services and in the evaluation of economic and financial viability of the integrated agricultural development project.

4. Services to be provided by the Government

The Government will provide the following for carrying out the Consultant's services.

(a) All available documents, drawing, maps, statistics, data and other information related to the Integrated Agricultural Development Project in the Project Area.

(b) Suitable full-time counterparts personnel, including engineers, technicians and professionals, as required for the project; and

(c) To exempt the Consultants from (or bear the cost of) any taxes, duties, fees, levies and other impositions imposed under its laws and regulations in the respect of;

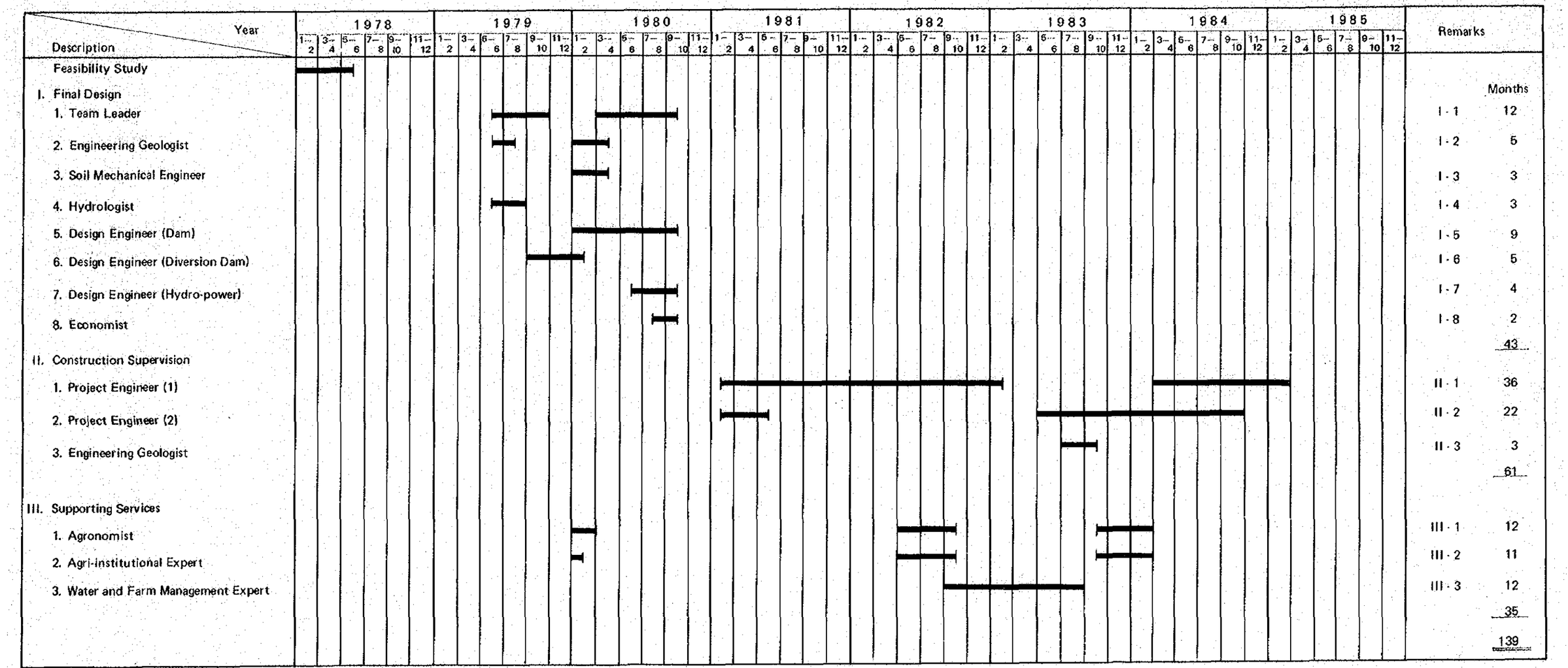
(i) any payment made to the Consultants in connection with the carrying out their services;

(ii) any equipment and materials and supplies brought into the territories of the Government for the purpose of carrying out the services; and

(iii) any property brought by the members of the Consultants for their personnel use and consumption.

Figure 5D-1 shows the proposed schedule for the Consultant's services.

FIGURE 5D - 1 PROPOSED SCHEDULE FOR CONSULTANT'S SERVICES



CHAPTER VI. PROJECT JUSTIFICATION

Gross Production, Gross Production Value and Production Cost

Quickly benefit formation is not expected without better close and timely connection on the construction schedule between Main Dam and Diversion Dam and on-farm works.

On-farm works would be executed from 1982 to 1985, then constructed farm are decided into 4 blocks.

Growing of project benefit start from dry season in 1982 and wet season in 1983. The irrigable area by Malinao Diversion would be even until the completion of Pamacsalan Dam in 1985, June.

Gestation period which all benefited area reach to target yield will be projected in 9 years from 1982 to 1990 years.

Application volume of fertilizers which correlate annual target yield would reach to the target application in the third years.

Table 6D-1 Gross Production with Project - Wet Season Palay

			1982	1983	1984	1985	1986	1987	1988	1989	1990
(A) (Benefited Fields)		Area (ha)	-	943	943	943	943	943	943	943	943
	No.1	Yield (ton)	-	2.4	2.9	3.4	3.7	3.8	3.8	3.8	3.8
		G.P. (ton)	-	2,263	2,735	3,206	3,489	3,583	3,583	3,583	3,583
Reclaimed (Block)		Area (ha)	-	-	1,225	1,225	1,225	1,225	1,225	1,225	1,225
	No.2	Yield (ton)	-	-	2.4	2.9	3.4	3.7	3.8	3.8	3.8
		G.P. (ton)	-	-	2,940	3,553	4,165	4,533	4,655	4,655	4,655
		Area (ha)	-	-	-	-	1,043	1,043	1,043	1,043	1,043
	No.3	Yield (ton)	-	-	-	-	2.4	2.9	3.4	3.7	3.8
		G.P. (ton)	-	-	-	-	2,503	3,025	3,546	3,859	3,963
		Area (ha)	-	-	-	-	597	597	597	597	597
	No.4	Yield (ton)	-	-	-	-	2.4	2.9	3.4	3.7	3.8
		G.P. (ton)	-	-	-	-	1,433	1,731	2,030	2,209	2,269
Irrigated Paddy to be benefited		Area (ha)	-	46	57	313	439	439	439	439	439
		Yield (ton)	-	3.1	3.4	3.6	3.7	3.8	3.8	3.8	3.8
		G.P. (ton)	-	143	194	1,127	1,624	1,668	1,668	1,668	1,668
Converted from rainfed to irrigated		Area (ha)	-	376	532	532	929	929	929	929	929
		Yield (ton)	-	2.5	3.1	3.4	3.6	3.8	3.8	3.8	3.8
		G.P. (ton)	-	940	1,649	1,809	3,344	3,530	3,530	3,530	3,530
Benefited Area (Sub-total)		Area (ha)	-	1,365	2,757	3,013	5,176	5,176	5,176	5,176	5,176
		Yield (ton)									
		G.P. (ton)	-	3,346	7,518	9,695	16,558	18,070	19,012	19,504	19,868
(B) (Remining field)											
Irrigated wet season		Area (ha)	449	402	390	126	-	-	-	-	-
		Yield (ton)	2.6	2.7	2.8	2.8	-	-	-	-	-
		G.P. (ton)	1,167	1,085	1,092	353	-	-	-	-	-
Reinfed Wet season		Area (ha)	1,060	665	501	501	-	-	-	-	-
		Yield (ton)	1.6	1.7	1.7	1.7	-	-	-	-	-
		G.P. (ton)	1,696	1,131	852	852	-	-	-	-	-
Remining field (Sub-total)		Area (ha)	1,509	1,067	891	627	-	-	-	-	-
		G.P. (ton)	2,863	2,216	1,944	1,205	-	-	-	-	-
Palay total (A + B)		Area (ha)	1,509	2,432	3,648	3,640	5,176	5,176	5,176	5,176	5,176
		G.P.	2,863	5,562	9,462	10,900	16,558	18,070	19,012	19,504	19,668

Table 6D-2 Gross Production with Project - Dry Season Palay

			1982	1983	1984	1985	1986	1987	1988	1989
(A) (Benefited Field)		Area (ha)	943	943	943	943	943	943	943	943
	No.1	Yield (ton)	2.7	3.2	3.6	4.0	4.2	4.2	4.2	4.2
		G.P. (ton)	2,546	3,018	3,395	3,772	3,961	3,961	3,961	3,961
Reclaimed (Block)		Area (ha)	-	1,225	1,225	1,225	1,225	1,225	1,225	1,225
	No.2	Yield (ton)	-	2.7	3.2	3.6	4.0	4.2	4.2	4.2
		G.P. (ton)	-	3,308	3,920	4,410	4,900	5,145	5,145	5,145
		Area (ha)	-	-	-	1,105	1,105	1,105	1,105	1,105
	No.3	Yield (ton)	-	-	-	2.7	3.2	3.6	4.0	4.2
		G.P. (ton)	-	-	-	2,984	3,536	3,978	4,420	4,641
		Area (ha)	-	-	-	597	597	597	597	597
	No.4	Yield (ton)	-	-	-	2.7	3.2	3.6	4.0	4.2
		G.P. (ton)	-	-	-	1,612	1,910	2,149	2,388	2,507
Irrigated Paddy to be benefited		Area (ha)	46	57	57	439	439	439	439	439
		Yield (ton)	3.2	3.6	3.9	4.1	4.2	4.2	4.2	4.2
		G.P. (ton)	147	205	222	1,800	1,844	1,844	1,844	1,844
Converted from rainfed to irrigated		Area (ha)	376	532	532	1,011	1,011	1,011	1,011	1,011
		Yield (ton)	2.8	3.3	3.7	4.0	4.2	4.2	4.2	4.2
		G.P. (ton)	1,053	1,756	1,968	4,044	4,246	4,246	4,246	4,246
Benefited Area (Sub-total)		Area (ha)	1,365	2,757	2,757	5,320	5,320	5,320	5,320	5,320
		G.P. (ton)	3,746	8,287	9,505	18,622	20,397	21,323	22,004	22,344
(B) (Remining Field)										
Irrigated	Dry season	Area (ha)	402	390	383	-	-	-	-	-
		Yield (ton)	2.3	2.4	2.4	-	-	-	-	-
		G.P. (ton)	925	936	919	-	-	-	-	-
Rainfed	Dry season	Area (ha)	665	501	345	-	-	-	-	-
		Yield (ton)	0.8	0.8	0.8	-	-	-	-	-
		G.P. (ton)	532	400	276	-	-	-	-	-
Remining field (Sub-total)		Area (ha)	1,067	891	728	-	-	-	-	-
		G.P. (ton)	1,457	1,336	1,195	-	-	-	-	-
Palay total (A + B)		Area (ha)	2,432	3,648	3,485	5,320	5,320	5,320	5,320	5,320
		G.P. (ton)	5,203	9,623	10,700	18,622	20,397	21,323	22,004	22,344

Table 6D-3 Gross Production - Upland Crops

		1982	1983	1984	1985	1986	1987	1988	1989
Upland Palay	Area (ha)	287	248	164					
	Yield (ton)	0.8	0.8	0.8	-	-	-	-	-
	G.P. (ton)	230	198	131					
Corn	Area (ha)	133	129	40					
	Yield (ton)	0.5	0.5	0.5	-	-	-	-	-
	G.P. (ton)	67	65	20					
Cassava	Area (ha)	49	47	15					
	Yield (ton)	1.1	1.1	1.1	-	-	-	-	-
	G.P. (ton)	54	52	17					
Sweet Potato	Area (ha)	92	90	28					
	Yield (ton)	0.6	0.6	0.6	-	-	-	-	-
	G.P. (ton)	55	54	17					

Table 6D-4 Gross Production - without Project

		1982	1983	1984	1985	1986	1987	1988	1989
Irrigated	Area (ha)	468	468	468	468	468	468	468	468
Wet season	Yield (ton)	2.6	2.7	2.8	2.8	2.9	2.9	3.0	3.0
Palay	G.P. (ton)	1,217	1,264	1,310	1,310	1,357	1,357	1,404	1,404
Irrigated	Area (ha)	468	468	468	468	468	468	468	468
Dry season	Yield (ton)	2.3	2.4	2.4	2.5	2.5	2.6	2.6	2.7
Palay	G.P. (ton)	1,076	1,123	1,123	1,170	1,170	1,217	1,217	1,264
Rainfed	Area (ha)	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060
Wet season	Yield (ton)	1.7	1.8	1.8	1.8	1.9	1.9	1.9	2.0
Palay	G.P. (ton)	1,802	1,908	1,908	1,908	2,014	2,014	2,014	2,120
Reinfed	Area (ha)	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060
Dry season	Yield (ton)	1.6	1.7	1.7	1.7	1.7	1.8	1.8	1.8
Palay	G.P. (ton)	1,696	1,802	1,802	1,802	1,802	1,908	1,908	1,908
Upland Palay	Area (ha)	287	287	287	287	287	287	287	287
	Yield (ton)	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9
	G.P. (ton)	230	230	230	230	230	230	258	258
Palay G.P. Sub-total	G.P. (ton)	6,021	6,327	6,373	6,420	6,573	6,726	6,801	6,954
Corn	Area (ha)	173	173	173	173	173	173	173	173
	Yield (ton)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	G.P. (ton)	87	87	87	87	87	87	87	87
Cassava	Area (ha)	63	63	63	63	63	63	63	63
	Yield (ton)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	G.P. (ton)	69	69	69	69	69	69	69	69
Sweet Potato	Area (ha)	120	120	120	120	120	120	120	120
	Yield (ton)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	G.P. (ton)	72	72	72	72	72	72	72	72
Total	Area (ha)	3,699	3,699	3,699	3,699	3,699	3,699	3,699	3,699
	G.P. (ton)	6,248	6,558	6,601	6,648	6,801	6,954	7,029	7,182

Table 6D-5 Gross Production Value with Project (Peso x 10^3)

			1982	1983	1984	1985	1986	1987	1988	1989	1990
A. Palay											
	Unit Price	(₱/ton)	1,290	1,320	1,340	1,375	1,375	1,375	1,375	1,375	1,375
Wet season	G.P.	(ton)	2,863	5,562	9,462	10,900	16,558	18,070	19,012	19,504	19,668
Dry season	G.P.	(ton)	5,203	9,623	10,700	18,622	20,397	21,323	22,004	22,344	22,344
Sub-total	G.P.	(ton)	8,066	15,185	20,162	29,522	36,955	39,393	41,016	41,848	42,012
G.P.V. (A)	₱ x 10^3		10,405	20,044	27,017	40,593	50,813	54,165	56,397	57,541	57,767
B. Upland Palay	Unit Price	(₱/ton)	1,290	1,320	1,340	-	-	-	-	-	-
	G.P.	(ton)	230	198	131	-	-	-	-	-	-
G.P.V. (B)	₱ x 10^3		297	261	176	-	-	-	-	-	-
C. Corn	Unit Price	(₱/ton)	1,100	1,120	1,130	-	-	-	-	-	-
	G.P.	(ton)	67	65	20	-	-	-	-	-	-
G.P.V. (C)	₱ x 10^3		74	73	23	-	-	-	-	-	-
D. Cassava	Unit Price	(₱/ton)	450	450	450	-	-	-	-	-	-
	G.P.	(ton)	54	52	17	-	-	-	-	-	-
G.P.V. (D)	₱ x 10^3		24	23	8	-	-	-	-	-	-
E. Sweet Potato	Unit Price	(₱/ton)	350	350	350	-	-	-	-	-	-
	G.P.	(ton)	55	54	17	-	-	-	-	-	-
G.P.V. (E)	₱ x 10^3		19	19	6	-	-	-	-	-	-
G.P.V. (A - E)	₱ x 10^3		10,819	20,420	27,230	40,593	50,813	54,165	56,397	57,541	57,767

