

## IX. Cost Estimation

### §-1. Schedule of Implementation

There are two alternative processes for the completion of these systems.

(a) When three systems are completed simultaneously

Case in which the Agno, Bicol and Cagayan systems are brought into construction simultaneously for simultaneous completion.

(b) When the systems are completed on a step-by-step basis

Case in which the systems are completed one by one according to the priority schedule.

#### 1. Simultaneous Completion of the Three Systems

In this case the schedule of implementation is as follows:

- |   |          |
|---|----------|
| 1) Detail design of facilities and structure                    | 6 months |
| 2) Multiple line test and detail design                         | 5 months |
| 3) Manufacture of telecommunications facilities                 | 8 months |
| 4) Installation and adjustment of telecommunications facilities | 2 months |
| 5) Civil work   | 8 months |

#### 2. Completion on a Step-by-step Basis

The schedule of implementation here is three years, with the Agno, Bicol, and Cagayan systems completed in the following order.

First year ----- Agno system  
Second year ----- Bicol system  
Third year ----- Cagayan system



Table 9-2 Schedule of Implementation Case 2 (the three systems are to be completed on a step-by-step basis.)

Item	1			2			3			4			5												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
I Detail design																									
1. Detail design of civil work																									
Architectural design																									
Civil engineering design																									
Design of towers and foundation works																									
2. Detail design of Telecommunication																									
Manufacture of facilities																									
Multiple link survey																									
Detail design																									
II Bidding, document, etc.																									
1. Appraisal mission																									
2. Selection of consultant																									
3. Tender document																									
4. Bidding																									
5. Evaluation																									
III Telecommunication																									
1. Manufacture																									
2. Installation and adjustment																									
IV Civil works																									
1. Sub-center																									
2. Relay station																									
3. Towers and poles																									
4. Housing																									
5. Water level stage station																									
6. Gaging facilities																									
Manufacture of facilities																									
Installation and adjustment																									
V Engineering service																									
1. Training																									
2. Consultant of supervision																									
3. On-the job training																									
Agno System																									
Bicol System																									
Cagayan System																									

## §-2. Condition of the Estimation

The following conditions have been considered in the estimation of the cost of the systems.

1) Estimation is based as of March 1977 and reflects a yearly 10%\* price increase in the yearly schedule.

2) The provision for reserves is equal to 20% of the total sum of the construction and equipment costs allowing for the cost of technical supervision and operation and maintenance.

3) A sum equal to 3% of the total cost of construction and equipment is appropriated as the cost of operation and maintenance.

4) Water level, rainfall and flow rate gaging facilities, already existing, will be utilized as they are, with no cost of new construction allowed in the estimation. Cost of adjustment of telecommunications facilities will be reflected, however.

5) For existing gaging facilities, housing cost will be appropriated as new construction items (Cagayan River Basin, Maris Dam, and Dallibubun gaging stations).

6) Design of new housing for gaging facilities will be such that it will contain telemetering facilities. The purchase of such construction lot will be undertaken by the Government of the Philippines for estimation purposes.

Cost of each facility will be estimated by the BPW personnel, with the price prevailing as of March 1977, expressed in unit cost in terms of Peso.

7) The cost of rainfall gages, water level gages, desk-top computers, and telemetering installations as well as accessories, spare parts, installation and adjustment materials and maintenance cars will be estimated with respect to Japanese suppliers on the basis of unit cost prevailing as of March 1977, expressed in terms of US\$. The freight from Yokohama to Manila, insurance, handling fee, transportation from Manila to local sites have been estimated and incorporated as unit price prevailing as of March 1977 based on the estimation information available from the BPW.

8) Installation and adjustment cost means the cost required by Japanese engineers in making installation and adjustment on the site and has been estimated in unit price prevailing as of March 1977 in terms of US\$.

9) Training expenditure means the cost expense necessary to train eight hydrologists and eleven telecommunications engineers in Japan for

two months, in the study of flood forecasting and warning projects in the Philippines, and has been estimated in unit price prevailing as of March 1977 in terms of US\$.

10) Design and engineering charge refers to the design and engineering service rendered by one Japanese hydrologist five telecommunications engineers and one architect (especially for the pole type stations), and has been estimated in price prevailing as of March 1977 in terms of US\$.

11) Technical supervision fee refers to the expense incurred by one Japanese hydrologist and four telecommunications engineers to train three Philippine hydrologists and fifteen telecommunication engineers for two years as local supervision service, and has been estimated in price prevailing as of March 1977 in terms of US\$.

12) The cost of detail design of civil engineering work refers to the cost incurred in local survey and design of buildings, pole type stations, and towers, and has been estimated in price prevailing as of March 1977 in terms of US\$.

13) The cost of detail design of telecommunications facilities refers to the cost of analysis and design, and has been estimated in price prevailing as of March 1977 in terms of US\$.

14) All US\$ and Peso conversions will be made on a 1 US\$ = 7.39 Peso basis.

### 15) Classification by Foreign and Domestic Currencies

Cost of Flood Forecasting and Warning Systems in the Philippines  
Classified by Foreign and Domestic Currencies

Kind of Works	Foreign Currencies	Domestic Currencies	Remarks
I. Civil Works Observation	Equipment cost	Transportation and Installation labor cost	Rainfall gages, waterlevel gages, current meters float droppers vacuum pumps, patrol vehicles, small computers
Housing		Materials cost Transportation cost Installation and assembly labor cost	Stations (20), relay stations (4) sub-centers (3), relay centers (2), site maintenance
Telecommunica- tions	Steel tower upper part materials cost	Steel tower founda- tion materials cost Materials cost Labor cost	Steel towers, telepoles
II. Telecommunica- tions equipment	Equipment cost Installation and adjustment cost		
III. Engineering Service Civil engineer- ing design	Stations (20) Repeater stations (4) Sub-centers (3) Relay centers (2) Telepoles (18) Pole type station (10)	Wele type station (well) (6)	Detail design Civil works tower founda- tion, surveying
Design of tele- communication facilities	Telecommunication Analysis and design cost		
Engineering supervision	Engineering supervi- sion cost		
Training	Training cost	Tranning cost in the Philippines	
IV. Operation and Maintenance	Foreign currencies (I + II) x 3%	Domestic currencies (I + II) x 3%	
V. Contingency	Foreign currencies (I + II) x 20%	Domestic currencies (I + II) x 20%	

\* In regard to percentage increase in wages, and cost of materials, and machinery and equipment, etc., the Deflator GNP of Japan is adopted taking the upward trend in the Philippines into consideration. Because it is presumed, especially for the costs of machinery and equipment, that the rates of price hike in Japan reflect considerably in the above-mentioned percentage increase. The Deflator GNP of 10% is based on the forecast by the Japan Economic Research Center, and the latest economic trend in Japan (approx. 10% increase in the Consumer Price Index: 1976 - 1977).

GNP (GDP) Deflator Increase Percentage

Organization for Economic Co-Operation and  
Development

Countries/Year	1959/60 - 1972/73	1974	1975*	1976**
Developed Countries (US, W. Europe, Japan)	4.1	12.2	10.75	8.0

Japan Economic Research Center

Countries/Year	1960 - 1970	1970 - 1975*
South-East Asia	1.8	11.8
Africa	2.7	10.3
Middle & Near-East	1.9	10.0
Central & South America	3.0	8.5
Developing Countries	2.4	10.0
World, average	3.0	9.6

Note: \* Presumed \*\* Forecasting

(1) When the three systems are to be completed at the same time.