Table 6D-6 Gross Production Value without Project Peso x 10^3

			1982	1983	1984	1985	1986	1987	1988	1989
	G.P.	(ton)	6,021	6,327	6,373	6,420	6,573	6,726	6,801	6,954
Palay	Unit Price	(₱/ton)	1,290	1,320	1,340	1,375	1,375	1,375	1,375	1,375
	G.P.V.	(10^3 ₱)	7,767	8,352	8,540	8,828	9,038	9,248	9,351	9,562
	G.P.	(ton)	87	87	87	87	87	87	87	87
Corn	Unit Price	(₱/ton)	1,110	1,120	1,130	1,135	1,135	1,135	1,135	1,135
	G.P.V.	(10^3 ₱)	97	97	98	99	99	99	99	99
	G.P.	(ton)	69	69	69	69	69	69	69	69
Cassava	Unit Price	(₱/ton)	450	450	450	450	450	450	450	450
	G.P.V.	(10^3 ₱)	31	31	31	31	31	31	31	31
	G.P.	(ton)	72	72	72	72	72	72	72	72
Sweet Potato	Unit Price	(₱/ton)	350	350	350	350	350	350	350	350
	G.P.V.	(10^3 ₱)	25	25	25	25	25	25	25	25
Total	G.P.V.	(10^3 ₱)	7,920	8,478	8,694	8,983	9,193	9,403	9,506	9,717

Table 6D-7 Production Cost per ha with Project - Wet Season Palay

	1st Year			2nd Year			3rd Year		
	Volume	Unit Price	P.C. ₱	Volume	Unit Price	P.C. ₱	Volume	Unit Price	P.C. ₱
(Wet Season)									
Seeds	45 kg	1.6 ₱/kg	72	45 kg	1.6 ₱/kg	72	45 kg	1.6 ₱/kg	72
Fertilizer									
N	35.3 kg	3.6 ₱/kg	127	40.3 kg	3.6 ₱/kg	145	50.4 kg	3.6 ₱/kg	181
P	20.6 kg	3.6 ₱/kg	74	23.5 kg	3.6 ₱/kg	85	29.4 kg	3.6 ₱/kg	106
K	20.6 kg	1.4 ₱/kg	29	23.5 kg	1.4 ₱/kg	33	29.4 kg	1.4 ₱/kg	41
Pesticides									
Liquide	2.2 Qt	38 ₱/Qt	84			84			84
Granular	3.5 kg	7 ₱/kg	25			25			25
Herbicides									
Liquide	-								
Granular	25.0 kg	4.6 ₱/kg	115			115			115
Land preparation									
Animal (Hallow)	(100%)	₱/ha	82			82			82
Machinary (Plow)	(100%)	₱/ha	75			75			75
Threshing									
Pedal	(50%)	₱/ha	6			6			6
Power	(50%)	₱/ha	59			59			59
Drying									
Dryer	(50%)	₱/ha	46			46			46
Miscellaneous	above items cost x 0.03		30			30			32
Total			824			849			924

Note: 1. Figures in parentheses indicate the ratio of coverage area.
2. Land preparation, threshing and drying cost not include the labor cost.
3. Miscellaneous was counted at 3% of gross value of production.
4. P.C. indicate the Production Cost.
5. Animal and machinery would be used in the hallowing operation and plowing respectively. Threshing and drying cost was counted considering the ratio of coverage area.

Table 6D-8 Production Cost per ha with Project - Dry Season Palay

	1st Year			2nd Year			3rd Year		
	Volume	Unit Price	P.C. ₱	Volume	Unit Price	P.C. ₱	Volume	Unit Price	P.C. ₱
Seeds	45 kg	1.6 ₱/kg	72	45 kg	1.6 ₱/kg	72	45 kg	1.6 ₱/kg	72
Fertilizer									
N	51.0 kg	3.6 ₱/kg	184	58.3 kg	3.6 ₱/kg	210	72.9 kg	3.6 ₱/kg	262
P	20.6 kg	3.6 ₱/kg	74	23.5 kg	3.6 ₱/kg	85	29.4 kg	3.6 ₱/kg	106
K	20.6 kg	1.4 ₱/kg	29	23.5 kg	1.4 ₱/kg	33	29.4 kg	1.4 ₱/kg	41
Pesticides									
Liquide	2.2 Qt	38 ₱/Qt	84			84			84
Granular	3.5 kg	7 ₱/kg	25			25			25
Herbicides									
Liquide	-								
Granular	25.0 kg	4.6 ₱/kg	115			115			115
Land preparation									
Animal (Hallow)	(100%)	₱/ha	82			82			82
Machinery (Plow)	(100%)	₱/ha	75			75			75
Threshing									
Pedal	(50%)	₱/ha	6			6			6
Power	(50%)	₱/ha	59			59			59
Drying									
Dryer		₱/ha	46			46			46
Miscellaneous	987 x 0.03		30	1,028 x 0.03		30	1,109 x 0.03		33
Total			881			922			1,006

Table 6D-9 Production Cost per ha without Project

		Palay Irrigated															
		Wet Season								Dry Season							
		1982		1983		1984		1985		1982		1983		1984		1985	
	Unit Price	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱
Seeds	1.6 ₱/kg	60 kg	96	60 kg	96	60 kg	96	60 kg	96	55 kg	88	55 kg	88	55 kg	88	55 kg	88
Fertilizer																	
N	3.6 ₱/kg	34.9kg	126	35.9kg	129	37.0kg	133	38.1kg	137	41.8kg	150	43 kg	155	44.3kg	159	45.6kg	164
P	3.6 ₱/kg	25.6kg	92	26.4kg	95	27.2kg	98	28.0kg	101	26.5kg	95	27.2kg	98	28.1kg	101	28.9kg	104
K	1.4 ₱/kg	25.6kg	36	26.4kg	37	27.2kg	38	28.0kg	39	26.5kg	37	27.2kg	38	28.1kg	39	28.9kg	40
Pesticides																	
Liquide	38 ₱/Qt	1.2Qt	45	1.3Qt	49	1.3Qt	49	1.3Qt	49	1.5Qt	57	1.6Qt	61	1.6Qt	61	1.6Qt	61
Granular	7 ₱/Qt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Herbicides																	
Liquide	27 ₱/Qt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land preparation																	
Animal	82 ₱/ha	(93%)	76.3	(92%)	75.4	(91%)	74.6	(90%)	73.8	(93%)	76.3	(92%)	75.4	(91%)	74.6	(90%)	73.8
Machinery	75 ₱/ha	(7%)	5.3	(8%)	6.0	(9%)	6.8	(10%)	7.5	(7%)	5.3	(8%)	6.0	(9%)	6.8	(10%)	7.5
Threshing																	
Pedal	11 ₱/ha	(75%)	8.3	(80%)	8.8	(85%)	9.4	(90%)	10.0	(75%)	8.3	(80%)	8.8	(85%)	9.4	(90%)	10.0
Power	116 ₱/ha	-		-		-		-		-		-		-		-	
Drying																	
Dryer	92 ₱/ha	(2%)	1.8	(3%)	2.8	(4%)	3.7	(5%)	4.6	(2%)	1.8	(3%)	2.8	(4%)	3.7	(5%)	4.6
Miscellaneous			14		15		15		16		16		17		17		17
Total			500		514		518		534		535		550		560		570

Note: Figures in parentheses indicate the ratio of coverage area.
Land preparation, threshing and drying cost was counted considering such ratioes.

Table 6D-10 Production Cost per ha without Project - Continue 1

		Palay Rainfed															
		Wet Season								Dry Season							
		1982		1983		1984		1985		1982		1983		1984		1985	
	Unit Price	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱
Seed	1.6 ₱/kg	58 kg	93	58 kg	93	58 kg	93	58 kg	93	50 kg	80	50 kg	80	50 kg	80	50 kg	80
Fertilizer																	
N	3.6 ₱/kg	14.2kg	51	14.3kg	51	14.3kg	51	14.6kg	53	14.6kg	53	14.7kg	53	14.8kg	53	15 kg	54
P	3.6 ₱/kg	13.5kg	49	13.6kg	49	13.6kg	49	13.9kg	49	13.9kg	50	14.0kg	50	14.1kg	51	14.3kg	51
K	1.4 ₱/kg	13.5kg	19	13.6kg	19	13.6kg	19	13.9kg	19	13.9kg	19	14.0kg	20	14.1kg	20	14.3kg	20
Pesticides																	
Liquide	38 ₱/Qt	0.5Qt	19	0.6Qt	23	0.6Qt	23	0.6Qt	23	0.5Qt	19	0.6Qt	23	0.6Qt	23	0.6Qt	23
Granular	7 ₱/kg	0.03kg	1	0.04kg	1	0.04kg	1	0.04kg	1	0.5kg	4	0.6kg	4	0.6kg	4	0.6kg	4
Herbicides																	
Liquide	27₱/Qt	0.11Qt	3	0.11Qt	3	0.12Qt	3	0.12Qt	3	0.08Qt	2	0.12Qt	3	0.12Qt	3	0.12Qt	3
Land preparation																	
Animal	82 ₱/ha	(96)	79	(95)	78	(95)	78	(95)	78	(96)	78	(95)	78	(95)	78	(95)	78
Machinery	75 ₱/ha	(4)	3	(5)	4	(5)	4	(5)	4	(4)	3	(5)	4	(5)	4	(5)	4
Threshing																	
Pedal	11 ₱/ha	(71)	8	(74)	8	(78)	9	(80)	9	(71)	8	(74)	8	(78)	9	(80)	9
Power	116 ₱/ha	-		-		-		-		-		-		-		-	
Drying																	
Dryer	92 ₱/ha	-		-		-		-		-		-		-		-	
Miscellaneous			10		10		10		10		10		11		11		11
Total			335		339		340		340		327		334		336		336

Table 6D-11 Production Cost per ha without Project - Continue 2

		Upland Palay						Corn		Cassava		Sweet Potato	
		1982		1983		1984							
	Unit Price	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱	Volume	P.C. ₱
Seed		52.5kg	84	52.5kg	84	52.5kg	84	16.7kg	20	2,928piece	29	4,965piece	15
Fertilizer													
N	3.6 ₱/kg	6.7kg	24	6.8kg	24	6.8kg	24	2.4kg	9	-	-	3kg	11
P	3.6 ₱/kg	6.7kg	24	6.8kg	24	6.8kg	24	2.4kg	9	-	-	3kg	11
K	1.4 ₱/kg	6.7kg	9	6.8kg	10	6.8kg	10	2.4kg	4	-	-	3kg	5
Pesticides													
Liquide	38 ₱/Qt	-		-		-		-		-			
Granular	7 ₱/kg	-		-		-		0.13kg	1	-	-		
Herbicides													
Liquide	27 ₱/Qt	-		-		-				-			
Land preparation													
Animal	82 ₱/ha	(100%)	82	(100%)	82	(100%)	82	(100%)	82	(100%)	82	(100%)	82
Machinery	75 ₱/ha	-		-		-				-			
Threshing													
Pedal	11 ₱/ha	-		-		-				-			
Power	116 ₱/ha	-		-		-				-			
Drying	92 ₱/ha	-		-		-				-			
Miscellaneous			7		7		7		5		5		5
Total			230		231		231		130		116		129

Note: Unit price of seed are 1.6 ₱/kg of Upland Palay, 1.1 ₱/kg of Corn, 1 ₱/100pieces of Cassava and 0.3 ₱/100 pieces of Sweet Potato.

Table 6D-12 Gross Production Cost with Project

10^3 Peso

	1982	1983	1984	1985	1986	1987	1988	1989	1990
Wet Season Palay	580	1,558	2,681	2,929	4,618	4,660	4,783	4,783	4,783
Dry Season Palay	1,635	2,874	3,008	5,140	5,209	5,352	5,352	5,352	5,352
Upland Crops	101	91	49	-	-	-	-	-	-
G.P.C.	2,316	4,523	5,738	8,069	9,827	10,012	10,135	10,135	10,135

Table 6D-13 Cross Production Cost without Project

10^3 Peso

	1982	1983	1984	1985	1986	1987	1988	1989	1990
G.P.C.	1,298	1,324	1,333	1,346	1,346	1,346	1,346	1,346	1,346

Economic Evaluation of Commodities Price

The valuation of benefit and cost may be done by dividing the different items into: a) traded or non-traded goods, and b) services.

The traded goods may be generally values at c.i.f. prices in the case of imports or import substitutes, and f.o.b. in the case of exports or potential exports, with an allowance for domestic transportation and distribution costs.

Traded goods to be evaluated to shadowprice are palay, corn, fertilizer and oil.

Government of the Philippines has approved the first rice export to Indonesia as of November 18, 1977.

It may be considered that the country has attained a comfortable degree of self-sufficiency in this staple food.

Importation, however, is imperative in the interim that the country is yet in the process of attaining self-sufficiency in the production of both food grains and feedgrains. The capability of the stabilized export must be ensured by a certain level of stock and to raise productivity which is still below those of some nearby countries. And it must be noticed that the food production is not sufficient to solve the problem of malnutrition.

Table 6D-14 Rice Price Structure, 1977 and 1985[1/]

	1977		1985	
	₱/ton	US$/ton	₱/ton	US$/ton
1) Export Price of Thai 25-35% broken, f.o.b. Bangkok	1,840	245[7/]	2,110	281[8/]
2) Ocean freight and insurance to Cebu Port[2/]	135	18	145	19
3) Port handling charge	55	7	55	7
4) Price of rice, Cebu	1,975	270	2,310	307
5) Average Cost of Transport to selling center[3/] (Area-Cebu)	-60	-8	-60	-8
Area-Taribon (truck)	(30)			
Taribon - Cebu				
Handling Taribon	(9)			
Freight Charge	(13)			
Handling Cebu	(8)			
6) Price milled rice, area	1,915	262	2,250	299
7) Paddy equivalent price Area (0.63)	1,205	165	1,420	188
8) Milling costs less value of by-products[4/]	-40	-5	-40	-5
9) Transportation cost (farm-mill)	-5	-1	-5	-1
10) Farm gate price of paddy	1,160	159	1,375	182
(Financial farm-gate price)	(1,020)[5/]		(1,375)[6/]	
11) ₱/cavan	58		69	
	(51)		(69)	

1/ ₱/ton and US$/ton values at 1977 constant prices.
Peso shadow priced at exchange rate of US$1.00 = ₱7.5, though IBRD use a shadow exchange rate of US$1.00 = ₱8.33 in the economic analysis.
₱/ton figures rounded to nearest 5 pesos.

2/ A selling center where the additional rice production would be sold is projected as Cebu City.

3/ Transportation Cost to selling center is evaluated via Tubigon Port.

4/ Milling Cost is larger than by products.
The basic data is as follows.

5/ 1977 financial price is actual

6/ 1985 financial price calculated by using the official exchange rate of US$1.00 = ₱7.5

7/ 8/ Export Price of Thai 25-35% broken, f.o.b. Bangkok was estimated as follows.

Basic data: Milling Costs less value of by products

Milling Cost (obtained in NGA, Tagbilaran)

50 kg of rice ---- ₱6.0

50 kg of rice = 79 kg of Palay (50 ÷ 0.63)

Milling cost of 1,000 kg of Palay: $6.0 \times \frac{1,000}{79} = 76$ Pesos

By Products

Bran one sack (40 kg) is gained from 10 bag of 50 kg green rice

Unit price of bran per kg are ₱0.5 to 0.7

Price of Bran one sack (40 kg) is ₱20 to ₱28

One M ton of Palay milled recover 630 kg of rice

630 kg of rice recover bran

as ₱20 $\times \frac{630kg}{500kg} =$ ₱25

₱28 $\times \frac{630}{500} =$ ₱35

Milling Costs less value of by products

76 - 35 = 41 ≒ 40 Pesos

Basic data: Export Price of Thai 25-35% broken, f.o.b. Bangkok

Export Price of Rice, Thai, Milled 5% broken, f.o.b. Bangkok was based on the Official Memorandum, World Bank, May 17, 1976.