Total Cost

Table 9-3

Item	Agno System		Bicol System		Cagayan System		Total	
	Foreign	Total	Foreign	Local	Foreign	Local	Foreign	Local
I. Civil works	473	1,336	301	815	245	376	1,019	2,527
II. Telecommunication	1,443	-	928	-	760	-	3,131	-
III. Technical service	371	59	401	59	217	25	989	143
(1) Expenditure for training	21	35	21	35	20	25	62	95
(2) Supervision	50	-	54	-	27	-	131	-
(3) Detail design for civil works	72	24	79	24	39	-	190	48
(4) Detail design for telecom.	25	-	25	-	20	-	70	-
(5) On-the-job training	203	-	222	-	111	-	536	-
IV. Operation and Maintenance	58	40	37	25	30	11	125	76
V. Contingency	383	268	246	165	201	76	830	509
VI. Total	2,728	1,703	1,913	1,064	1,453	488	6,094	3,255
							6,535x10 <sup>3</sup> US\$	

Foreign : x10<sup>3</sup>US\$

Local : x10<sup>3</sup>p      1US\$ = 7.39p = 291₱

Technical services are divided into individual systems according to the number of stations involved.

Yearly costing schedule

Item	First year		Second year*	
	Foreign	Local	Foreign	Local
Cost of system	5,813x10 US\$	3,255x10 p	281x10 US\$	

Note: \* Cost for the second year is on-the-job training charge.



(2) When the three systems are to be completed on a step-by-step basis

Table 9-4

Total Cost

Item	Ago System		Bicol System		Cagayan System		Total	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
I. Civil works	473	1,336	332	897	297	455	1,102	2,688
II. Telecommunication	1,443	-	1,021	-	920	-	3,384	-
III. Technical services	527	59	519	66	628	31	1,674	156
(1) Expenditure for training	21	35	21	39	20	31	62	105
(2) Supervision	79	-	53	-	58	-	190	-
(3) Detail design for civil works	72	24	79	27	39	0	190	51
(4) Detail design for telecom.	25	-	25	-	20	-	70	-
(5) On-the job training	330	-	341	-	491	-	1,162	-
IV. Operation and Maintenance	58	40	41	27	37	14	136	81
V. Contingency	383	268	271	180	244	91	898	539
VI. Total	2,884	1,703	2,184	1,170	2,126	591	7,194	3,464
							7,663x10 <sup>3</sup> US\$	
Deflator	1.0	1.0	1.10	1.10	1.21	1.21		

Foreign : x10<sup>3</sup>US\$

Local : x10<sup>3</sup>p

1US\$=7.39p=291₱

Table 9-5

## Yearly Costing Schedule

Item	1st year		2nd year		3rd year		4th year	5th year	Total	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Foreign	Foreign	Local
I. Civil works	473	1,336	332	897	297	455	0	0	1,102	2,401
Aguo Basin	473	1,336	-	-	-	-	-	-	473	1,226
Bicol Basin	-	-	332	897	-	-	-	-	332	796
Cagayan Basin	-	-	-	-	297	455	-	-	297	379
II. Telecommunication	1,443	-	1,021	-	920	-	-	-	3,384	-
Aguo Basin	1,443	-	-	-	-	-	-	-	1,443	-
Bicol Basin	-	-	1,021	-	-	-	-	-	1,021	-
Cagayan Basin	-	-	-	-	920	-	-	-	920	-
III. Technical service	512	156	289	-	371	-	341	161	1,674	156
*Expenditure for training	62	105	-	-	-	-	-	-	62	105
*Supervision	79	-	53	-	58	-	-	-	190	-
Aguo Basin	79	-	-	-	-	-	-	-	79	-
Bicol Basin	-	-	53	-	-	-	-	-	53	-
Cagayan Basin	-	-	-	-	58	-	-	-	58	-
*Detail design for civil works	190	51	-	-	-	-	-	-	190	51
*Detail design for telecon.	70	-	-	-	-	-	-	-	70	-
*On-the job training	111	-	236	-	313	-	341	161	1,162	-
Aguo Basin	111	-	157	-	62	-	-	-	330	-
Bicol Basin	-	-	79	-	164	-	98	-	341	-
Cagayan Basin	-	-	-	-	87	-	243	161	491	-
IV. Operation and Maintenance	58	40	41	27	37	14	-	-	136	81
V. Contingency	383	268	271	180	244	91	-	-	898	539
VI. Total	2,869	1,800	1,954	1,104	1,869	560	341	161	7,194	3,464
	3,113 x 10 <sup>3</sup> US\$		2,104 x 10 <sup>3</sup> US\$		1,944 x 10 <sup>3</sup> US\$		341 x 10 <sup>3</sup> US\$	161 x 10 <sup>3</sup> US\$	7,663 x 10 <sup>3</sup> US\$	

Foreign : x10<sup>3</sup> US\$

1US\$ = 7.39p = 291 ₪

Local : x10<sup>3</sup> p

§-3. Construction Cost

1. Unit Cost for Civil Works

Unit cost for civil works is shown in the following table.

Table 9-6(1)

Unit Cost

Item	Unit	Agno River Basin		Bicol Cagayan River Basin		Remarks
		Foreign	Local	Foreign	Local	
<b>1. Housing, facilities, etc.</b>		US\$	₱	US\$	₱	
1 Station housing	Place	-	8,000	-	8,500	Type A
"	"	-	11,000	-	11,000	Type B
2 Well-type gagging station	"	-	35,000	-	42,000	
3 Pole-type gagging station	"	-	-	-	-	
4 Floater dropping	"	10,000	10,000	12,000	12,500	
5 Fence	Set	-	2,400	-	2,400	
6 Repeater station house	Place	-	37,500	-	45,000	5 <sup>M</sup> x 5 <sup>M</sup>
7 Sub-center house	"	-	160,000	-	192,000	10 <sup>M</sup> x 8 <sup>M</sup>
8 Sub-center house	"	-	400,000	-	480,000	10 <sup>M</sup> x 20 <sup>M</sup>
9 Site, cost	m <sup>2</sup>	-	8	-	5	
10 Removal	Set		10,000		10,000	
11 Footing	Set		10,000		10,000	
<b>2. Tower, antenna</b>						
1 Tel pole	Set	-	4,000	-	4,000	
2 Traiangular tower	"	8,000	12,000	8,000	12,000	
3 Steel tower	Set	65,000	20,000	65,000	20,000	

Table 9-6(2)

## Unit Cost

Item	Unit	Agno River Basin		Bicol Cagayan River Basin		Remarks
		Foreign	Local	Foreign	Local	
<b>3. Equipment facilities and installation</b>						
1 Rainfall gaging	Set	6,500	100	6,600	100	
2 Water level gaging						
Pole type	m	1,500	200	1,700	200	
Float type	Set					
Suiken 62	"	10,000	500	11,000	500	
" 70	"	12,000	500	13,000	500	Dumper
3 Vacuum pump	Set	3,500	-	3,600	-	
4 Current meter	Set	1,500	-	1,600	-	
5 Car	Set	15,000	-	15,000	-	
6 Desk-top computer	Set	30,000	-	30,000	-	

Table 9-7

Recorder Housing R.C (Agno River Basin)  
 0.90m $\phi$  x 17.00m Circular Stilling Well  
 2.50m x 2.50m Housing