1) Commodity prices and price projections:

	1976	1977	1985
in Current Dollars $/MT	300	340	679
in 1976 Constant Dollars	300	313.5	359.4
in 1977 Constant Dollars		340 1/	390 2/

° Inflation factor 1976 = 100, 1977 = 108.4 (Official Memorandum)

1/ 313.5 x 108.4 = 340

2/ 340/313.5 x 359.4 = 390

2) Rice, Thai, Milled 25-35% broken, f.o.b. Bangkok:

	1977	1985
5%	340	390
25-35%	245	281
	(340 x 0.72)	(359.5 x 0.72)

° Raito of milled 25 percent broken rice price to 5 percent price:

IBRD 1985 forecast in constant end 1974 prices

5% broken US$285/MT -----(1)

25% broken US$206/MT -----(2)

(2) ÷ (1) 72%

Source: "Price forecast for main primary commodities" July 1975. IBRD.

Table 6D-15 Corn Price Structure, 1977 and 1985[1/]

	1977		1985	
	₱/ton	US$/ton	₱/ton	US$/ton
1) Export price, US No.2 yellow f.o.b. Gulf[2/]	900	120	945	126
2) Ocean freight, insurance to Jagna	205	27	210	28
3) Import price c.i.f. Jagna[3/]	1,105	147	1,155	154
4) Jagna handling charges	60	8	60	8
5) Price of Corn, Jagna	1,165	155	1,215	162
6) Less average cost of transport, mill to Jagna	-15	-2	-15	-2
7) Corn price, ex-mill project area	1,150	153	1,200	160
8) Less milling and packaging cost	-60	-7	-60	-7
9) Less average cost of transport farm to mill	-15	-2	-15	-2
10) Farm gate corn price	1,075	144	1,135	151
(Financial farmgate price)	(1,070)[4/]		(1,135)[5/]	

1/: ₱/ton or US$/ton at Constant June 1977 prices. Peso shadow-priced at an exchange rate of US$1.00 = ₱7.5, though IBRD use US$1.00 = ₱8.33.
Peso figures rounded to nearest 5 pesos.

2/: Due to unavailability of price data on white corn, the projection for yellow corn is used. US$/ton was based on the NISIP:1, Appraisal Report by IBRD.

3/: Jagna port locate in the nearest place to the Project Area from Gulf.

4/: 1977 financial price is actual.

5/: 1985 financial price calculated at the official exchange rate of US$1.00 = ₱7.50

Table 6D-16 Fertilizer Price Structure, 1977 and 1985[1]

A. Urea Case 1: Distribution Center would still locate in Cebu City in future. Import Europe Urea.

	1977		1985	
	₱/ton	US$/ton	₱/ton	US$/ton
1) Export price, f.o.b. Europe bagged	1,240	165	1,390	185
2) Ocean freight and insurance to Cebu Port	270	36	285	38
3) Handling charge Cebu Port	45	6	45	6
4) Price of Cebu Port	1,555	210	1,720	230
5) Transportation Cost to distribution center, Cebu City[2]	15	2	15	2
6) Cost of handling at distribution center	45	6	45	6
7) Ex-warehouse price for implementation by manufacture/importer Cebu	1,615	215	1,780	238
8) Transportation Cost from Cebu to Project Area	59	8	59	8
of which: Handling Cebu Port	(8)			
Freight Charge	(13)			
Handling Talibon Port[3]	(8)			
Talibon to Area (Truck)	(30)			
9) Cost of handling by dealers at Project Area[4]	30	4	30	4
10) Transportation Cost dealers to farmer	8	1	8	1
11) Farm gate price of Urea	1,710	228	1,875	251
(Financial farm-gate price)	1,750[5]		1,875[6]	
12) ₱/kg	3.8		4.2	
	3.9		4.2	

1/ ₱/ton and US$/ton values at constant 1977 prices.
Peso shadow priced at exchanged rate of US$1.00 = ₱7.5
₱/ton figures rounded to nearest 5 pesos.

2/ The fertilizer manufacturers/importers who has been approved the ex-warehouse prices by the Fertilizer Industry Authority locate at Cebu, Ormoc and Gogo in Southern Island District. Such manufacturers/importers would be the distribution center of fertilizer for the Project Area.

3/ Talibon port locates in the nearest place from the Project Area.

3/ The numbers of dealers/sub-dealers of fertilizers and farm chemicals who was accredited by Bohol Provincial Office amount to two persons of Pilar and one of Sierra Bullones.
At present, fertilizers which were sent from the distribution center in Cebu City to the Project Area are selled to farmers by those dealers.

5/ 1977 financial price is actual

° Farm management:	45-0-0	87.5 ₱/bag (bag=20kg)
° BAEX, Tagbilaran:	46%	83.6 ₱/bag
° F.I.A. Sep. 27, 1976: Ex-warehouse prices for implementaion by all fertilizer manufacturer/importers, Cebu		76.45 ₱/bag

6) 1985 financial price calculated by using the official exchange rate of US$1.00 = ₱7.5

Urea Case 2: It is assuming that new distribution center will be established in Tagbilaran City in future.
Import Europe Urea.

	1985 ₱/ton	1985 US$/ton
1) Export price, f.o.b. Europe	1,390	185
2) Ocean freight and insurance in Tagbilaran	285	38
3) Handling Charge Tagbilaran	45	6
4) Price of Tagbilaran Port[1/]	1,720	230
5) Cost of handling at distribution Center, Tagbilaran	45	6
6) Ex-warehouse price for implementation by manufacturers/importers Tagbilaran	1,765	235
7) Transportation Cost to Project Area by Truck	60	7
8) Cost of handling by dealers (or-Cooperative) At Project Area	20	4
9) Transportation Cost, dealers (or-Cooperative) to farmer	8	1
10) Farm gate price of Urea	1,850	245
(Financial farm gate price)	1,850	
11) N/kg	4.1	
	4.1	

Urea Case 3: Urea of Philippines will be imported from ASEAN Urea Plants of Malaysia & Indonesia after 1981, Distribution center is Cebu City.

	1985 ₱/ton	1985 US$/ton
1) Export price, f.o.b., Jakarta bulk 1/	1,275	170
2) Ocean freight and insurance to Cebu Port	142	19
3) Handling Charge Cebu Port	45	6
4) Price of Cebu Port	1,462	195
5) ibid Case 1	15	2
6) ibid Case 1	45	6
7) ibid Case 1	1,522	205
8) ibid Case 1	68	9
9) ibid Case 1	30	4
10) ibid Case 1	8	1
11) Farm gate price Urea	1,630	219
(Financial farm-gate price)	1,630	
12) N/kg	3.6	
	3.6	

1/ The Indonesia's indicative price of urea at $175 per mt, FOB, bulk is not accepted by Philippines. Then, some price less than $175 would be forecasted. In this case $170 would be assumed. (Source: FPA)

Philippines importable volume is shown in bellows:

	1981	1982	1983	1984	1985
Importable Volume 10^3 MT	322	242	257	278	339
Malaysian ASEAN Plant	161	121	128	139	169
Indonesian ASEAN Plant	161	121	128	139	169

B. Triple Super-phospate

	1977		1985	
	₱/ton	US$/ton	₱/ton	US$/ton
1) Export price, f.o.b. U.S. Gulf bulk	990	132	1,238	165
2) Ocean freight and insurance to Cebu Port	203	27	210	28
3) Handling Charge Cebu	45	6	45	6
4) Price of Cebu Port	1,240	165	1,495	199
5) Transportation Cost to distribution Center, Cebu	15	2	15	2
6) Cost of handling at distribution Center, Cebu	45	6	45	6
7) Ex-warehouse price for implementation by manufacture/importer Cebu	1,300	173	1,555	207
8) Transportation Cost to Project Area (Cebu-Area)	59	8	59	8
9) Cost of handling by dealers at Project Area (Cooperative)	30	4	30	4
10) Transportation Cost, dealers to farmer (Cooperative-farm)	8	1	8	1
11) Farm gate price of Phosphate	1,400	186	1,652	220
(Financial farm-gate price)	1,450		1,652	
12) P/Kg	3.1		3.6	
	3.2		3.6	

C. Potash

	1977		1985	
	₱/ton	US$/ton	₱/ton	US$/ton
1) Export price, f.o.b. Vancouver bulk	495	66	503	67
2) Ocean freight and insurance to Cebu	135	18	143	19
3) Handling Charge Cebu	45	6	45	6
4) Price of Cebu Port	675	90	691	92
5) Transportation Cost to distribution Center, Cebu	15	2	15	2
6) Cost of handling at distribution Center, Cebu	45	6	45	6
7) Ex-warehouse price for implementation by manufacturer/importer Cebu	735	98	751	100
8) Transportation Cost to Project Area (Cebu-Area)	59	8	59	8
9) Cost of handling by dealers at Project Area (Cooperative)	30	4	30	4
10) Transportation Cost, dealers to farmer (Cooperative-farm)	8	1	8	1
11) Farm gate price of Potash	835	111	850	113
(Financial farm-gate price)	1,200		850	
12) P/kg	1.4 2.0		1.4 1.4	

Pasic data: Fertilizer

° Commodity prices and price projection

	1976	1977	1985
(UREA)			
in Current Dollars	137	165	322
in 1976 Constant Dollars	137	152.1	170.6
in 1977 Constant Dollars		165	185
(TSP)			
in Current Dollars	115	132	288
in 1976 Constant Dollars	115	121.7	152.4
in 1977 Constant Dollars		132	165
(Potash)			
in Currency Dollars	60	66	117
in 1976 Constant Dollars	60	60.9	61.9
in 1977 Constant Dollars		66	67

Source: Official Memorandum, World Bank, May 17, 1976.

Table 6D-17 Petroleum Price Structure, 1977 and 1985

	1977		1985	
	₱/10^3ℓ	US$/$10^3$ℓ	₱/10^3ℓ	US$/$10^3$ℓ
1) Saudi Arabian light crude oil 34° average realized price f.o.b. Ras Tanura[1/]	730	97	730	97
2) Ocean freight, insurance and ocean loss to Manila Port[2/]	180	24	195	26
3) Price of light crudeoil, Cavite refining factory	910	121	925	123

1/ Based on Office Memorandum, May 17, 1976, IBRD

2/ Ocean freight value was assumed refering to freight values of other commodities.

Insurance and ocean loss was each computed at 0.2% and 1.0% of CIF price.

Economic Costs of Farm Labor

1. Methods of Estimation

Pricing of farm labor is the assessment of the opportunity cost. The opportunity costs are estimated in the following general criteria.

Point A: The opportunity for off-farm employment

During the "non-peak" period farmers can, and often do, undertake activities like fishing, carpentry, home repairs, wood gathering, cottage industries like hat weaving and basket making, construction work and other casual labor. Wage rates of these jobs are unclear. NIA, however, surveied the important information on farm labor wages. According to this labor wage survey, the meal cost for hired labor is 2 peso. The value of the incremental caloric intake demanded by changes in labor activity would be considered 2 peso.

Point B: The farm work season as usual (non-peak period)

The opportunities for work would compete with the permanent off-farm employment opportunities. The less productive off-farm employment is scarce, the more farm labor force is drawn into farm work.

Point C: The full employment peak periods

At the employment level corresponding to full employment peak periods, the opportunity cost is equal to the observed market wage rate. Average farm hired labor wage of 6.5 peso in the Project area is considered as market wage rate.

Point D: The attractive farm wage rate for outside labor market

Labor would be hired under the more demand than the full employment for farmers themselves. Then wage rate go up. The opportunity cost of alternative labor pool correspond to the highest level of farm labor wage in the Project area.

It is postulated that the marginal opportunity cost of labor supplied for farm work in the Project area can be represent by an "S-shaped" curve which is drawn in Figure 6D - 1 and 6D - 2 using Point A, B, C and D as mentioned above.

2. Available Farm Labor Force

Farm labor forces to be available in the Project area will be depended upon labor inside and outside the Project Area. Table 6D-18 and 6D-19 indicate the mandays per month of full time and part time farmer with and without Project inside the Project area. Table 6D-20 explain available farm labor force outside the Project area. Both side labor are summed up Table 6D-21.

3. Total Labor Demand by Month

The labor demand by month which are shown in Table 6D-22 and 6D-23 was calculated based on the data of labor distribution by crops. These man days by month are converted to percentage of potential full employment as shown at Table 6D-24 and 6D-25.

4. Wage Rate by Month

Wage rate, namely, marginal opportunity cost are assumed by application of percentage of potential full employment to "S-shaped" curve. (Table 6D-26 and 6D-27)

Table 6D-18 Available Farm Labor Force Inside the Project Area

—— With Project ——

Year	No. of Farm household	Full Time Farmer household	Part Time Farmer household	Family Labor per Farm: Full Time person	Family Labor per Farm: Part Time person	Mandays per Month: Full Time	Mandays per Month: Part Time	Mandays per Month: Total
						- 10^3 man days -		
1977	2,069	1,552	517	2.0	1.0	81	13	94
1978	2,069	1,552	517	2.0	1.0	81	13	94
1979	2,069	1,552	517	2.0	1.0	81	13	94
1980	2,069	1,552	517	2.1	1.1	85	15	100
1981	2,069	1,552	517	2.1	1.1	85	15	100
1982	2,125	1,594	531	2.1	1.1	87	15	102
1983	2,201	1,761	440	2.2	1.2	101	14	115
1984	2,262	1,810	452	2.2	1.2	104	14	118
1985	2,289	2,060	229	2.3	1.3	123	8	131
1986	2,289	2,060	229	2.3	1.3	123	8	131
1987	2,289	2,060	229	2.4	1.4	129	8	137
1988	2,289	2,060	229	2.4	1.4	129	8	137
1989	2,289	2,060	229	2.5	1.5	134	9	143

Note: Labor days per month is average 26 days.
Ratio of part time farmer assumed at 25 % in '77-'82, 20 % in '83-'84 and 10 % after '85.

Table 6D-19 Available Farm Labor Force Inside the Project Area

— Without Project —

Year	No. of Farm household	Full Time Farmer household	Part Time Farmer household	Family Labor per Farm: Full Time person	Family Labor per Farm: Part Time person	Mandays per Month: Full Time	Mandays per Month: Part Time	Mandays per Month: Total
						- 10^3 man day -		
1977	2,069	1,552	517	2.0	1.0	82	13	95
1978	2,069	1,552	517	2.0	1.0	82	13	95
1979	2,069	1,552	517	2.0	1.0	82	13	95
1980	2,069	1,552	517	2.1	1.1	85	15	100
1981	2,069	1,552	517	2.1	1.1	85	15	100
1982	2,069	1,552	517	2.1	1.1	85	15	100
1983	2,069	1,552	517	2.1	1.1	85	15	100
1984	2,069	1,552	517	2.1	1.1	85	15	100
1985	2,069	1,552	517	2.1	1.1	85	15	100
1986	2,069	1,552	517	2.2	1.2	89	16	105
1987	2,069	1,552	517	2.2	1.2	89	16	105
1988	2,069	1,552	517	2.2	1.2	89	16	105
1989	2,069	1,552	517	2.2	1.2	89	16	105

Table 6D-20 Available Farm Labor Force Outside the Project Area

Year	Unemployment	Mandays per Month
		10^3 man days
1977	1,700	44
1978	1,730	45
1979	1,760	46
1980	1,790	47
1981	1,820	48
1982	1,850	49
1983	1,890	50
1984	1,930	51
1985	1,970	52
1986	2,010	53
1987	2,050	54
1988	2,090	55
1989	2,130	56

Note: 50 % of unemployment in municipalities adjacent the Project area was assumed to be hired in the Project area.
Annual growth rate is 1.9 %.

Table 6D-21 Available Farm Labor Force per Month including Surrounding Areas

(unit: 10^3 man-days)

Year	Without Project			With Project		
	Inside	Outside	Total	Inside	Outside	Total
1977	95	44	139	94	44	138
1978	95	45	140	94	45	139
1979	95	46	141	94	46	140
1980	100	47	147	100	47	147
1981	100	48	148	100	48	148
1982	100	49	149	102	49	149
1983	100	50	150	115	50	165
1984	100	51	151	118	51	169
1985	100	52	152	131	52	183
1986	105	53	158	131	53	184
1987	105	54	159	137	54	191
1988	105	55	160	137	55	192
1989	105	56	161	143	56	199

Table 6D-22 Total Labor Demand by Month Without Project

(unit: 10^3 man-days)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1981 - 1987	35	8	7	34	13	39	39	16	3	18	38	33	283

Note: It is assumed that the labor demand for farming in the Project area is constant in the conditions of without porject.

Table 6D-23 Taotal Labor Demand by Month with Project

Year	AL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1981	148	35	8	7	34	13	39	39	16	3	18	38	33	283 (0.8)
1982	149	42	15	33	38	10	41	38	14	3	21	60	69	384 (2.0)
1983	165	57	23	61	47	12	52	74	28	13	48	85	111	611 (1.7)
1984	169	53	75	60	42	13	70	115	41	24	74	91	107	765 (2.4)
1985	183	65	35	108	48	9	66	113	40	25	81	127	176	893 (1.5)
1986	184	66	36	108	48	14	91	171	63	42	119	133	176	1,067
1987	191	66	36	108	48	14	91	171	63	42	119	133	176	1,067

Note: AL; Available Labor Forces (inside and outside the Project area)
The figures in parentheses indicate the labor required for construction works of the Project, and was exclude from total figures because of small numbers.

Table 6D-24 Monthly Farm Labor Demand as Percentage of Potential Full Employment
— Without Project —

(unit: %)

Year	AL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1981	148	24	5	5	23	9	26	26	11	2	12	26	22
1982	149	23	5	5	23	9	26	26	11	2	12	26	22
1983	150	23	5	5	23	9	26	26	11	2	12	26	22
1984	151	23	5	5	23	9	26	26	11	2	12	25	22
1985	152	23	5	5	22	9	25	25	11	2	12	25	22
1986	158	22	5	4	21	8	25	25	10	2	11	24	21
1987	159	22	5	4	21	8	24	24	10	2	11	24	21

Table 6D-25 Monthly Farm Labor Demand as Percentage of Potential Full Employment
— With Project —

(unit: %)

Year	AL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1981	148	24	5	5	23	9	26	26	11	2	12	26	22
1982	149	28	10	22	26	7	28	26	9	2	14	40	46
1983	165	35	14	37	28	7	32	45	17	8	29	52	67
1984	169	31	44	36	25	7	41	68	24	14	44	54	63
1985	183	36	19	59	26	5	36	62	22	14	44	69	96
1986	184	36	20	59	26	8	49	93	34	23	65	72	96
1987	191	36	20	59	26	8	49	93	34	23	65	72	96

FIGURE 6D-1 TYPICAL OPPORTUNITY COST CURVE FOR FARM LABOR

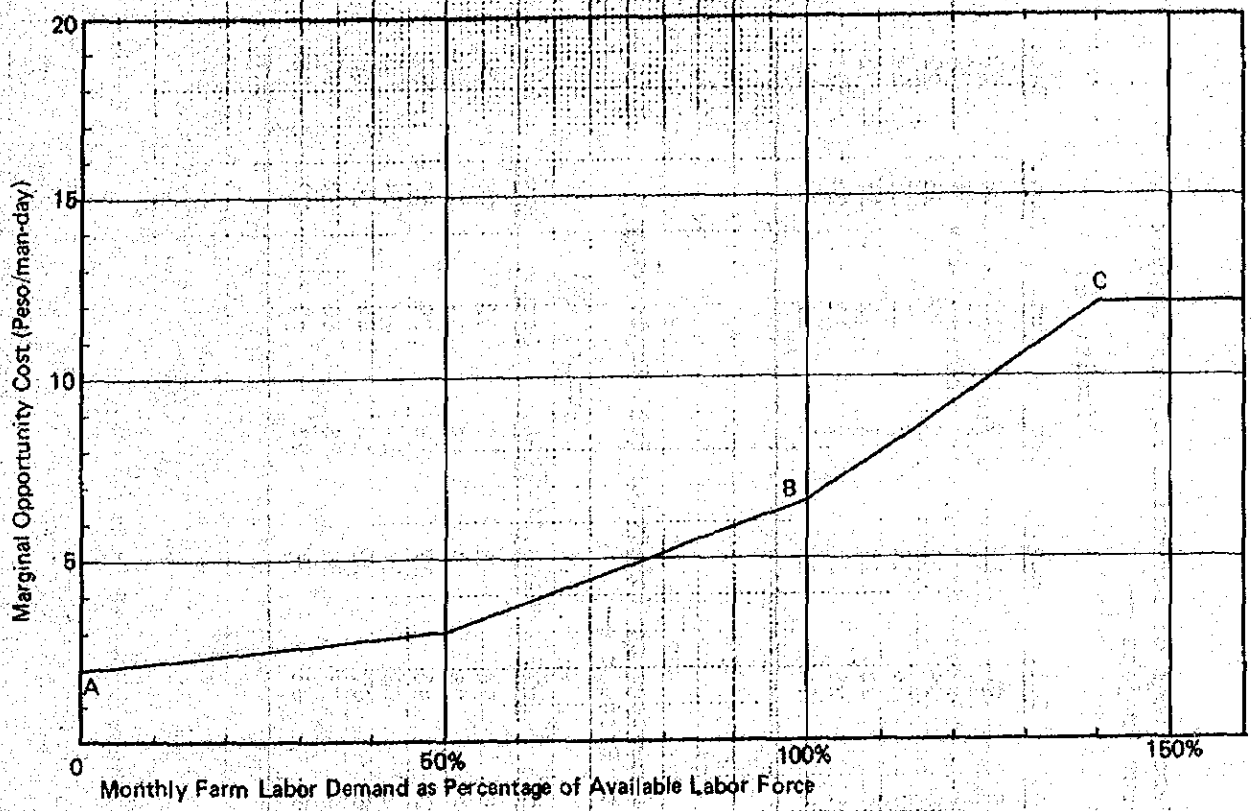


FIGURE 6D-2 OPPORTUNITY COST CURVE FOR FARM LABOR

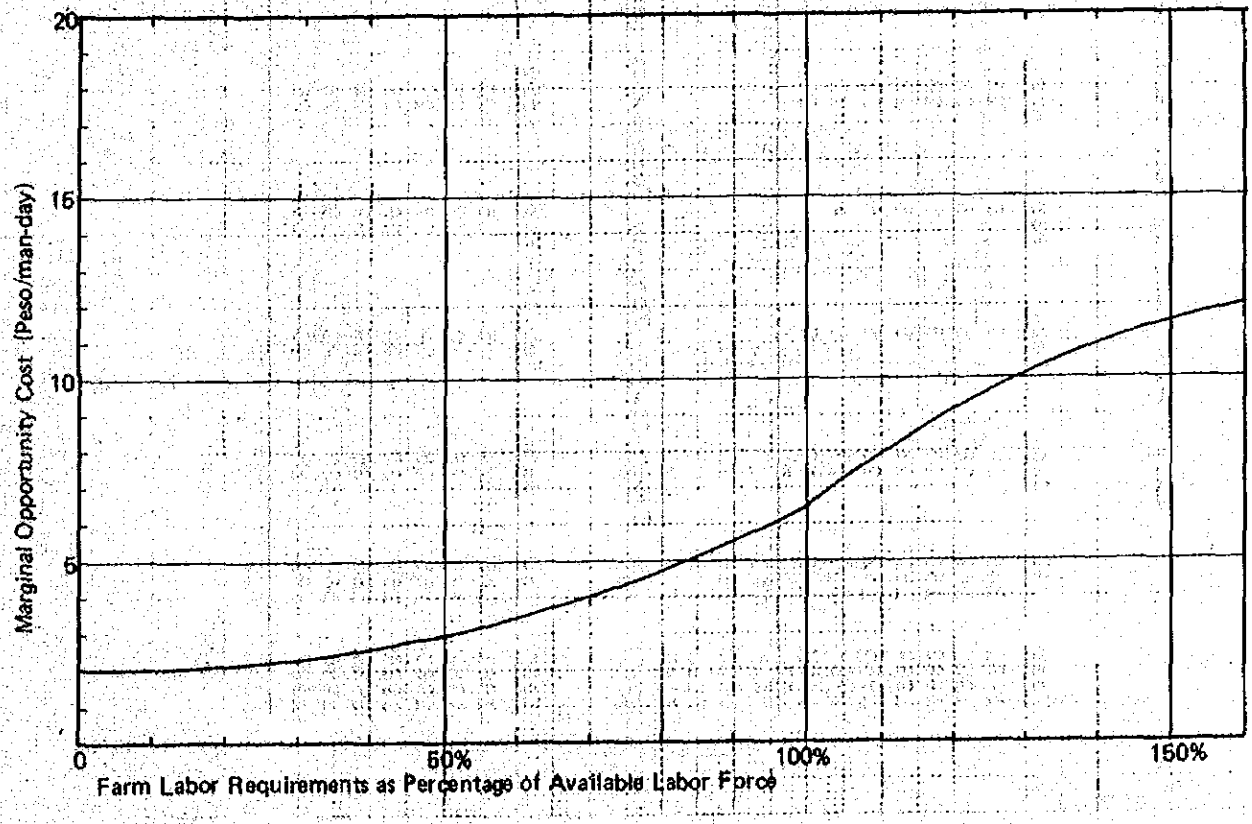


Table 6D-26 Wage Rate by Month without Project

(unit: peso/man-day)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1981	2.3	2.0	2.0	2.2	2.0	2.3	2.3	2.0	2.0	2.0	2.3	2.1
1982	2.2	2.0	2.0	2.2	2.0	2.3	2.3	2.0	2.0	2.0	2.3	2.1
1983	2.2	2.0	2.0	2.2	2.0	2.3	2.3	2.0	2.0	2.0	2.3	2.1
1984	2.2	2.0	2.0	2.2	2.0	2.3	2.3	2.0	2.0	2.0	2.3	2.1
1985	2.2	2.0	2.0	2.1	2.0	2.3	2.3	2.0	2.0	2.0	2.3	2.1
1986	2.1	2.0	2.0	2.1	2.0	2.3	2.3	2.0	2.0	2.0	2.3	2.1
1987	2.1	2.0	2.0	2.1	2.0	2.3	2.3	2.0	2.0	2.0	2.3	2.1

Table 6D-27 Wage Rate by Month with Project

(unit: peso/man-day)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1981	2.3	2.0	2.0	2.2	2.0	2.3	2.3	2.0	2.0	2.0	2.3	2.1
1982	2.3	2.0	2.2	2.3	2.0	2.3	2.3	2.0	2.0	2.1	2.6	2.8
1983	2.4	2.1	2.4	2.3	2.0	2.4	2.7	2.1	2.0	2.3	3.0	3.9
1984	2.4	2.7	2.4	2.2	2.0	2.6	3.9	2.3	2.1	2.7	3.2	3.6
1985	2.4	2.2	3.4	2.3	2.0	2.5	3.6	2.2	2.1	2.7	4.0	6.1
1986	2.4	2.2	3.4	2.3	2.0	3.0	5.6	2.4	2.3	3.6	4.1	6.1
1987	2.4	2.2	3.4	2.3	2.0	3.0	5.6	2.4	2.3	3.6	4.1	6.1

Table 6D-28 Total Labor Costs by Month without Project

(unit: 10^3 Peso)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1981	81	16	14	75	26	90	90	32	6	36	87	69	622
1982	77	16	14	75	26	90	90	32	6	36	87	69	618
1983	77	16	14	75	26	90	90	32	6	36	87	69	618
1984	77	16	14	75	26	90	90	32	6	36	87	69	618
1985	77	16	14	71	26	90	90	32	6	36	87	69	614
1986	74	16	14	71	26	90	90	32	6	36	87	69	611
1987	74	16	14	71	26	90	90	32	6	36	87	69	611

Table 6D-29 Total Labor Costs by Month with Project

(unit: 10^3 Peso)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1981	81	16	14	75	26	90	90	32	6	36	87	69	622
1982	97	30	73	87	20	94	87	28	6	44	156	193	915
1983	137	48	146	108	24	125	200	59	26	110	255	433	1,671
1984	127	203	144	92	26	182	449	94	50	200	291	385	2,243
1985	156	77	367	110	18	165	407	88	53	219	508	1,074	3,242
1986	158	79	367	110	28	273	958	151	97	428	545	1,074	4,268
1987	158	79	367	110	28	273	958	151	97	428	545	1,074	4,268

Decision of Escalation Factor

Escalation factor was be used by 8 percent decided in reference to the following back datas.

1. The price escalation factor which were used in the recent irrigation feasibility and appraisal report are around 8 percent (Data 1, 2 and 3).

2. Afterwards the oil crisis as of 1974 years, the inflation in the Philippines have-been quiet down comparatively. (Data 4, 5, 6, 7, 8 and 9)

3. The domestic inflation rate in recent years, especially, that in 1976 to 1979 years was lower than ADB Guidelines of 12 percent. (Data 10).

4. Guideline of World Bank indicate compare index of international inflation with GNP deflator (Data 11). Data 12 was made for the same purpose. The indicator on GDP and Consumer's price index in 1975 to 1976 indicate less difference. According to the Long-Term And Five Year (1978-82) Development Plans, NEDA, GNP was forecasted at an average annual rate of approximately 8 percent. Escalation factor infuture would be used by 8 percent in reference to such forecasting.

Basic Data on Cost Escalation Factor

1. Cagayan Integrated Agricultural Development Project.
   Feasibility Report, April 1976, JICA
   8 percent per annum for both the foreign and local currency.

2. Jalaur Irrigation Project
   Appraisal Report, October 1976, World Bank

	Annual Inflation Rate (%)	
	1977-79	1980-81
Civil Works	12	10
Equipment and services	8	7

3. Laguna de Bay Development Project-1st Package
   Appraisal Report, November 1975 Asian Development Bank
   :- 8 percent per annum during the construction period 1976-1980.

4. Trend of Growth Rate of Consummer's Price in Metro Manila

	1972	1973	1974	1975	1976
Annual Growth Rate	10.2	11.0	34.3	8.0	5.6

Source: Central Bank of Philippines

5. Retail Price Index of Selected Commodities in Metro Manila
   Philippine Economic Indicators, August 1977, NEDA

Construction Materials

Unit: Pesos

	1976					
	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1) Cement, 94 lbs (bags)	14.70 (100.0)	14.70	15.67	15.67	15.67	15.67
2) Steel Bar, Round, 1/2" x 20' (P.C.)	16.67 (100.0)	16.67	16.67	16.67	16.67	16.67 (100.0)
3) Pipes, Specified Brand; Loca (each)	n.a.	n.a.	n.a.	n.a.	n.a.	31.98 (100.0)
4) G.I. Sheet, Corrugated 26 G 32' x 8"	32.16 (100.0)	32.16	32.16	32.16	32.16	34.00
5) Lumber, Tangile, Rough (bd. ft)	1.64 (100.0)	1.64	1.64	1.64	1.64	1.69

	1977						
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.
	15.67	15.61	15.61	15.61	15.61	15.61	15.61 (106.2)
	a/	a	a	a	a	a	a
	32.50	32.50	32.50	32.50	32.50	32.50	32.50 (101.6)
	34.00	34.00	34.40	34.40	34.40	32.50	34.40 (106.9)
	1.69	1.69	1.79	1.79	1.79	1.79	1.79 (109.1)

a/ Data collection was discontinued.