## I Estimated Cost of Proposed Work:

Scope of Work to be done: Item	% of Total	Unit	Quantity	Unit Cost	Amount (P)		
					Total	Materials	Labor
I. Earth Work					255.00	255.00	3,200.00
II. Concrete & Masonry					7,207.10	7,207.10	
III. Fabricated & Materials					3,746.00	3,746.00	
IV. Lumber & Hardware					855.60	855.60	
V. Form Lumber					2,960.55	2,960.55	
Labor							6,360.00
Total					15,024.25	15,024.25	9,560.00

## II Breakdown of Estimated Expenditures

Item	% OF TOTAL	Amount (P)
1. Direct Cost:		
a. Total Cost of Materials	43.04	15,024.25
b. Labor	27.30	9,560.00
c. GSIS/SSS	1.23	430.20
d. Equipment Expenses	1.43	500.00
e. Contingencies	3.65	1,275.70
f. Sub-Total for Direct-Cost		26,790.15
2. Indirect Cost:		
a. Contractor's Profit	11.50	4,018.52
b. Contractor's Tax	2.65	924.25
c. Surcharge	9.09	3,263.28
Say	100.00	34,996.20
Total Project Cost		35,000.00

Table 9-8

Recorder Housing R.G (Bicol, Cagayan River BASINS)

0.90m $\phi$  x 17.00m Circular Stilling Well

2.50m x 2.50m Housing

## I Estimated Cost of Proposed Work:

Scope of Work to be done Item	% of Total	Unit	Quantity	Unit Cost	Amount (P)		
					Total	Materials	Labor
I. Site Reparation					5,700.00	4,340.65	1,359.35
II. Reinforced Con- crete & Masonry					21,913.73	17,119.00	4,794.73
III. Backfilling					650.00	-	650.00
IV. Riprapping					2,219.00	1,619.00	600.00
V. Welding of Door					150.00	-	150.00
IV. Hardware					3,026.70	3,026.70	-
Total					33,659.43	26,105.35	7,554.08

## II Breakdown of Estimated Expenditures

Item	% of Total	Amount (P)
1. Direct Cost:		
a. Total Cost of Materials	62.67	26,105.35
b. Labor	18.14	7,554.08
c. Leaves	1.51	629.51
d. GSIS/SSS	1.72	717.64
e. Modicare	0.14	60.43
f. State Insurance Fund	0.18	75.54
g. Contingencies	4.33	1,803.12
2. Indirect Cost:		
a. Surcharge	11.31	3,786.57
Say	100.00	41,652.23
Total Project Cost		42,000.00

## 2. Construction Cost of Civil Works

Construction cost of civil engineering works for each of the stations in the Agno, Bicol, and Cagayan systems

### (1) Agno River Basin

Table 9-10-(1) Construction and Equipment Cost of Civil Works

Location of Station	Foreign (US\$)	Local (P)
(Banban)	(6,500)	(14,500)
Tibag	23,750	20,400
Binga Dam	59,000	28,500
San Roque	31,500	27,100
Carmen Rosales	21,500	24,500
Wawa	21,500	54,000
Bañaga	15,500	58,900
Sta. Barbara	21,500	52,600
Sto. Tomas R.S	8,000	49,500
Carmen S.C	65,000	420,000
Deliman R.S	65,000	420,000
Tanay R.S	65,000	180,000
<b>Sub Total</b>	<b>397,250</b> <b>(403,750)</b>	<b>1,335,500</b> <b>(1,350,000)</b>
Patrol Car (3 sets)	45,000	-
Desk-top Computer	30,000	-
<b>Sub Total</b>	<b>75,000</b>	<b>-</b>
<b>Total</b>	<b>472,250</b> <b>(478,750)</b>	<b>1,335,500</b> <b>(1,350,000)</b>
	<b>652,968</b> <b>(661,430) US\$</b>	

1 US\$ = 7.39 P

Table 9-10-(2) Breakdown of Civil Works (Agno River Basin)

Item	Banban (Future)		Tibag		Binga Dam		San Roque	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
	US\$	₱	US\$	₱	US\$	₱	US\$	₱
°Rainfall Gaging	6,500	100	6,500	100	6,500	100	6,500	100
°Housing	-	8,000	-	11,000	-	11,000	-	11,000
°Tele Pole	-	4,000	-	4,000	-	4,000	-	4,000
°Fence	-	2,400	-	2,400	-	2,400	-	-
°Pole-type Water Level Gaging	-	-	15,750	2,100	52,500	7,000	15,000	2,000
°Steel Pipe	-	-	-	-	-	3,000	-	-
°Site Cost	-	-	-	800	-	1,000	-	-
°Floater Dropping	-	-	-	-	-	-	10,000	10,000
°Current Meter	-	-	1,500	-	-	-	-	-
<b>Total</b>	<b>6,500</b>	<b>14,500</b>	<b>23,750</b>	<b>20,400</b>	<b>59,000</b>	<b>28,500</b>	<b>31,500</b>	<b>27,100</b>

Items	Sto. Tomas R.S		Carmen Sub-Center		Deliman R.S		Tanay R.S	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
	US\$	₱	US\$	₱	US\$	₱	US\$	₱
°Housing	-	37,500	-	400,000	-	400,000	-	160,000
°Steel Tower	-	-	65,000	20,000	65,000	20,000	65,000	20,000
°Triangular Tower	8,000	12,000	-	-	-	-	-	-
<b>Total</b>	<b>8,000</b>	<b>49,500</b>	<b>65,000</b>	<b>420,000</b>	<b>65,000</b>	<b>420,000</b>	<b>65,000</b>	<b>180,000</b>



Table 9-10-(3) Breakdown of Civil Works (Agno River Basin)

Item	Carmen Rosales		Wawa		(Bañaga)		Sta. Barbara	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
	US\$	p	US\$	P	US\$	P	US\$	P
°Rainfall Gaing	6,500	100	6,500	100	-	-	6,500	100
°Housing	-	11,000	-	11,000	-	11,000	-	11,000
°Tele Pole	-	4,000	-	4,000	-	4,000	-	4,000
°Fence	-	2,400	-	2,400	-	2,400	-	-
°Pole-Type Water Level Gaging	15,000	2,000	-	-	-	-	-	-
°Banking	-	5,000	-	-	-	5,000	-	1,000
°Float-Type Water-Level Gaging	-	-	10,000	500	12,000	500	10,000	500
°Well-Type Gaging Station	-	-	-	35,000	-	35,000	-	35,000
°Vacuum Pump	-	-	3,500	-	3,500	-	3,500	-
°Current Met	-	-	1,500	-	-	-	1,500	-
°Site Cost	-	-	-	1,000	-	1,000	-	1,000
°Footing	-	-	-	-	-	-	-	-
<b>Total</b>	<b>21,500</b>	<b>24,500</b>	<b>21,500</b>	<b>54,000</b>	<b>15,500</b>	<b>58,900</b>	<b>21,500</b>	<b>52,600</b>

°CAR (3) 45,000<sup>US\$</sup> US\$ 472,250 (478,750) 652,968<sup>US\$</sup>  
 °Desk-top Computer 30,000<sup>US\$</sup> Total P 1,335,500 (1,350,000) (661,430)