6. Labor Wage Index 1/

	Rates of Change from Previous Year (%)	
	1975	1976
Monetary Wage rate		
Skilled labor	4.0	3.6
Unskilled labor	9.7	4.0
Real Wage rate		
Skilled labor	-8.5	-1.6
Unskilled labor	-20.8	-1.3

Source: Central Bank of Philippines

Note: 1/ Industry labor wage.

7. The minimum standard of labor wage was decided as of May 1, 1976 based on No.978 of Presidential Degree.

1) Non-farm labor in Metro Manila	8 to 10 Peso
2) Non-farm labor in other districts	8 to 9 Peso
3) Plantation and organized labor	4.75 to 7 Peso
4) Farm labor	4.75 to 6 Peso

8. Hired farm labor wage in the Project area.
- Farm management Survey, 1977, LRED, NIA -

(Unit: Pesos)

	Palay Irrigated		Palay Rainfed	
	Wet	Dry	Wet	Dry
Land Preparation	8.5	8.3	9.0	7.5
Repair of Dikes	6.0	6.0	7.1	7.0
Transplanting	5.5	5.8	6.3	6.2
Handweeding	7.2	7.3	6.6	6.7
Fertilizer	7.5	7.8	7.0	6.8
Hauling	6.0	6.0	6.8	7.5
Drying	-	6.0	5.9	6.0

Weighted average 6.6 Peso

9. Retail Price of rice in Bohol Province - 1976

Unit: Pesos per kg

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
1.86 (100)	1.90	1.90	1.90	1.94	2.06	2.10	2.10	2.00	2.10	2.09	2.00	2.00 (107.5)

Source: Annual Report, NGA, Region VII, 1976

10. Guidelines of A.D.B.

	Cost Escalation Factor[a]		
	1976 %	Annually 1977-79 %	Annually 1980-85 %
Equipment	10	8	7
Civil Works	14	12	10

a/ World Bank recommendation, March 1975

11. Guidelines of World Bank

Inflation Indices, 1961 - 1985

	GNP Deflation (at market prices) (% per annum)	Index of International Inflation[a] (% per annum)
1961-70	3.7	1.7
1971-73	11.1	11.2
1973	15.5	18.7
1974	10.2	22.4
1975 provisional	11.9	14.5
1976 projected	6.5	6.5
1977-80 projected	7.7	7.7
1981-85 projected	7.0	7.0

a/ Index of c.i.f. prices of developed countries manufactured goods.

12. Comparison GDP, GNP with Consumer Price Index in Philippines

	1972	1973	1974	1975	1976
G.D.P.	4.8	8.7	4.8	6.9	6.3
G.N.P.	4.2	9.9	5.8	na	na
Consumer's Price Index	10.2	11.0	34.3	8.0	5.6

Economic Cost

Component cost to be re-estimated for economic evaluation consist of unskilled labor, fuel and oil and land acquisition and compensation.

Financial unit wage of 15 Pesos used in cost estimation was adjusted based on opportunity costs of labor. Opportunity costs of labor were obtained from labor study and values from 2.2 pesos in 1979 to 6.1 pesos in 1985 years.

Financial diesel oil price per litter of 1.3 pesos was adjusted at economic price of 0.9 peso.

Cost to acquire the existing cultivated lands is excluded in economic evaluation to avoid the double country with benefit stream. But cost to acquire other purpose lands is counted. Methods of evaluation are the use of value capitalized from annual benefit of land or land value for tax assessment to fixed assets.

On the compensation cost, cultivated land's and other land's value was assessed using above methods. Farm house building's value was estimated on residual value of constructed cost newly.

Cost allocation of joint facilities is computed using the "Separable Costs Remaining Benefits Methods". The procedure of computation is shown the following Table.

Table 6F-1 Component Cost to be re-estimated for Economic Evaluation

Unit: ₱x10³

	1979	1980	1981	1982	1983	1984	1985	Total
Financial Cost								
Unskilled Labor	170	38	910	2,163	1,888	2,704	1,613	9,486
Fuel and Oil	194	46	1,099	2,628	2,274	3,256	1,931	11,426
Land acquisition and Compensation	-	-	4,185	1,140	1,310	805	-	7,440
Total	364	84	6,194	5,931	5,472	6,766	3,544	28,352
Total rounded	360	80	6,200	5,930	5,470	6,770	3,540	28,350
Economic Cost								
Unskilled Labor	26	6	137	411	491	703	661	2,435
Fuel and Oil	134	32	757	1,813	1,569	2,247	1,332	7,884
Land Acquisition and Compensation	-	-	2,645	500	580	355	-	4,080
Total	160	38	3,539	2,724	2,640	3,305	1,993	14,399
Total rounded	160	40	3,540	2,720	2,640	3,310	1,990	14,400

Cost Allocation

1. Cost of joint facilities to be allocated

Pamacsalan Dam	48,380 ₱ 10^3
Malinao Diversion Dam	21,370 ₱ 10^3
Total	69,750 ₱ 10^3

This study include the depreciation cost of equipment and not include the contingency

2. Alternative Construction Cost

1) Irrigation

a. Alternative dam

Total storage capacity	29,500 m^3 x 10^3
Construction Cost	45,400 ₱ x 10^3

b. Alternative diversion dam

Total storage capacity	3,361 m^3 x 10^3
Construction Cost	20,600 ₱ x 10^3

c. Specific costs for agriculture 119,810 ₱ x 10^3

d. Gross alternative Construction Cost

a + b + c 185,810 ₱ x 10^3

2) Electric Power

a. Alternative dam

Total storage capacity	22,920 m^3 x 10^3
Construction Cost	43,800 ₱ x 10^3

b. Specific costs for electric power 13,500 ₱ x 10^3

c. Gross alternative Construction Cost

a + b 57,300 ₱ x 10^3

3. Separable Cost

1) Irrigation 69,750 - 43,800 = 25,950 ₱ x 10^3

2) Electric Power 69,750 - (45,400 + 20,600) = 375 ₱ x 10^3

4. Justifiable Expenditure Value

1) Irrigation

a. Annual incremental net production value not deduct labor cost 37,859 ₱ x 10^3

b. Incremental labor cost (farm family labor + hired labor)

(i) with the Project 4,268 ₱ x 10^3

(ii) without the Project 611

(i) - (ii) 3,657

c. Annual net benefit

a - b 37,859 - 3,657 = 34,202 ₱ x 10^3

d. Justifiable expenditure value

$$34,202 \div \frac{0.12\ (1+0.12)^{50}}{(1 + 0.12)^{50}-1} = 284,070 \text{ ₱} \times 10^3$$

i = 12%, n = 50 years

2) Electric Power

a. Annual benefit 1,746 10^3 ₱

b. Justifiable expenditure value

$$1,746 \div \frac{0.083\ (1 + 0.083)^{45}}{(1 + 0.083)^{45}-1} \left(1 - \frac{0.1}{(1 + 0.083)^{45}}\right)$$

= 20,510 ₱ x 10^3

i = 0.083 n = 45 years

Residual value rate 10%

5. Cost Allocation

(Unit: ₱ x 10^3)

	Item	Irrigation	Power	Total
a.	Alternative cost	185,810	57,300	
b.	Justifiable expenditure value	228,013	20,510	248,523
c.	Smaller either of a and b	185,810	20,510	
d.	Specific cost	119,810	14,425	134,235
e.	(c - d)	66,000	6,085	
f.	Separable cost	25,950	3,750	29,700
g.	(e - f)	40,000	2,335	42,385
h.	% of g	94.5	5.5	100.0
i.	Remining joint cost	37,850	2,200	40,050 1/
j.	Allocation cost	63,800	5,950	69,750
k.	% to be allocated	91.5	8.5	100.0

Note; 1/ 69,750 - 29,700 = 40,050

Internal Rate of Return

Internal rate of return is obtained by computation of present worth value. Present worth value of benefit and cost was computed at 50 years term as shown in the following Tables. Benefit streams are shown in Table 6-3 of main report. Cost streams consist of irrigation and power's construction economic cost, O & M cost and power's replacement cost.

Electric power and irrigation's present worth value isolated are shown in Table 6-6 and 6-7 of main report. Based on this Tables, internal rate of return of both project are obtained as the following figures.

Table 6G-1 Present Worth Value of Economic Cost - Irrigation and Power

Unit: Peso x 10^6

Year	Project Year	Irrigation	Power	O & M Irrig.	O & M Power	Power Re-Placement	Total Annual Cost	Discount Rate 5%	10%	15%	20%
1977	0	-	-	-	-	-	-	-	-	-	-
1978	1	-	-	-	-	-	-	-	-	-	-
1979	2	6.22	-	-	-	-	6.22	5.64	5.14	4.70	4.32
1980	3	5.91	-	-	-	-	5.91	5.13	4.44	3.88	3.42
1981	4	32.36	1.95	-	-	-	34.31	28.20	23.43	19.59	16.54
1982	5	28.29	1.46	-	-	-	29.75	23.29	18.45	14.79	11.93
1983	6	28.63	14.32	(1.47)	-	-	42.95	32.04	24.22	18.55	14.35
1984	7	38.81	2.96	(1.47)	-	-	41.77	29.66	21.43	15.66	11.65
1985	8	21.21	2.67	(0.74)	-	-	23.88	16.14	11.13	7.78	5.54
1986	9	-	-	2.39	0.43	-	2.82	1.82	1.19	0.80	0.54
1987 -2008	10 -31	-	-	2.39	0.43	-	2.82	Σ 23.93	Σ 10.49	Σ 5.10	Σ 2.68
2009	32	-	-	2.39	0.43	2.33	5.15	1.07	0.25	0.06	0.03
2010 -2018	33 -41	-	-	2.39	0.43	-	2.82	Σ 4.21	Σ 0.76	Σ 0.15	Σ 0.03
2019	42	-	-	2.39	0.43	13.20	16.02	2.05	0.29	0.03	0.00
2020 -2027	43 -50	-	-	2.39	0.43	-	2.82	Σ 2.34	Σ 0.27	Σ 0.04	Σ 0.00
Total		161.43	23.36	(104.06)	18.06	15.53	318.76	175.52	121.49	91.13	71.00

Note: Figures in the Parenthesis includes in the costs of Irrigation.

Table 6G-2 Present Worth Value of Benefit - Irrigation and Power

Unit: Peso c 10^6

Year	Project Year	Irrigation	Power	Total	Discount Rate 5%	10%	15%	20%
1977	0	-	-	-	-	-	-	-
1978	1	-	-	-	-	-	-	-
1979	2	-	-	-	-	-	-	-
1980	3	-	-	-	-	-	-	-
1981	4	-	-	-	-	-	-	-
1982	5	1.88	-	1.88	1.47	1.17	0.93	0.75
1983	6	8.74	-	8.74	6.52	4.93	3.78	2.92
1984	7	14.13	-	14.13	10.03	7.25	5.30	3.94
1985	8	24.73	-	24.73	16.72	11.52	8.06	5.74
1986	9	32.23	1.75	33.98	21.88	14.41	9.65	6.56
1987	10	35.94	1.75	37.69	23.10	14.51	9.31	6.07
1988	11	37.95	1.75	39.70	23.18	13.90	8.50	5.32
1989	12	38.88	1.75	40.63	22.59	12.92	7.56	4.55
1990	13	39.11	1.75	40.86				
-	-	-	-	-				
-	-	-	-	-	Σ 383.80	Σ 126.71	Σ 50.67	Σ 22.88
-	-	-	-	-				
2027	50	39.11	1.75	40.86				
Total		1,680.66	73.5	1,754.16	508.69	207.32	103.76	58.73

FIGURE 6G-1 INTERNAL RATE OF RETURN
— Irrigation Isolated —

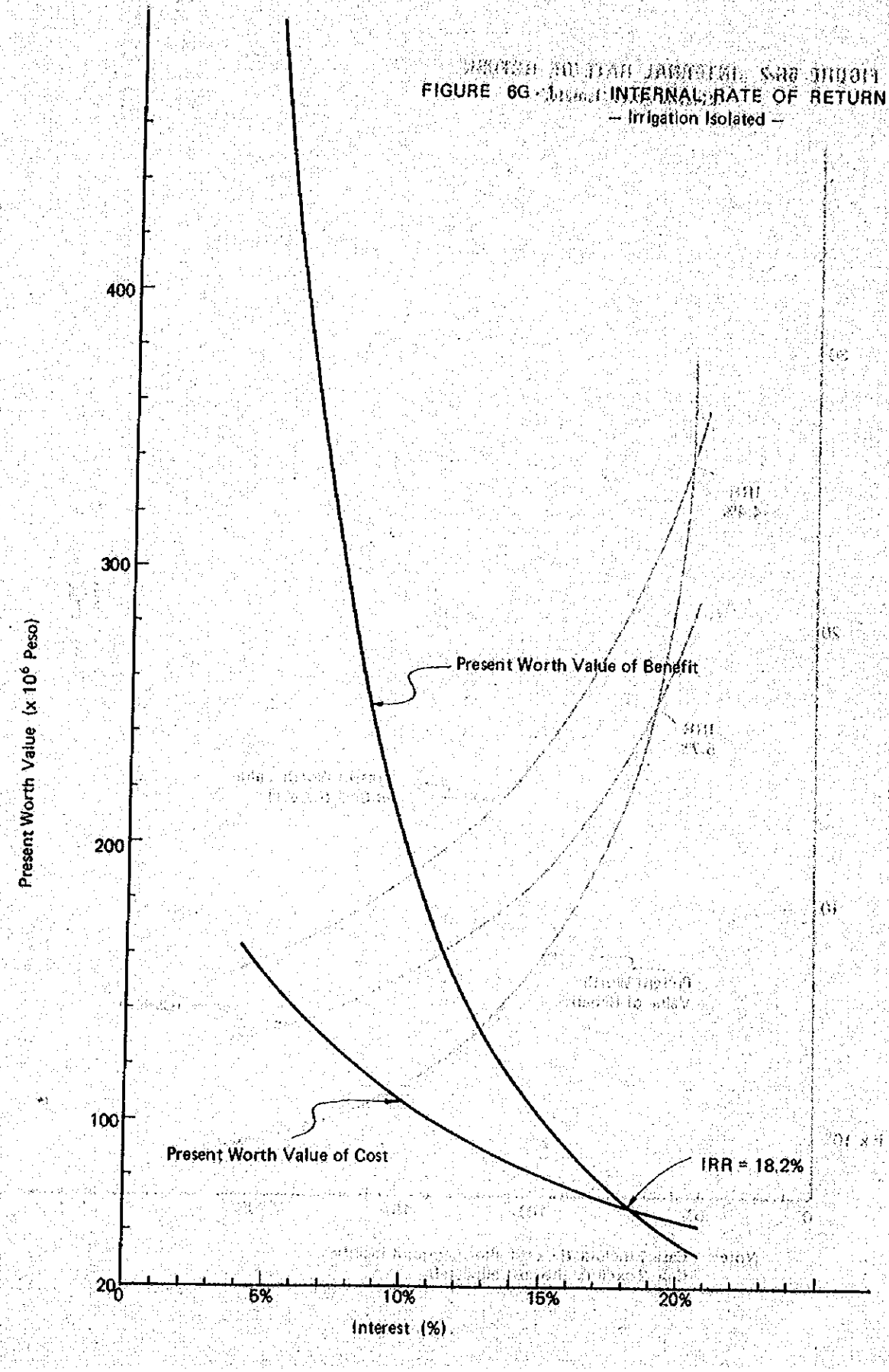
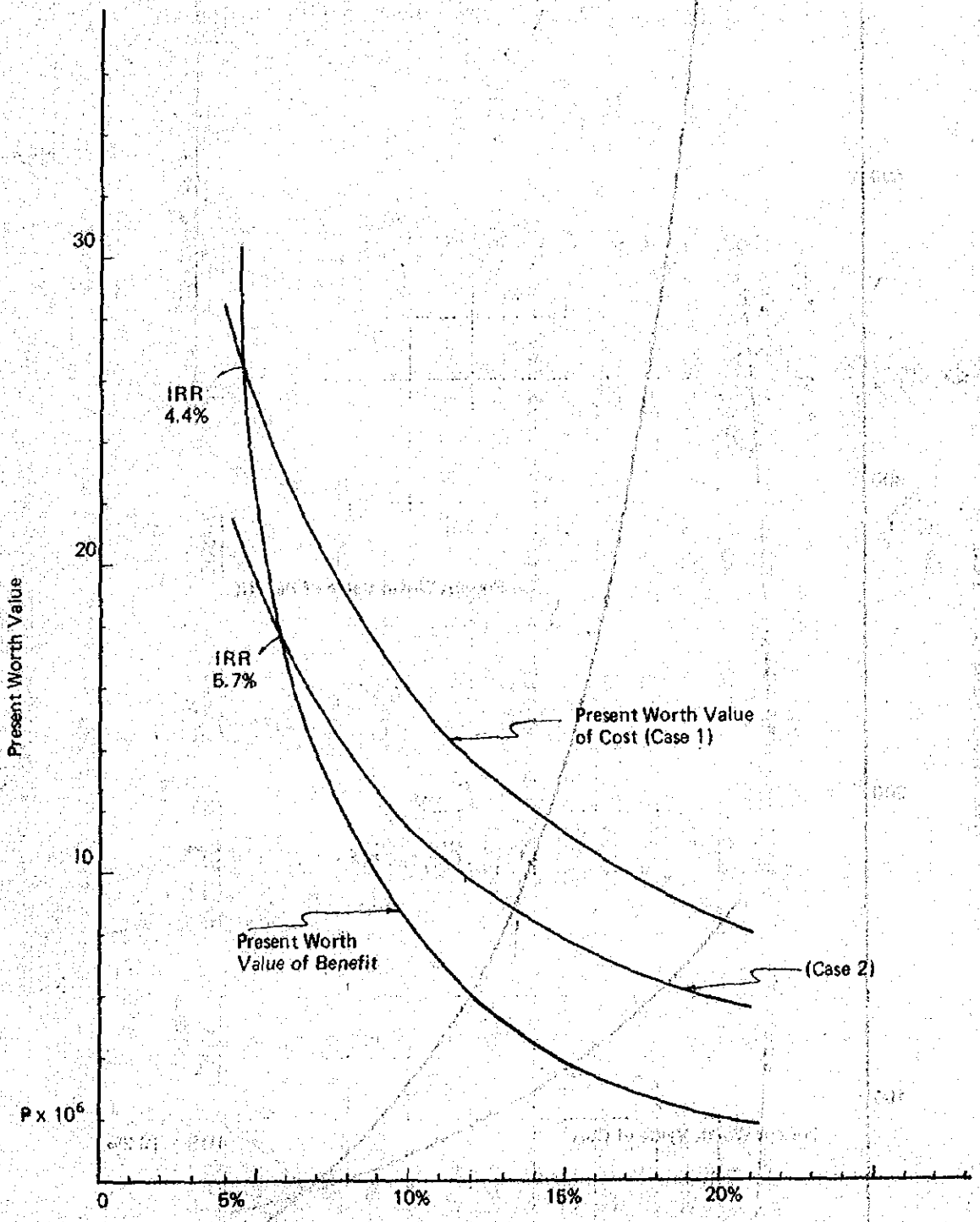