1US\$ = 7.39 P

(2) Bicol River Basin

Table 9-11-(1) Construction and Equipment Cost of Civil Works

Location of Station	Foreign (US\$)	Local (P)
Napolidan	6,600	15,000
Sipocot	42,200	22,000
Ligao	6,600	18,500
Bato	18,500	29,600
Buhi	21,200	57,600
Ocampo	6,600	17,500
Camaligan	22,800	42,600
Ombao	22,800	70,000
Barongay	11,900	16,400
Sipocot R.S	8,000	61,000
Iriga R.S	8,000	60,400
Naga S.C	65,000	404,000
Sub Total	240,200	814,600
Patrol Car ( 2 set )	30,000	-
Desk-top Computer	30,000	-
Sub Total	60,000	-
Total	300,200	814,600

410,430 US\$

Table 9-11-(2) Breakdown of Civil Works (Bicol River Basin)

Item	Napolidan		Sipocot R.S		Sipocot		Ligao	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
	US\$	₱	US\$	₱	US\$	₱	US\$	₱
°Rainfall Gaging	6,600	100	-	-	6,600	100	6,600	100
°Housing	-	8,500	-	45,000	-	11,000	-	11,000
°Fence	-	2,400	-	3,000	-	2,400	-	2,400
°Tele Pole	-	4,000	-	-	-	4,000	-	4,000
°Triangular Tower	-	-	8,000	12,000	-	-	-	-
°Site Cost	-	-	-	1,000	-	500	-	1,000
°Pole Type Water Level Gaging	-	-	-	-	34,000	4,000	-	-
°Current Meter	-	-	-	-	1,600	-	-	-
<b>Total</b>	<b>6,600</b>	<b>15,000</b>	<b>8,000</b>	<b>61,000</b>	<b>42,200</b>	<b>22,000</b>	<b>6,600</b>	<b>18,500</b>

Table-9-11-(3) Breakdown of Civil Works (Bicol River Basin)

Item	Bato		Buhí		Ocampo		Iriga R.S	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
	US\$	₱	US\$	₱	US\$	₱	US\$	₱
°Rainfall Gaging	6,600	100	6,600	100	6,600	100	-	-
°Pole-Type Water Level Gaging	11,900	1,400	-	-	-	-	-	-
°Tele Pole	-	4,000	-	4,000	-	4,000	-	-
°Housing	-	11,000	-	11,000	-	11,000	-	45,000
°Footing	-	10,000	-	-	-	-	-	-
°Site Cost	-	700	-	-	-	-	-	1,000
°Fence	-	2,400	-	-	-	2,400	-	2,400
°Float-Type Water-Level Gaging	-	-	11,000	500	-	-	-	-
°Well Type Gaging	-	-	-	42,000	-	-	-	-
°Vacuum Pump	-	-	3,600	-	-	-	-	-
°Triangular Tower	-	-	-	-	-	-	8,000	12,000
<b>Total</b>	<b>18,500</b>	<b>29,600</b>	<b>21,200</b>	<b>57,600</b>	<b>6,600</b>	<b>17,500</b>	<b>8,000</b>	<b>60,400</b>

Table-9-11-(4) Breakdown of Civil Works (Bicol River Basin)

Item	Naga Sub-Center		Camaligan		Ombao		BARONGAY	
	Foreign US\$	Local, P (2)	Foreign US\$	Local P	Foreign US\$	Local P	Foreign US\$	Local P
°Housing		384,000	-	-	-	11,000	-	11,000
°Steel Tower	65,000	20,000	-	-	-	-	-	-
°Rainfall Gaging	-	-	6,000	100	6,000	100	-	-
°Pole-Type Water Level Gaging	-	-	-	-	-	-	11,900	1,400
°Current Meter	-	-	1,600	-	1,600	-	-	-
°Well-Type Gaging Station	-	-	-	42,000	-	42,000	-	-
°Float-Type Water Level Gaging	-	-	11,000	500	11,000	500	-	-
°Fence	-	-	-	-	-	2,400	-	-
°Removal	-	-	-	-	-	10,000	-	-
°Vacuum Pump	-	-	3,600	-	3,600	-	-	-
°Tele Pole	-	-	-	-	-	4,000	-	4,000
<b>Total</b>	<b>65,000</b>	<b>404,000</b>	<b>22,800</b>	<b>42,600</b>	<b>22,800</b>	<b>70,000</b>	<b>11,900</b>	<b>16,400</b>

CAR (2)	30,000	US\$	US\$	300,200	} 411,459 US\$
Desk-top Computer (1)	30,000	US\$	P	822,200	

(3) Cagayan River Basin

Table 9-12-(1) Construction and Equipment Cost of Civil Works

Location of Station	Foreign (US\$)	Local (P)
Maris Dam	23,600	30,500
Dalibubun	29,200	23,500
Tumauini	32,100	21,200
Tuguegarao (Aparri)	27,000 (29,200)	31,600 (65,500)
Tuguegarao S.C	65,000	212,000
Iragan R.S	8,000	57,000
Sub Total	184,900 (214,100)	375,800 (441,300)
Car (2 set)	30,000	-
Desk-top Computer	30,000	-
Sub Total	60,000	-
Total	244,900 (274,100)	375,800 (441,300)
	295,753 (333,816)	US\$

1 US\$ = 7.39 P

Table-9-12-(2) Breakdown of Civil Works (Cagayan River Basin)

Item	Maris Dam		Dálíbubun		Tumauini		Tuguegarao	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
	US\$	P	US\$	P	US\$	P	US\$	P
°Rainfall Gaging	6,600	100	6,600	100	6,600	100	6,600	100
°Pole Type Water Level Gaging	17,000	2,000	-	-	25,500	3,000	20,400	2,400
°Tele Pole	-	4,000	-	-	-	4,000	-	4,000
°Housing	-	(2) 22,000	-	8,500	-	11,000	-	11,000
°Fence	-	2,400	-	2,400	-	2,400	-	2,400
°Float Type Water Level Gaging	-	-	11,000	500	-	-	-	-
°Well Type Gaging Station	-	-	-	-	-	-	-	-
°Triangular Tower	-	-	8,000	12,000	-	-	-	-
°Vacuum Pump	-	-	3,600	-	-	-	-	-
°Footing	-	-	-	-	-	-	-	10,000
°Site Cost	-	-	-	-	-	700	-	700
°Talap	-	-	-	-	-	-	-	1,000
<b>Total</b>	<b>23,600</b>	<b>30,500</b>	<b>29,200</b>	<b>23,500</b>	<b>32,100</b>	<b>21,200</b>	<b>27,000</b>	<b>31,600</b>

Item	Tuguegarao Sub		Iragan R.S		(Aparri)			
	Foreign	Local	Foreign	Local	Foreign	Local		
	US\$	P	US\$	P	US\$	P		
°Housing	-	192,000	-	45,000				
°Steel Tower	65,000	20,000	-	-				
°Triangular Tower	-	-	8,000	12,000				
<b>Total</b>	<b>65,000</b>	<b>212,000</b>	<b>8,000</b>	<b>57,000</b>	<b>(29,200)</b>	<b>(65,500)</b>		

°CAR (2) 30,000 US\$  
 °Desk-top Computer TOTAL US\$ 244,900 (274,100) 295,753 US\$  
 P 375,800 (441,300) 333,816)

(1) 30,000 US\$

### 3. Cost of Telecommunications Facilities

Estimated cost of Flood Forecasting systems  
in the Agno, Bicol and Cagayan River Basins

Table 9-13

River \ Item	Telemetering Facilities	Multiplex Telecommunication Facilities	SSB Telecommunication Facilities	VHF Telecommunication and Others	Total
Agno R.	614	685	113	31	1443
Bicol R.	360	480	60	28	928
Cagayan R.	237	440	60	23	760
Total	1211	1605	233	82	3131

UNIT: x 10<sup>3</sup>US\$

### Telecommunication Cost of Agno Systems

Table 9-14

UNIT: x 10<sup>3</sup>US\$

Station	Telemetering Facilities	Multiplex/Telecommunication Facilities	SSB Telecommunication Facilities	VHF Telecommunication Facilities and Others
PAGASA	223.0	228.37	-	-
B. P. W	154.3	146.6	-	-
Carmen S.C	103.0	171.63	58.0	22.68
Sto. Tomas R.S	30.8	-	-	-
Tibag	14.7	-	-	-
Wawa	14.7	-	-	-
Banaga	14.7	-	-	-
Sta. Barbara	14.7	-	-	-
Carmen	14.7	-	-	-
San Roque	14.7	-	-	-
Binga Dam	14.7	-	-	-
Deliman R,S	-	138.4	55.0	8.32
Total	614.0	685.0	113.0	31.0



Telecommunication cost of Bicol Systems

Table 9-15

UNIT: x 10<sup>3</sup>US\$

Station	Telemetering Facilities	Multiplex Telecommunication Facilities	S.S.B Telecommunication Facilities	VHF Telecommunication Facilities and Others
Naga S.C	128.0	163.93	60.0	28.0
Sipocot R.S	30.8	-	-	-
Iriga R.S	30.8	-	-	-
Barongay	14.7	-	-	-
Camaligan	14.35	-	-	-
Ocampo	10.3	-	-	-
Ombao	14.7	-	-	-
Bato	14.7	-	-	-
Sipocot	14.7	-	-	-
Napolidan	10.3	-	-	-
Buhi	14.7	-	-	-
Ligao	10.3	-	-	-
B.P.W	17.0	30.0	-	-
PAGASA	34.65	30.1	-	-
Deliman	-	93.92	-	-
Tanay	-	162.05	-	-
<b>Total</b>	<b>360.0</b>	<b>480.0</b>	<b>60.0</b>	<b>28.0</b>

Telecommunication Cost of Cagayan Systems

Table 9-16

UNIT: x 10<sup>3</sup> US\$

	Telemetering Facilities	Multiplex Telecommunication Facilities	SSB Telecommunication Facilities	VHF Telecommunication Facilities and Others
Tuguegarao S.C	97.0	244.0	60.0	17.6
Iragan R.S	30.8	-	-	5.4
Tuguegarao	14.7	-	-	-
Tumauni	14.7	-	-	-
Dalibubun	14.7	-	-	-
Maris	14.7	-	-	-
B.P.W.	15.4	20.0	-	-
PAGASA	35.0	20.0	-	-
Carmen Rosales S.C	-	156.0	-	-
<b>Total</b>	<b>237.0</b>	<b>440.0</b>	<b>60.0</b>	<b>23.0</b>

Table 9-17-(1)

## Breakdown of Estimated Cost of Agno River Basin Telemetry Facilities

Components	Installation Site Standard	PACASA		B.P.W		Carmen Rosales		Sto Tomas R.S.		Tibag		Wawa		Banaga	
		Monitor-control (Quantity) Amount	Amount	Monitor- ing Amount	Amount	Monitor control Amount	Relay station Amount	Rain fall Amount	Rain fall Amount	Rain fall Amount	Rain fall Amount	Water Amount	Amount	Amount	Amount
Signal device	Monitor control	(1) 44,800													
"	"					1 21,000									
"	Monitoring			1 38,000											
"	Rain fall (with TR)									1 4,200	1 4,200				
"	Water ( " )													1 4,200	
"	Repeat ( " )							1 11,200							
Aerial wire	150MHz 3-stage carrina					1 1,150	1 1,150								
"	150MHz Yagl type									1 250	1 250	1 250	1 250		
Graphic panel	Stand alone type	1 61,000	1 43,000												
Display panel	Wall type					1 15,500									
Control panel	Console type	1 24,000				1 9,500									
Typewriter	Remington 26 type 21 inch	3 9,300	1 9,300	1 3,000											
Stabilizing power supply	200/100V 7.5KVA 1.5 KVA	1 6,000	1 6,000	1 1,500											
DC power supply	BATT 60 AH	1 2,600	1 2,600	1 2,600											
Diesel power generator	2 KVA or 7.5 KVA	1 3,800	1 3,800	1 2,600	1 2,600	1 2,600	1 2,600	1 2,600	1 2,600	1 2,600	1 2,600	1 2,600	1 2,600	1 2,600	1 2,600
Solar cell power supply	12V terminal									1 3,000	1 3,000	1 3,000	1 3,000	1 3,000	1 3,000
"	Relay						1 8,200								
Cable protector										1 800	1 800	1 800	1 800	1 800	1 800
Cages and inst- ruments		1 7,000	1 7,000	1 7,000											
Spare parts and accessories		1 10,910	1 7,000	1 10,910	1 380	1 350	1 350	1 350	1 350	1 350	1 350	1 350	1 350	1 350	1 350
Spare terminal station facilities						1 4,200									
Clock power supply															
Sub total		169,410	116,700	78,960	23,530	11,200	11,200	11,200	11,200	11,200	11,200	11,200	11,200	11,200	11,200
Installation and adjustment		1 53,590	1 37,600	1 24,040	1 7,270	1 3,500	1 3,500	1 3,500	1 3,500	1 3,500	1 3,500	1 3,500	1 3,500	1 3,500	1 3,500
Total		223,000	154,300	103,000	30,800	24,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700

Components	Installation Site Standard	Sta. Barbara	Carmen	San Roque	Binga Dam	(Unit: US\$)	
		Rain fall	Rain fall	Rain fall	Rain fall	Subtotal	
		Amount	Amount	Amount	Amount		
Signal device	Monitor control					44,800	
"	"					21,000	
"	Monitoring					38,000	
"	Rain fall (with TR)	1 4,200	1 4,200	1 4,200	1 4,200	25,200	
"	Water ( " )					4,200	
"	Repeat ( " )					11,200	
Aerial wire	150MHz 3-stage carinfa					2,300	
"	150MHz Yagi type	1 250	1 250	1 250	1 250	1,750	
Graphic panel	Stand alone type					104,000	
Display panel	Wall type					15,500	
Control panel	Console type					33,500	
Typewriter	Remington 26 type 21 inch					21,600	
Stabilizing power supply	200/100V 7.5KVA 1.5 KVA					13,500	
DC power supply	BATT 60 AH					7,800	
Diesel power generator	2 KVA or 7.5 KVA	1 2,600	1 2,600	1 2,600	1 2,600	31,000	
Solar cell power supply	12V terminal	1 3,000	1 3,000	1 3,000	1 3,000	21,000	
"	Relay					8,200	
Cable protector		1 800	1 800	1 800	1 800	5,600	
Cages and instruments						21,000	
Spare parts and accessories		1 350	1 350	1 350	1 350	31,650	
Spare terminal station facilities						4,200	
Clock power supply							
Sub total			11,200	11,200	11,200	11,200	467,000
Installation and adjustment		1 3,500	1 3,500	1 3,500	1 3,500	147,000	
Total			14,700	14,700	14,700	14,700	614,000