FIGURE 6G-2 INTERNAL RATE OF RETURN
– Electric Power Isolated –



Note: Case 1 include the cost allocated joint facilities.
Case 2 exclude the cost allocated.

CHAPTER VII STAGE DEVELOPMENT

Stage Development

A. Implementation Schedule

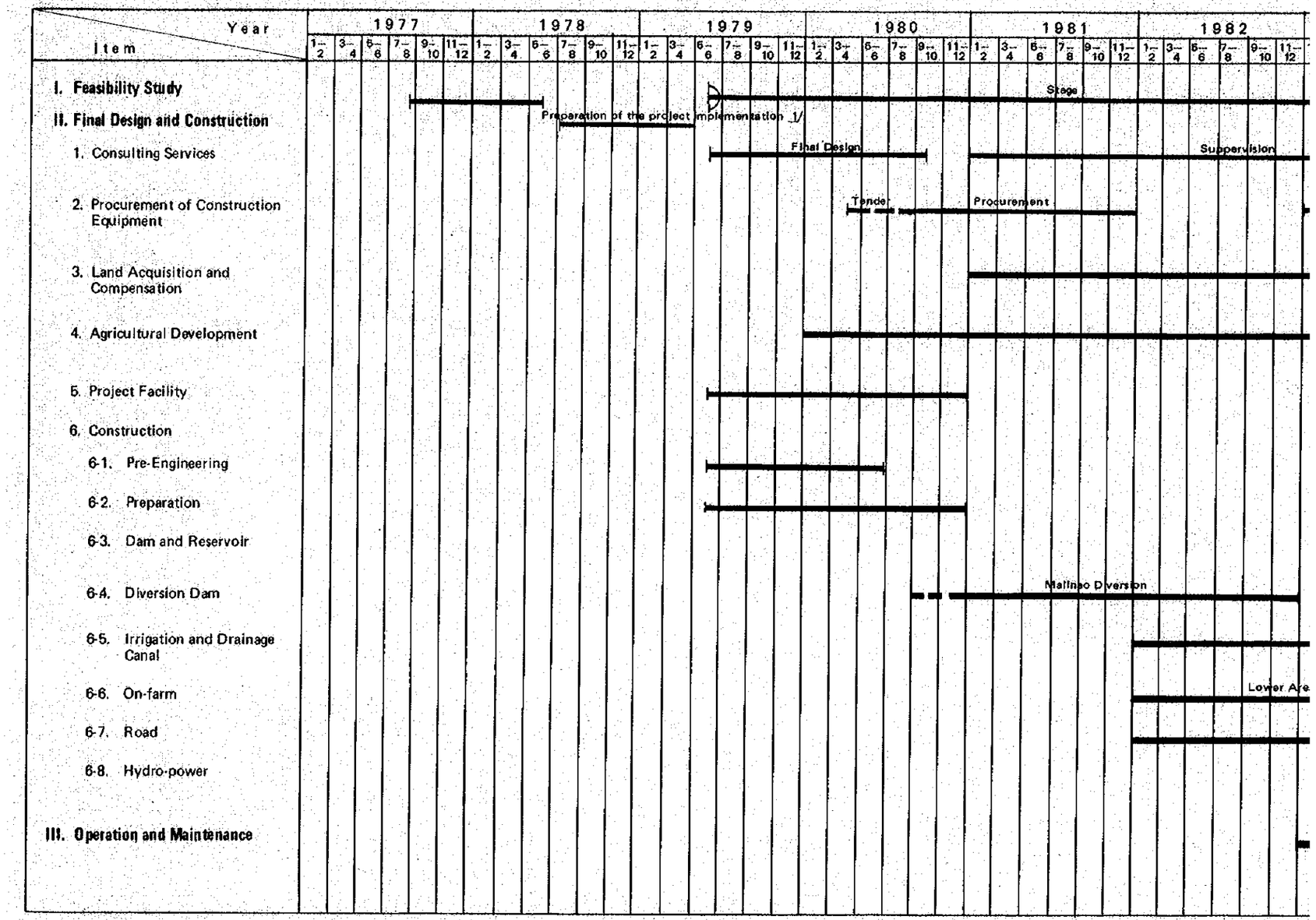
As one alternatives of the development schedule, stage development in phasing manner has been studied; the project is planned to be developed in two stages. The first stage (stage I) aims at developing the area of about 2,760 ha by using the available dependable discharge served by the proposed Malinao diversion dam only, and the second stage (Stage II) might be implemented, when the national economic conditions shall improve to be able to justify the high cost of developing the storage scheme. In the second stage, all of the areas of 5,320 ha will be served by means of the diversion dam and Pamacsalan dam.

The Stage I involves the construction of the Malinao diversion dam, irrigation and drainage systems to serve the area of about 2,760 ha, on-farm development, road and supporting services to meet the said areas. The Second Stage comprises of the construction of Pamacsalan dam, irrigation and drainage systems for the remaining areas of 2,560 ha including those of the upper area, remaining on-farm development, road and supporting services as well as hydro-power.

The construction periods of the Stage I is planned to be three years from FY 1981 to FY 1983 and Stage II is planned to start its construction from FY 1984 taking into account long construction periods of the Pamacsalan dam, and will be completed by mid-1987. Under this plan, the four and half years, from FY 1983 to mid-1987, have been considered to be enough to satisfy the above mentioned conditions.

Figure 7A-1 indicates the proposed implementation schedule for stage development. Table 7A-1 shows the yearly construction schedule of on-farm development.

FIGURE 7A-1. IMPLEMENTATION SCHEDULE FOR THE PROJECT



Note: 1/ include the negotiation for external financial arrangement of the project establishment of project organization and recruitement of consulting firm.

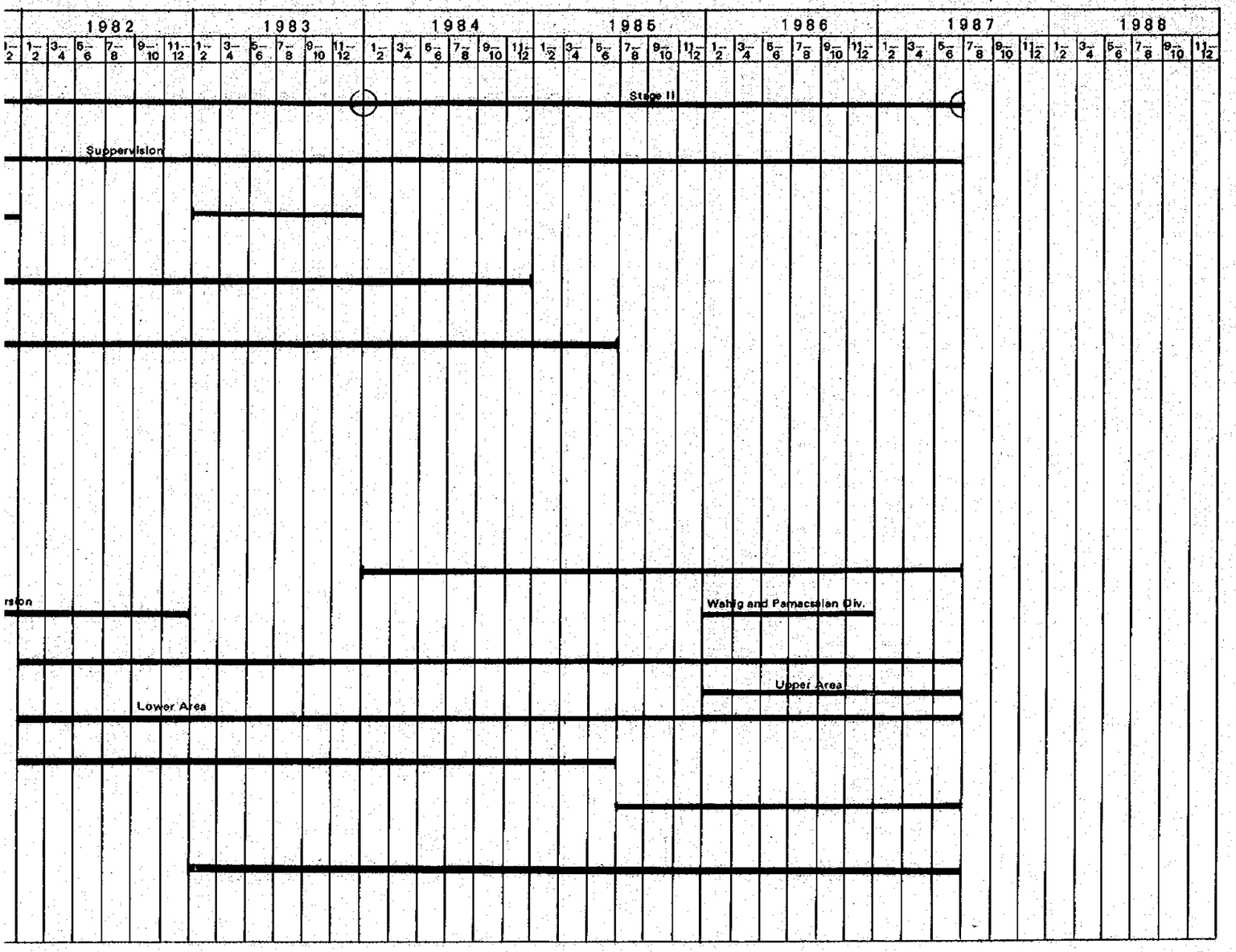
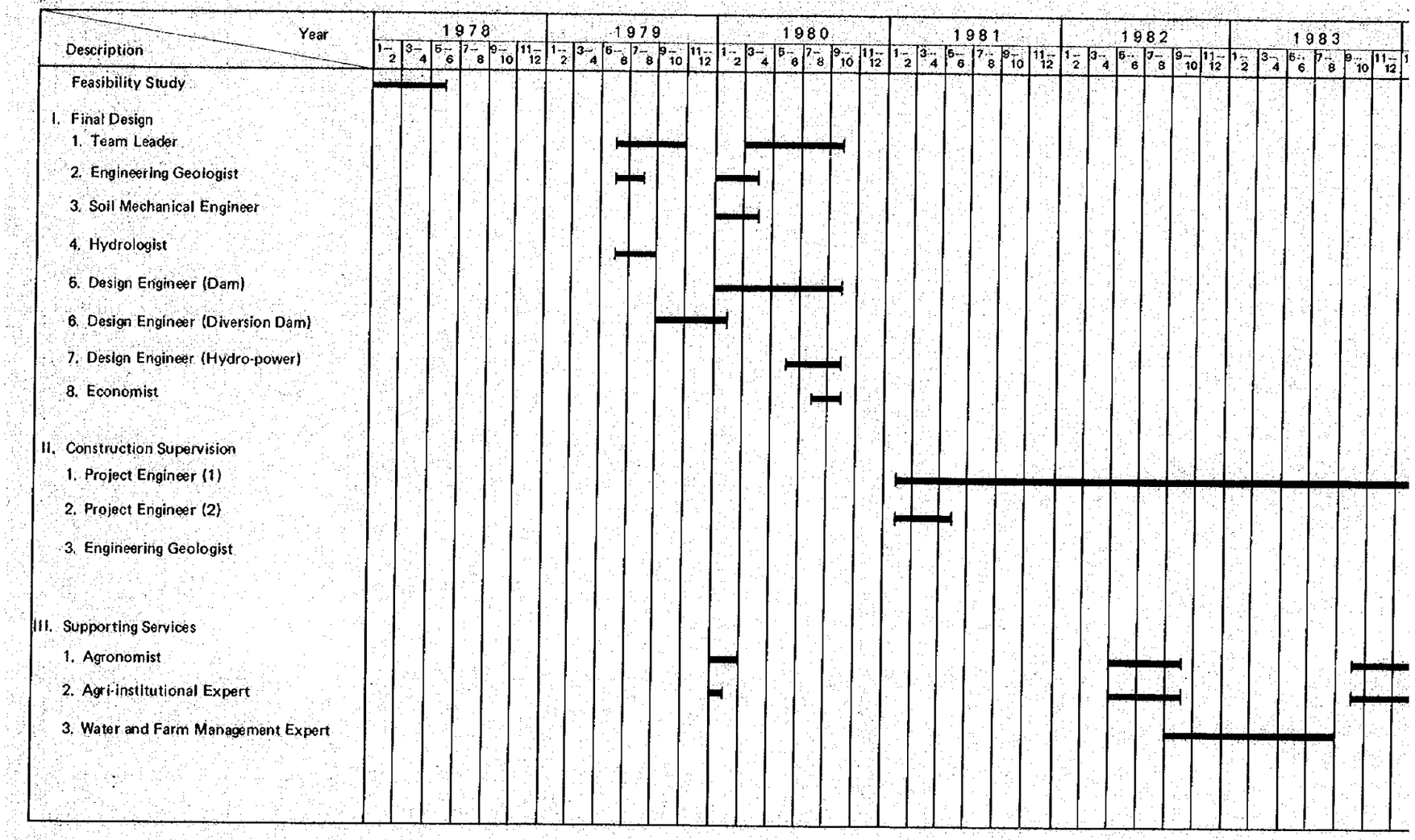
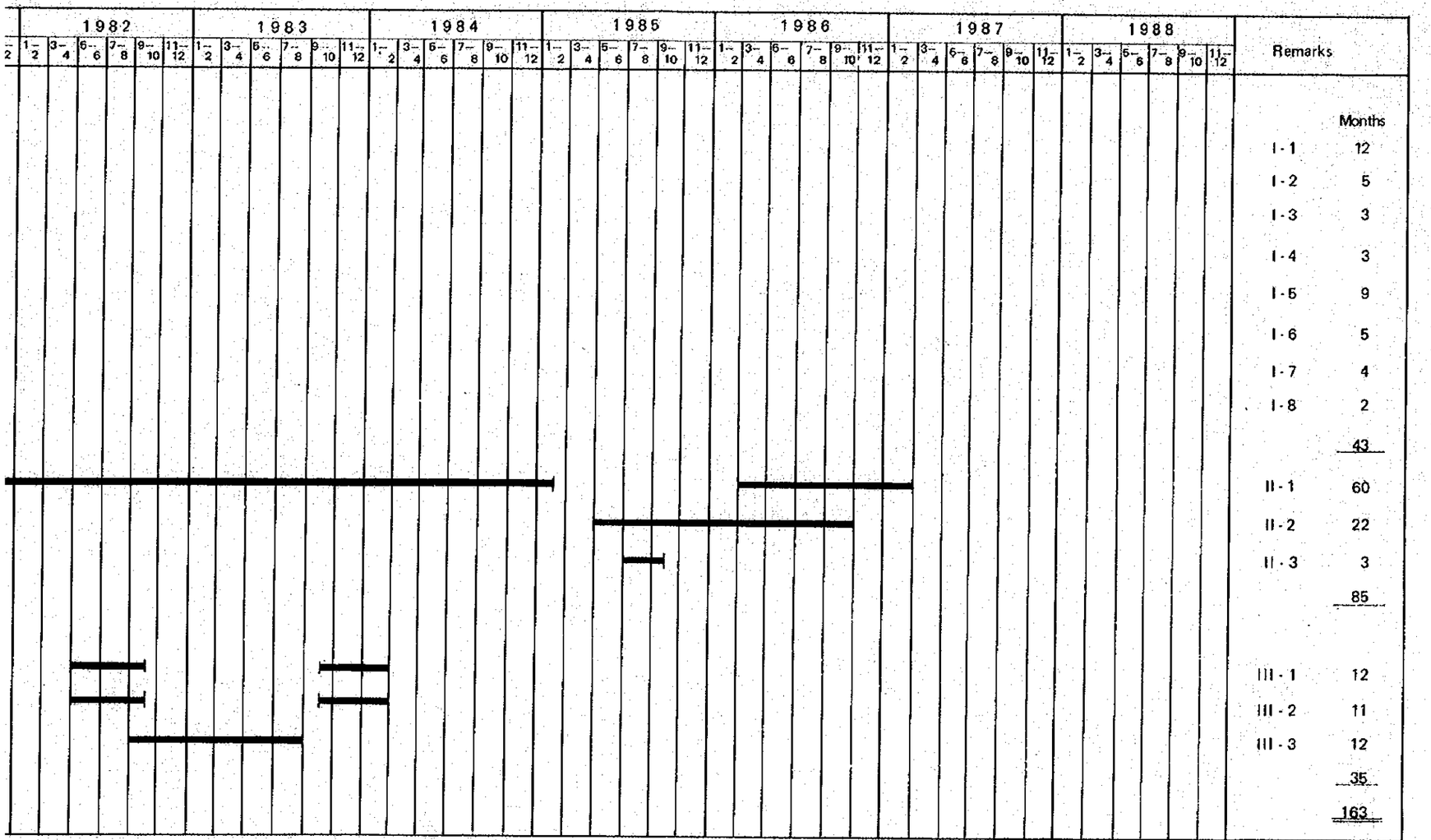

1982
1983
1984
1985
1986
1987
1988
Stage II
Supervision
rsion
Wahig and Pamaccalan Div.
Upper Area
Lower Area

FIGURE 7A - 2 PROPOSED SCHEDULE FOR CONSULTANT'S SERVICES





Remarks	
	Months
I-1	12
I-2	5
I-3	3
I-4	3
I-5	9
I-6	5
I-7	4
I-8	2
	43
II-1	60
II-2	22
II-3	3
	85
III-1	12
III-2	11
III-3	12
	35
	163

Table 7A-1. Yearly Construction Schedule of On-farm Development

Year	Upper Area			Lower Area	Total
	Wahig	Pamacsalan	Sub-Total		
1982	-	-	-	1,365	1,365
1983	-	-	-	1,392	1,392
1984	-	-	-	698	698
1985	-	-	-	690	690
1986	400	-	400	453	853
1987	-	120	120	202	322
Total	400	120	520	4,800	5,320

B. Project Cost and Disbursement Schedule

The Project cost in case of stage development is estimated by applying the same procedures as those of the Project Plan, except the cost of consulting services, which is evaluated based upon the expanded implementation schedule.

As the results, the total investment cost in each stage, including the cost for price escalation during the construction period, is estimated at about US$20.9 million (₱157.1 million) in Stage I and US$26.4 million (₱197.7 million) in Stage II, totaling US$47.3 million (₱369.2 million) as a whole. Table 7B-1 shows the breakdown of the investment by major items.

The project cost per hectare is estimated at about US$4,800 for overall plan in stage development plan, of which US$4,010 per hectare is in stage I and US$2,890 per hectare in Stage II respectively as shown below;

Description	Stage I	Stage II	Overall Plan
Project cost (US$'000) [1/]	11,070	15,380	26,450
Cost per hectare ($/ha)	4,010	2,890	4,970 (4,410) [2]

Note; 1/ : cost estimated by the depreciation basis for construction equipment and no inclusive at construction equipment cost and price escalation.
2/ : exclusive of allocated hydro-power cost.

Table 7B-1. Investment Cost of the Project

(Unit: ₱'000)

Description	Stage I			Stage II			Total
	F.C.	L.C.	Sub-total	F.C.	L.C.	Sub-total	
1. Civil Works	14,940	21,450	36,390	33,830	34,520	68,350	104,740
2. Land Acquisition and Compensation	-	5,770	5,770	-	700	700	6,470
3. Construction Equipment	37,900	380	38,380	13,250	13,480	13,480	51,760
4. Agricultural Development	-	1,040	1,040	-	480	480	1,520
5. Operation and Maintenance	-	710	710	-	2,490	2,490	3,200
6. Project Facility	990	4,750	5,740	-	-	-	5,740
7. Project Administration	4,300	2,730	7,030	3,770	3,070	6,840	13,870
8. Consulting Services	6,180	1,040	7,220	2,730	460	3,190	10,410
Sub-total	64,310	37,870	102,180	53,680	41,850	95,530	197,710
9. Contingency	9,650	5,680	15,330	8,050	6,280	14,330	29,660
Sub-total	73,960	43,550	117,510	61,730	48,130	109,860	227,370
			US$15,670x10^3			US$14,650x10^3	US$30,320x10^3
10. Price Escalation	23,730	15,870	39,600	46,960	48,130	109,860	149,460
Grand Total	97,690	59,420	157,100	108,690	89,030	197720	354,820
			US$20,950x10^3			US$26,360x10^3	US$47,310x10^3

Note: F.C.: Foreign currency L.C.: Local currency

The required investment cost on the depreciation basis of construction equipment is given in Table 7B-2.

Table 7B-2. Investment Cost of the Project (Depreciation Base)

(Unit: ₱'000)

	Description	Stage 0 F.C.	Stage 0 L.C.	Stage 0 Sub-total	Stage II F.C.	Stage II L.C.	Stage II Sub-total	Total
1.	Civil Works	14,940	21,450	36,390	33,830	34,520	68,350	104,740
2.	Land Acquisition and Compensation	-	5,770	5,770	-	700	700	6,470
3.	Construction Equipment	10,500	-	10,500	17,880	-	17,880	28,380
4.	Agricultural Development	-	1,040	1,040	-	480	480	1,520
5.	Operation and Maintenance	-	710	710	-	2,490	2,490	3,200
6.	Project Facility	990	4,750	5,740	-	-	-	5,740
7.	Project Administration	2,110	2,700	4,810	4,140	3,050	7,190	12,000
8.	Consulting Services	6,180	1,040	7,220	2,730	460	3,190	10,410
	Sub-total	34,720	37,460	72,180	58,580	41,700	100,280	172,460
9.	Contingency	5,210	5,620	10,830	8,790	6,250	15,040	25,870
	Sub-total	39,930	43,080	83,010	68,370	47,950	115,320	198,330
				US$11,070			US$15,380	US$26,450
10.	Price Escalation	14,950	15,740	30,690	56,080	40,800	96,880	127,570
	Grand Total	54,880	58,820	113,700	123,450	88,750	212,200	325,900
				US$15,160			US$28,290	US$43,450

Note: F.C.: Foreign currency
L.C.: Local currency

Table 7B-3. Disbursement Schedule for Stage I Development

(unit: ₱'000)

Description	Total			1st year (Jan.'79-Dec.'79)			2nd year (Jan.'80-Dec.'80)			3rd year (Jan.'81-Dec,'81)			4th year (Jan.'82-Dec,'82)			5th year (Jan.'83-Dec.'83)		
	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total
1. Civil Works	14,940	21,450	36,390	-	1,010	1,010	-	250	250	10,140	5,570	15,710	3,120	8,610	11,730	1,680	6,010	7,690
1-1. Preparation	80	140	220	-	-	-	-	-	-	80	140	220	-	-	-	-	-	-
1-2. Dam	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-3. Diversion Dam	11,500	8,030	19,530	-	-	-	-	-	-	10,060	5,430	15,490	1,440	2,600	4,040	-	-	-
1-4. Irrigation and Drainage Canals	2,220	8,440	10,660	-	-	-	-	-	-	-	-	-	1,110	4,220	5,330	1,110	4,220	5,330
1-5. On-farm	820	2,160	2,980	-	-	-	-	-	-	-	-	-	410	1,080	1,490	410	1,080	1,490
1-6. Roads	320	1,420	1,740	-	-	-	-	-	-	-	-	-	160	710	870	160	710	870
1-7. Hydro-power	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-8. Pre-Engineering	-	1,260	1,260	-	1,010	1,010	-	250	250	-	-	-	-	-	-	-	-	-
2. Land Acquisition and Compensation	-	5,770	5,770	-	-	-	-	-	-	-	3,640	3,640	-	990	990	-	1,140	1,140
3. Construction Equipment	37,900	380	38,280	-	-	-	-	-	-	37,900	380	38,280	-	-	-	-	-	-
4. Agricultural Development	-	1,040	1,040	-	-	-	-	260	260	-	260	260	-	260	260	-	260	260
5. Operation and Maintenance Cost	-	710	710	-	-	-	-	-	-	-	-	-	-	-	-	-	710	710
6. Project Facility	990	4,750	5,740	990	2,370	3,360	-	2,380	2,380	-	-	-	-	-	-	-	-	-
7. Project Administration	4,300	2,730	7,030	80	270	350	-	230	230	3,840	790	4,630	250	790	1,040	130	650	780
8. Consulting Services	6,180	1,040	7,220	770	130	900	1,750	290	2,040	820	140	960	1,420	240	1,660	1,420	240	1,660
Sub-total (1 to 8)	64,310	37,870	102,180	1,840	3,780	5,620	1,750	3,410	5,160	52,700	10,780	63,480	4,790	10,890	15,680	3,230	9,010	12,240
9. Contingency	9,650	5,680	15,330	280	570	850	260	510	770	7,900	1,620	9,520	720	1,630	2,350	490	1,350	1,840
Sub-total (1 to 9)	73,960	43,550	117,510	2,120	4,350	6,470	2,010	3,920	5,930	60,600	12,400	73,000	5,510	12,520	18,030	3,720	10,360	14,080
10. Price Escalation	23,730	15,870	39,600	260	540	800	430	830	1,260	18,790	3,840	22,630	2,290	5,190	7,480	1,960	5,470	7,430
Grand-total (1 to 10)	97,690	59,420	157,110	2,380	4,890	7,270	2,440	4,750	7,190	79,390	16,240	95,630	7,800	17,710	25,510	5,680	15,830	21,510

Table 7B-4. Disbursement Schedule for Stage II Development

(Unit: ₱'000)

Description	Total			5th year (Jan.'83 - Dec.'83)			6th year (Jan.'84 - Dec.'84)			7th year (Jan.'85 - Dec.'85)			8th year (Jan.'86 - Dec. '86)			9th year (Jan.'87 - Dec.'87)		
	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total
1. Civil Works	33,830	34,520	68,350	-	-	-	3,530	7,770	11,300	15,510	8,240	23,750	10,740	11,740	22,480	4,050	6,770	10,820
1-1. Preparation	100	280	380	-	-	-	70	200	270	-	-	-	30	80	110	-	-	-
1-2. Dam	19,270	19,800	39,070	-	-	-	2,480	3,980	6,460	4,260	3,870	8,130	9,380	7,480	16,860	3,150	4,470	7,620
1-3. Diversion Dam	310	860	1,170	-	-	-	-	-	-	-	-	-	310	860	1,170	-	-	-
1-4. Irrigation and Drainage Canals	2,040	7,800	9,840	-	-	-	580	2,200	2,780	580	2,200	2,780	580	2,200	2,780	330	1,200	1,500
1-5. On-farm	760	2,000	2,760	-	-	-	210	570	780	210	570	780	210	870	780	130	290	420
1-6. Roads	310	1,320	1,630	-	-	-	190	820	1,010	120	500	620	-	-	-	-	-	-
1-7. Hydro-power	11,040	2,460	13,500	-	-	-	-	-	-	10,340	1,100	11,440	230	550	780	470	810	1,280
1-8. Pre-Engineering	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Land Acquisition and Compensation	-	700	700	-	-	-	-	700	700	-	-	-	-	-	-	-	-	-
3. Construction Equipment	13,350	130	13,480	13,350	130	13,480	-	-	-	-	-	-	-	-	-	-	-	-
4. Agricultural Development	-	480	480	-	-	-	-	260	260	-	220	220	-	-	-	-	-	-
5. Operation and Maintenance Cost	-	2,490	2,490	-	-	-	-	710	710	-	710	710	-	710	710	-	360	360
6. Project Facility	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7. Project Administration	3,770	3,070	6,480	1,070	10	1,080	280	760	1,040	1,240	730	1,970	860	1,000	1,860	320	570	890
8. Consulting Services	2,730	460	3,190	-	-	-	870	150	1,020	670	110	780	1,080	180	1,260	110	20	130
Sub-total	53,680	41,850	95,520	14,420	140	14,560	4,680	10,350	15,030	17,420	10,010	27,430	12,680	13,630	26,310	4,480	7,720	12,200
9. Contingency	8,050	6,280	14,330	2,160	20	2,180	700	1,550	2,250	2,620	1,500	4,120	1,900	2,050	3,950	670	1,160	1,830
Sub-total (1 to 9)	61,730	48,130	109,860	16,580	160	16,740	5,380	11,900	17,280	20,040	11,510	31,550	14,580	15,680	30,260	5,150	8,880	14,030
10. Price Escalation	46,960	40,900	87,860	8,750	90	8,840	3,500	7,730	11,230	15,670	9,000	24,670	13,490	14,500	27,990	5,550	9,580	15,130
Grand-total (1 to 10)	108,690	89,030	197,720	25,330	250	25,580	8,880	19,630	28,510	35,710	20,510	56,220	28,070	30,180	58,250	10,700	18,460	29,160