Table 17-(2) Breakdown of Estimated Cost of Bicol Basin Telemetry Facilities

Components	Installation site		Naga	Sipocot No.2	Iriga R.S.	Baroogay	Canaligan	Ocamp	Ombao
	Standard	Monitor control (Quality) Amount	Repeater station Amount	Repeater station Amount	Rain fall Amount	Rain fall Amount	Water Amount	Rain fall Amount	
Signal device	Monitor control	1 21,000							
"	Rain fall (with TR)				1 4,200	1 4,200			1 4,200
"	Rain fall ( " )						1 4,000		
"	Water ( " )		1 11,200	1 11,200					
Aerial wire	150MHZ 3-stage collinear	1 1,150	1 1,150	1 1,150					
"	150MHZ Yagi type				1 250		1 250	1 250	1 250
Display panel	Wall type	1 15,500							
Control panel	Console type	1 9,500							
Typewriter	Remington 26 type 21 inch	1 3,000							
Stabilizing power supply	200/100V 1.5 KVA	1 1,500							
DC power supply	"DAIT" 60 AH	1 2,600							
Diesel power generator	2 KVA	1 2,600	1 2,600	1 2,600	1 2,600	1 2,600			1 2,600
Solar cell power supply	12V terminal				1 3,000	1 3,000	1 2,700	1 3,000	1 3,000
"	Repeater		1 8,200	1 8,200					
Cable protector					1 800	1 800			1 800
Gages and instruments		1 15,000							
Spare parts and accessories		1 17,840	1 380	1 380	1 350	1 350	1 350	1 350	1 350
Spare terminal station facilities		1 8,400							
Sub total		98,090	23,530	23,530	11,200	10,950	7,300	11,200	
	B.P.W 17,000	PAGASA 34,650	1 29,910	1 7,270	1 7,270	1 3,500	1 3,400	1 3,000	1 3,500
Total	17,000 34,650	128,000	30,800	30,800	14,700	14,350	10,300	14,700	

Table 17-(2) Breakdown of Estimated Cost of Bicol Basin Telemetry Facilities

Installation site		Bato		Sipocot		Napolitan		Bubi		Ligao		(Unit:US\$)
		Rain fall		Rain fall		Water		Rain fall		Water		Sub total
Components	Standard	Amount		Amount		Amount		Amount		Amount		Amount
		Signal device	Monitor control									
"	Rain fall (with TR)	1	4,200	1	4,200			1	4,200			25,200
"	Rain fall ( " )					1	4,000			1	4,000	12,000
"	Water ( " )											22,400
Aerial wire	150MHZ 3-stage collinear											3,450
"	150MHZ Yagi type	1	250	1	250	1	250	1	250	1	250	2,000
Display panel	Wall type											15,500
Control panel	Console type											9,500
Typewriter	Remington 26 type 21 inch											3,000
Stabilizing power supply	200/100V 1.5 KVA											1,500
DC power supply	"DATI" 60 AH											2,600
Diesel power generator	2 KVA	1	2,600	1	2,600			1	2,600			23,400
Solar cell power supply	12V terminal	1	3,000	1	3,000	1	2,700	1	3,000	1	2,700	1 26,100
"	Repeater											16,400
Cable protector		1	800	1	800			1	800			4,800
Gages and instruments												15,000
Spare parts and accessories		1	350	1	350	1	350	1	350	1	350	1 21,750
Spare terminal station facilities												3,400
Sub total			11,200		11,200		7,300		11,200		7,300	234,000
	B.P.W											
	PAGASA	17,000	34,650	1	3,500	1	3,000	1	3,500	1	3,000	1 126,000
Total		17,000	34,650		14,700		14,700		10,300		14,700	10,300 360,000

Table 9-17-(3)

## Breakdown of Estimated Cost of Cagayan River Basin Telemetry Facilities

Components	Installation site Standard	Tuguegarao S.C.		Iligan R.S.		Tuguegarao S.C.		Tunaufni		Dallibubun		Maris		B.P.W.			
		Monitor control (Quantity)	Amount	Repeater station	Amount	Rain water	Amount	Rain water	Amount	Rain water	Amount	Rain water	Amount	Rain water	Amount	Monitoring	Amount
Signal device	Monitor control	1	21,000														
"	Rain water (with IR)					1	4,200	1	4,200	1	4,200	1	4,200				
"	Repeater			1	11,200												
Aerial wire	150MHz 3-stage Colinear			1	1,150												
"	150MHz Yagi type	1	250			1	250	1	250	1	250	1	250				
Display panel	Wall type	1	15,500														
Control panel	Console type	1	9,500														
Typewriter	Remington 26 Type 21 inch	1	3,000														
Stabilizing power supply	200/100V 1.5KVA	1	1,500														
DC power supply	BATT 60AH	1	2,600														
Diesel power generator	21 KVA	1	2,600	1	2,600	1	2,600	1	2,600	1	2,600	1	2,600				
Solar cell power supply	12V terminal					1	3,000	1	3,000	1	3,000	1	3,000				
"	Repeater			1	8,200												
Cable protector						1	800	1	800	1	800	1	800				
Gages and Instruments		1	7,000														
Spare parts and accessories		1	6,520	1	380	1	350	1	350	1	350	1	350				
Spare terminal facilities		1	4,200														
Subtotal			73,670		23,530		11,200		11,200		11,200		11,200				
Installation and adjustment		1	23,330	1	7,270	1	3,500	1	3,500	1	3,500	1	3,500	1	15,400		
Total			97,000		30,800		14,700		14,700		14,700		14,700			15,400	

Components	Installation site Standard	PAGASA		(Unit:US\$)
		Monitor control Amount		Sub total
Signal device	Monitor control			21,000
"	Rain water (with TR)			16,800
"	Repeater			11,200
Aerial wire	150MHz 3-stage Colinear			1,150
"	150MHz Yagi type			1,250
Display panel	Wall type			15,500
Control panel	Console type			9,500
Typewriter	Remington 26 type 21 inch			3,000
Stabilizing power supply	200/100V 1.5KVA			1,500
DC power supply	BATT 60AH			2,600
Diesel power generator	21 KVA			15,600
Solar cell power supply	12V terminal			12,000
"	Repeater			8,200
Cable protector				3,200
Gages and instruments				7,000
Spare parts and accessories				8,300
Spare terminal facilities				4,200
Subtotal				142,000
Installation and adjustment		1	35,000	95,000
Total			35,000	237,000

Table 9-18-(1) Breakdown of Estimated Cost of Multiple Communication Installations in the Agno River Basin