TABLE 7B-5. Disbursement Schedule for Stage I Development (Depreciation Base)

Description	Total			1st year (Jan.'79 - Dec.'79)			2nd year (Jan.'80 - Dec.'80)			3rd year (Jan.'81 - Dec.'81)			4th year (Jan.'82 - Dec.'82)			5th year (Jan.'83 - Dec.'83)		
	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total
1. Civil Works	14,940	21,450	36,390	-	1,010	1,010	-	250	250	10,140	5,570	15,710	3,120	8,610	11,730	1,680	6,010	7,690
1-1. Preparation	80	140	220	-	-	-	-	-	-	80	140	220	-	-	-	-	-	-
1-2. Dam	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-3. Diversion Dam	11,500	8,030	19,530	-	-	-	-	-	-	10,060	5,430	15,490	1,440	2,600	4,040	-	-	-
1-4. Irrigation and Drainage Canals	2,220	8,440	10,660	-	-	-	-	-	-	-	-	-	1,110	4,220	5,330	1,110	4,220	5,330
1-5. On-farm	820	2,160	2,980	-	-	-	-	-	-	-	-	-	410	1,080	1,490	410	1,080	1,490
1-6. Roads	320	1,420	1,740	-	-	-	-	-	-	-	-	-	160	710	870	160	710	870
1-7. Hydro-power	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-8. Pre-Engineering	-	1,260	1,260	-	1,010	1,010	-	250	250	-	-	-	-	-	-	-	-	-
2. Land Acquisition and Compensation	-	5,770	5,770	-	-	-	-	-	-	-	3,640	3,640	-	990	990	-	1,140	1,140
3. Construction Equipment	10,500	-	10,500	-	-	-	-	-	-	1,500	-	1,500	4,690	-	4,690	4,310	-	4,310
4. Agricultural Development	-	1,040	1,040	-	-	-	-	260	260	-	260	260	-	260	260	-	260	260
5. Operation and Maintenance Cost	-	710	710	-	-	-	-	-	-	-	-	-	-	-	-	-	710	710
6. Project Facility	990	4,750	5,740	990	2,370	3,360	-	2,380	2,380	-	-	-	-	-	-	-	-	-
7. Project Administration	2,110	2,700	4,810	80	270	350	-	230	230	930	760	1,690	620	790	1,410	480	650	1,130
8. Consulting Services	6,180	1,040	7,220	770	130	900	1,750	290	2,040	820	140	960	1,420	240	1,660	1,420	240	1,660
Sub-totsl (1 to 8)	34,720	37,460	72,180	1,840	3,780	5,620	1,750	3,410	5,160	13,390	10,370	23,760	9,850	10,890	20,740	7,890	9,010	16,900
9. Contingency	5,210	5,620	10,830	280	570	850	260	510	770	2,010	1,560	3,570	1,480	1,630	3,110	1,180	1,350	2,530
Sub-total (1 to 9)	39,930	43,080	83,010	2,120	4,350	6,470	2,010	3,920	5,930	15,400	11,930	27,330	11,330	12,520	23,850	9,070	10,360	19,430
10. Price Escalation	14,950	15,740	30,690	260	540	800	430	830	1,260	4,770	3,700	8,470	4,700	5,200	9,900	4,790	5,470	10,260
Grand-total (1 to 10)	54,880	58,820	113,700	2,380	4,890	7,270	2,440	4,750	7,190	20,170	15,630	35,800	16,030	17,720	33,750	13,860	15,830	29,690

Table 7B-6. Disbursement Cost for Stage II Development (Depreciation Base)

Description	Total			6th year (Jan.'84-Dec.'84)			7th year (Jan.'85-Dec.'85)			8th year (Jan,'86-Dec,'96)			9th year (Jan.'87-Dec.'87)		
	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total
1. Civil Works	33,830	34,520	68,350	3,530	7,770	11,300	15,510	8,240	23,750	10,740	11,740	22,480	4,050	6,770	10,820
1-1. Preparation	100	280	380	70	200	270	-	-	-	30	80	110	-	-	-
1-2. Dam	19,270	19,800	39,070	2,480	3,980	6,460	4,260	3,870	8,130	9,380	7,480	16,860	3,150	4,470	7,620
1-3. Diversion Dam	310	860	1,170	-	-	-	-	-	-	310	860	1,170	-	-	-
1-4. Irrigation and Drainage Canals	2.040	7,800	9,840	580	2,200	2,780	580	2,200	2,780	580	2,200	2,780	300	1,200	1,500
1-5. On-farm	760	2,000	2,760	210	570	780	210	570	780	210	570	780	130	290	420
1-6. Roads	310	1,320	1,630	190	820	1,010	120	500	620	-	-	-	-	-	-
1-7. Hydro-power	11,040	2,460	13,500	-	-	-	10,340	1,100	11,440	230	550	780	470	810	1,280
1-8. Pre-Engineering	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Land Acquisition and Compensation	-	700	700	-	700	700	-	-	-	-	-	-	-	-	-
3. Construction Equipment	17,880	-	17,880	6,040	-	6,040	5,590	-	5,590	4,290	-	4,290	1,960	-	1,960
4. Agricultural Development	-	480	480	-	260	260	-	220	220	-	-	-	-	-	-
5. Operation and Maintenance Cost	-	2,490	2,480	-	710	710	-	710	710	-	710	710	-	360	360
6. Project Facility	-	-	-	-	-	-	-	-	-	-	-		-	-	-
7. Project Administration	4,410	3,050	7,190	770	750	1,520	1,690	730	2.420	1,200	1,000	2,200	480	570	1,050
8. Consulting Services	2,730	460	3,190	870	150	1,020	670	110	780	1,080	180	1,260	110	20	130
Sub-total (1 to 8)	58,580	41,700	100,280	11,210	10,340	21,550	23,460	10,010	33,470	17,310	13,630	30,940	6,600	7,720	14,320
9. Contingency	8,790	6,250	15,040	1,680	1,550	3,230	3,520	1,500	5,020	2,600	2,040	4,640	990	1,160	2,150
Sub-total (1 to 9)	67,370	47,950	115,320	12,890	11,890	24,780	26,980	11,510	38,490	19,910	15,670	35,580	7,590	8,880	16,470
10. Price Escalation	56,080	40,800	96,880	8,380	7,730	16,110	21,100	9,000	30,100	18,420	14,490	32,910	8,180	9,580	17,760
Grand-total (1 to 10)	123,450	88,750	212,200	21,270	19,620	40,890	48,080	20,510	68,590	38,330	30,160	68,490	15,770	18,460	34,230

The annual disbursement schedule for the investment cost is shown in Table 7B-3 to 7B-6.

C. Economic Justification

1. Benefited Area

The beneficial area of the lower area in the Project Plan which would be served by the Malinao diversion dam was decided at 2,757 ha on the assumption that the construction of Pamacsalan dam will be completed within two and half years after completion of the Malinao diversion dam, that is the area of 2,757 ha corresponds to meet the probable discharge of about return period two years. However, in case of stage development plan, such area should be decided based on the more severe probable discharge considering the long periods of the completion of dam construction, thus reducing the beneficial area.

According to the operation study of the diversion dam for last 10 years from 1966/1967 to 1976/1976, an average irrigable area during the 10 years is computed at 2,375 ha as shown below. Therefore, the harvested area in the stage I is decided at 2,375 ha though the area of 2,757 ha will be planted.

Result of Operation Study

Year	Irrigable Area (ha)
1966 - 1967	2,040
1967 - 1968	1,780
1968 - 1969	1,610
1969 - 1970	2,757 (3,800)[1]
1970 - 1971	2,757 (3,270)
1971 - 1972	2,757 (4,800)
1972 - 1973	1,810
1973 - 1974	2,757 (4,800)
1974 - 1975	2,757 (3,105)
1975 - 1985	2,730
Average	2,375

Note: figures in the parenthesis show potential irrigable area by discharge
4,800 ha ..... Project area in lower area of the Project Plan
2,757 ha ..... Project area of Stage I Project.

Table 7C-1 shows the annual increase of beneficial area up to full target.

Based upon the implementation schedule in the stage development, on-farm development will be undertaken in two stages, Stage I in two years (1982 - 1983) and Stage II in four years (1984 - 1987). The present land category in each stage is as follows:

Present Land Category in Each Stage

Land use under existing situation	Stage I		Stage II		Overall	
	Before Const.	After Const.	Before Const.	After Const.	Before Const.	After Const.
Paddy irrigated	59	57	409	382	468	439
Rainfed	559	532	501	479	1,060	1,011
Upland						
Palay 1/	39	34	248	210	287	244
Others Crop 1/	55	47	168	143	223	190
Grasslands 1/	2,456	2,087	1,583	1,349	4,039	3,436
Total	3,168	2,757	2,909	2,563	6,077	5,320

Note: 1/ Land to be reclaimed for paddy field in the project.

2. Economic Cost

The economic cost was revised from the financial cost, which is estimated on the basis of financial base, under the economic consideration of the items of unskilled labor, fuel and oil, land acquisition and compensation. The depreciation cost of construction equipment is amounted to be US$1.40 million (₱10.5 million) in the Stage I and US$2.39 million (₱17.9 million) in the Stage II.

Table 7C-1. Annual Beneficial Area

(unit: ha)

	1982	1983	1984	1985	1986	1987	1988	1989	1990
Overall Project									
Wet Season									
Area Planted	-	1,365	2,757	2,757	2,757	2,757	5,176	5,176	5,176
Area Harvested	-	1,365	2,375	2,375	2,375	2,375	5,176	5,176	5,176
Dry Season									
Area Planted	1,365	2,757	2,757	2,757	2,757	5,320	5,320	5,320	5,320
Area Harvested	1,365	2,375	2,375	2,375	2,375	5,320	5,320	5,320	5,320
Total									
Area Planted	1,365	4,122	5,514	5,514	5,514	8,077	10,496	10,496	10,496
Area Harvested	1,365	3,740	4,750	4,750	4,750	7,695	10,496	10,496	10,496
Stage I. Project									
Total									
Area Planted	1,365	4,122	5,514	5,514	5,514	5,514	5,514	5,514	5,514
Area Harvested	1,365	3,740	4,750	4,750	4,750	4,750	4,750	4,750	4,750

3. Incremental Benefit

Target yield, production cost and unit price of products are assumed to be same as those of the Project Plan. Input materials in the Stage I are to be supplied to meet the planted area and output are estimated on the basis of harvested area.

Table 7C-2 indicates an annual stream of economic cost and incremental NPV in the Stage I and Overall Plan.

4. Internal Rate of Return

Internal Rate of Return (IRR) is computed at 17.2 percent in the Stage I and 16.4 percent in the Overall Plan as shown in Figure 7C-1 and 7C-2.

Table 7C-2. Economic Cost and Incremental Benefit

(unit: 10 peso)

Item	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
[Stage I] - Benefited Area 2,757 ha														
Economic Cost	6,170	5,860	31,540	19,020	15,300	-	-	-	-	-	-	-	-	-
Incremental NPV														
Irrigation	-	-	-	2,576	7,905	11,911	14,801	16,749	17,635	17,666	17,686	17,686	17,686	17,686
[Overall] - Benefited Area 5,320 ha														
Economic Cost	6,170	5,860	31,770	19,250	16,820	17,780	34,000	33,040	17,600	-	-	-	-	-
Incremental NPV														
Irrigation	-	-	-	1,881	7,212	11,017	13,463	14,826	24,952	34,115	35,546	37,341	38,485	38,711
Electric Power	-	-	-	-	-	-	-	-	1,750	1,750	1,750	1,750	1,750	1,750
Total	-	-	-	1,881	7,212	11,017	13,463	14,826	26,702	35,865	37,296	39,091	40,235	40,461

FIGURE 7C-1 INTERNAL RATE OF RETURN (STAGE I).
IRRIGATION ONLY (2,757 ha)

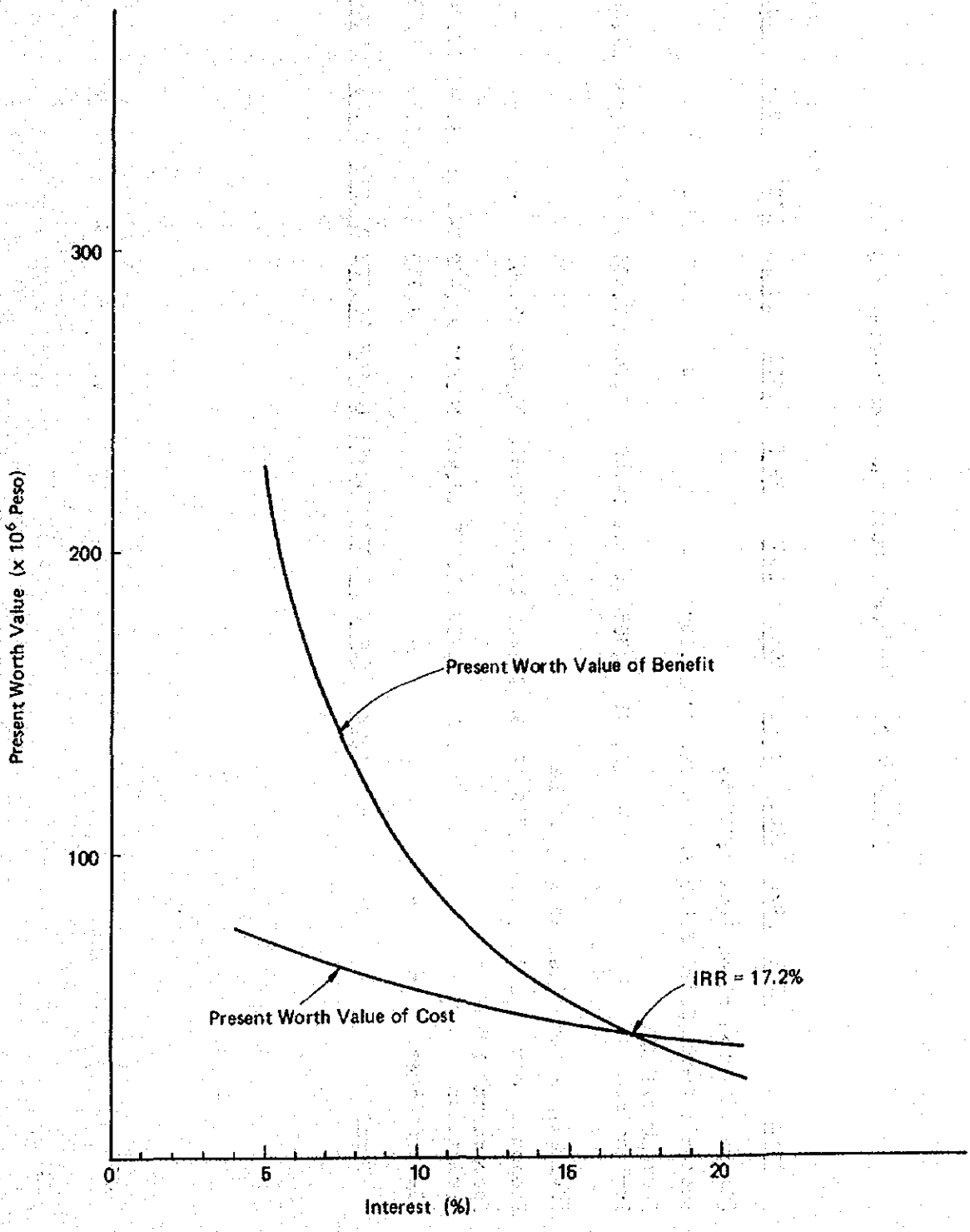


FIGURE 7C-7 INTERNAL RATE OF RETURN

(Overall Project in Stage Development)
Irrigation (5,320 ha) + Hydro-Power