Components	Installation Site	B.P.W.		PAGASA		Deliman		Carmen Rosales		Sub total	
		Monitoring		Monitor control		Relay station		Sub-Center		Sub total	
		Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount
400 MHz multiple links installation	Standard	1	10,300	2	20,600	1	10,300			4	41,200
"	10W SS-PX 24ch Model 1 and 2					1	18,000	1	18,000		36,000
Transfer station installation	24/24ch packaged	1	18,000	2	36,000					3	54,000
"	50W SS-PM Troppo 12ch Model 1 and 2							1	10,500	1	10,500
"	6/6CH "					1	10,300			1	10,300
Parabolic antenna	For Repeater					1	9,200	1	9,200	2	18,400
Yagi type antenna	6m diagrid type with stand	1	380	1	380					2	760
"	8 element, 400 MHz band with ST			1	350	1	350			2	700
Coaxial cables	5 element, 400 MHz band with ST	1	120	1	240	1	500	1	350	4	1,210
DC power supply	(AFZE-50-10) (AFZE-50-7)	1	5,000	1	5,000	1	5,000	1	5,000	4	20,000
Spare power generator	Alkali 24V/100AH	1	26,000	1	26,000	1	26,000	1	26,000	4	104,000
Remonitor control device	100V AC 10kVA Model 1 with self starter panel			1	19,000					2	19,000
"	SV20 Cont 10 master station (cycle type)					1	6,200	1	6,200		12,400
Key telephone switch-board device	Terminal Station ( " )							1	4,000	1	4,000
Automatic conveyer	With 10 TELs	1	26,000	1	26,000					2	52,000
Automatic voltage regulator	XB. 60CH with chargeable battery	1	1,800	1	1,800	1	1,800	1	1,800	4	7,200



Table 9-18-(1) Breakdown of Estimated Cost of Multiple Communication Installations in the Agno River Basin (Unit: US\$)

Components	Installation Site	B.P.W.		FACASA		Deliman		Carmen Roseles		Sub total	
		Monitoring		Monitor control		Relay station		Sub-Center			
		Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount		
	Standard										
Remote monitor control device	SV 20 Cont 10 master station (cyclic type)	1	1,800	1	3,300	1	250	1	700	4	6,050
"	Terminal station ( " )	1	5,200	1	20,000	1	6,500	1	19,000	4	50,700
Key telephone switchboard device	With 10 Tels	1	4,500	1	4,500	1	4,500	1	21,880	4	35,380
Sub total			105,300		163,170		98,900		122,630		490,000
		1	41,300	1	65,200	1	39,500	1	49,000	1	195,000
Total			146,600		228,370		138,400		171,630		685,000

Table 9-18-(2) Breakdown of Estimated Cost of Multiple Communications Installations  
in the Bicol River Basins (Unit: US\$)

Components	Installation site Standard	Naga		Tanay		Delinan		B.P.W	PAGASA	Sub-total		
		Sub-Center		Relay Center		Relay Center		Monitoring	FFC			
		Q'ty	Amount	Amount	Amount	Amount	Amount	Amount	Amount			
400MHz band multiple wireless installation	100W SS-FM			1	10,300	1	10,300			2	20,600	
"	50W SS-FM (Troppo)	1	18,000	1	18,000					2	36,000	
Transfer station installation	6/6 CH packaged	1	10,300							1	10,300	
"				1	10,300	1	10,300			2	20,600	
Parabolic antenna	6m diagrid type with stand	1	9,200	1	9,200					2	18,400	
"	42m <sup>2</sup> "			1	4,200	1	4,200			2	8,400	
Coaxial cables	(AFZE-50-10), AFZE-50-7	1	350	1	500	1	120			3	970	
DC power supply	Alkali 24V 100AH	1	5,000	1	5,000	1	5,000			3	15,000	
Spare power generator	100V AC 20KVA automatic starting	1	26,000	1	26,000	1	26,000			3	78,000	
Remote control device	Terminal station device (cyclic type)	1	6,200	1	6,200	1	6,200			3	18,600	
Simplified telephone switch board device	With 10 TELs	1	4,000							1	4,000	
Automatic voltage regulator	5 KVA	1	1,800	1	1,800					2	3,600	
Repeater bay	With 3-way outlet (with 3/6CH sig. pow.) self-starting type	1	2,200	1	250					2	2,450	
Gages and instruments		1	19,000	1	19,000					2	38,000	
Spare parts and accessories		1	15,080	1	5,000	1	5,000			3	25,080	
Subtotal			117,130		115,750		67,120				300,000	
Installation and adjustment		1	46,800	1	46,300	1	26,800	1	30,000	1	30,100	180,000
Total			163,930		162,050		93,920		30,000		30,100	480,000

(50W FD for Tanay)

Table 9-18- (3) Breakdown of Estimated Cost of Multiple Communications

Installations in the Cagayan River Basin

(Unit: US\$)

Components	Installation site Standard	Carmen Rosales		Tuguegarao		B.P.W.		PAGASA		Sub total	
		Sub-Center		Sub-Center		Monitoring	FFC				
		Q'ty	Amount	Amount	Amount	Amount	Amount	Q'ty	Amount		
400MHz band multiple wireless installation	1kW SS-PM Troppo scatter 6CH Model 1 and 2	1	72,000	1	72,000					2	144,000
Transfer station installation	6/6 CH packaged			1	10,300					1	10,300
Parabolic antenna	6m dia grid type with stand	1	9,200	1	9,200					2	18,400
Coaxial cables	AFZE-50-13W	1	800	1	800					2	1,600
DC power supply	Alkali 24V 100AH			1	5,000					1	5,000
Spare power generator	100V AC 20KVA automatic starting type Model 1 and 2			1	50,000					1	50,000
Remote control device	Terminal station device (cyclic type)			1	6,200					1	6,200
Simplified telephone switchboard device	With 10 TELs			1	4,000					1	4,000
Automatic voltage regulator	3 $\phi$ 15KVA	1	8,500	1	8,500					2	17,000
Repeater bay		1	2,000	1	2,000					2	4,000
Gage and instruments	One set	1	18,000	1	17,000					2	35,000
Spare parts and accessories	One set	1	9,500	1	15,000					2	24,500
Sub total			120,000		200,000						320,000
Installation and adjustment		1	36,000	1	44,000	1	20,000	1	20,000		120,000
Total			156,000		244,000		20,000		20,000		440,000

Table 9-19 Breakdown of Estimated Cost of HF Band Wireless Communications Installations (Unit: US\$)

Components	Name of River	Agno River Basin				Subtotal Amount	Bicol River Basin		Cagayan River Basin		Total Amount		
		Installation site		Deliman Q'ty	Carmen Rosales Amount		Naga		Tuguegarao				
		Standard	Amount				Amount	Amount					
SSB transmitter	1 kW 3-wave packaged	1	18,000	1	18,000	2	36,000	1	18,000	1	18,000	4	72,000
SSB receiver	All wave	1	7,200		7,200	2	14,400	1	7,200	1	7,200	4	28,800
Antenna selector unit	Ant. BK unit	1	500	1	500	2	1,000	1	500	1	500	4	2,000
Antenna	For directional receiving and transmitting	1	10,000	1	10,000	2	20,000	1	10,000	1	10,000	4	40,000
Distributor box		1	1,700	1	1,700	2	3,400	1	1,700	1	1,700	4	6,800
Automatic voltage regulator	100V 5kVA 1φ	1	1,700	1	1,700	2	3,400	1	1,700	1	1,700	4	6,800
Operator desk		1	3,000	1	3,000	2	6,000	1	3,000	1	3,000	4	12,000
Gages and instruments		1	1,000	1	1,000	2	2,000	1	1,000	1	1,000	4	4,000
Spare parts and accessories	Special tools included	1	1,900	1	1,900	2	3,800	1	1,900	1	1,900	4	7,600
Sub total			45,000		45,000		90,000		45,000		45,000		180,000
Installation and adjustment			10,000		13,000		23,000		15,000		15,000		53,000
Total			55,000		58,000		113,000		60,000		60,000		233,000

Table 9-20 Breakdown of Estimated Cost and VNF and Other Facilities

(Unit: US\$)

Components	Aguo River Basin				Bicol River Basin				Cagayan River Basin					
	Carmen Robales		Deliman Relay station		Naga		Tuguegarao		Iragan		Tuguegarao		Iragan	
	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount
(Base station)														
Wireless telephone device	2	2,200	1	1,100	3	3,300	1	1,100	1	1,100	1	1,100	1	1,100
Antenna system	2	500	1	250	3	750	1	250	1	250	1	250	1	250
AC power generator	2	800	1	400	3	1,200	1	400	1	400	1	400	1	400
Simple wireless set	4	3,000			4	3,000	4	3,000	4	3,000				
Spare parts and accessories	1	780	1	760	2	1,540	1	760	1	760	1	760	1	760
(Mobile station)														
Wireless telephone device	3	3,300	3	3,300	6	6,600	3	3,300	1	1,100	1	1,100	1	1,100
Antenna system	3	150	3	150	6	300	3	150	1	50	1	50	1	50
Sub total	1	250	1	600	2	850	1	240	1	250	1	250	1	250
(Others)														
Liaison cars	1	8,500			1	8,500	1	8,500	1	8,500				
Observation boats														
Sub total		22,680		8,320		31,000		28,000		17,600		5,400		23,000

#### §-4. Cost of Engineering Service

##### 1. Expenditure for Training

Expenditure is necessary for training Philippine engineers. The training will be conducted for a period of two months.

$$\text{Tutor} \quad 2^{\text{person}} \times \text{months} \times 5000 = 20,000 \text{ US\$}$$

##### Training

$$\text{Hydrologists} \quad 8^{\text{persons}} \times 2^{\text{months}} \times 800 = 12,800$$

$$\text{Telecommuni-} \quad 11^{\text{persons}} \times 2 \quad \times 800 = 17,600 \\ \text{cation} \\ \text{engineers}$$

$$\text{Transportation charge} \\ 19 \quad \times 600 \quad = 11,400$$

---

$$\text{Total} \quad \quad \quad 61,800 \text{ US\$}$$

##### 2. Consultant Fee for Supervision

(1) When the three systems are to be completed at the same time

In order to supervise the implementation of the design, one hydrologist will be stationed for eight months, five telecommunication engineers for four months and one construction engineer for establishing water level gages for two months.

##### . Salary, overhead, fee, living expense

$$\text{Hydrologist} \quad 1^{\text{person}} \times 8^{\text{month}} \quad \times 6000 = 48,000 \text{ US\$}$$

$$\text{Telecommuni-} \quad 1 \quad \times 4 \quad \times 6000 = 24,000 \\ \text{cation} \\ \text{Engineer}$$

$$\text{"} \quad 4 \quad \times 4 \quad \times 3000 = 48,000$$

##### . Construction

$$\text{engineer} \quad 1 \quad \times 2 \quad \times 3000 = 6,000$$

##### . Transportation charge

$$(1^{\text{person}} \times 2^{\text{time}}) + (6^{\text{person}} \times 1^{\text{time}}) \times 600 = 4,800 \text{ US\$}$$

The estimate is based on the assumption that engineers stationed for more than six months will incur the transportation expenses to and from their country on vacation or for other reasons.

$$\text{Total} \quad 130,800 \text{ US\$}$$

(2) When the three systems are to be completed on a step-by-step basis.

• Salary, overhead, fee, living expense

Hydrologist	1 <sup>person</sup>	x 6 <sup>month</sup>	x 6,000 = 36,000 US\$
Telecom. Engr.	1	x 3	x 6,000 = 18,000
Telecom. Engr.	2	x 3	x 3,000 = 18,000
Const. Engr.	1	x 1	x 3,000 = 3,000

Subtotal = 75,000 US\$

• Bicol Basin (Second year)

Hydrologist	0.5 <sup>person</sup>	x 6 <sup>month</sup>	x 6,000 = 18,000
Telecom. Engr.	0.5	x 3	x 6,000 = 9,000
Telecom. Engr.	2	x 3	x 3,000 = 18,000
Const. Engr.	1	x 0.5	x 3,000 = 1,500

Subtotal 46,500 US\$

46,500x1.1=51,150 US\$

• Cagayan Basin (Third year)

Hydrologist	0.5	x 6	x 6,000 = 18,000
Telecom. Engr.	0.5	x 3	x 6,000 = 9,000
Telecom. Engr.	2	x 3	x 3,000 = 18,000
Cost. Engr.	1	x 0.5	x 3,000 = 1,500

46,500 US\$

46,500x1.21=56,265 US\$

• Transportation charge

Agno Basin	1 <sup>person</sup>	x 2 <sup>time</sup>	x 600 = 1,200	Subtotal 3,600 US\$
	4	x 1	x 600 = 2,400	
Bicol Basin	2 <sup>person</sup>	x 1 <sup>time</sup>	x 600 = 1200	1200x1.1=1,320US\$
Cagayan Basin	2	x 1	x 600 = 1200	1200x1.21=1,452US\$

• Total

Agno Basin	78,600 US\$
Bicol Basin	52,470 US\$
Cagayan Basin	57,717 US\$

### 3. Detail Design of Civil Works

#### (1) Design quantity

##### 1 Architectural design

Sub-center	10m x 8m	Two-storied	1 site
	10m x 8m		2 sites
	20m x 10m		2 sites
Repeater station			
	5m x 5m		4 sites

##### 2 Facilities

Station	1.8 x 1.8		6 sites
	2.5 x 2.5		14 sites
Well type			7 sites
Pole type			10 sites

##### 3 Tower and foundation work

Earth filling-up work			2 sites
Footing foundation work			3 sites
Tower and foundation work			5 sites
Pole (18 sites) and triangular tower (5 sites)			
Foundation work			23 sites

#### (2) Cost

##### 1 Architectural design

###### o Design

Sub-center: 2 types

Architect	1 person	x 2 month	x 6000 US\$	= 12,000 US\$
"	2	x 2	x 3000	= 12,000

Repeater station: 1 type

Architect	1 person	x 0.4 month	x 6000	= 2,400
"	1	x 1.5	x 3000	= 4,500

Subtotal 30,900 US\$

###### o Survey: 9 places

Survey engineers

2 person	x 1 month	x 3000	= 6,000 US\$
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Subtotal 6,000 US\$



o Arrangement plan: 9 places

$$\text{Architect } 1^{\text{person}} \times 1.5^{\text{month}} \times 6000 = 9,000 \text{ US\$}$$

Subtotal 9,000 US\$

o Transportation charge

Architect(1)

$$\text{Survey engineers(2)} 3^{\text{person}} \times 1^{\text{time}} \times 600 = 1,800 \text{ US\$}$$

Subtotal 1,800 US\$

Total-1 47,700 US\$

## 2 Civil engineering design

o Well type stations -- To be designed by the  
Philippine officials

o Pole type stations -- 11 places (Survey to be  
carried out in 20 sites)

. Design

$$\text{Designer } 1^{\text{person}} \times 3 \times 6000 = 18,000 \text{ US\$}$$

$$\text{" } 2 \times 6 \times 3000 = 36,000$$

. Survey

Survey engineers

$$2^{\text{person}} \times 3 \times 3000 = 18,000$$

. Transportation charge (Designers)

$$3^{\text{person}} \times 1^{\text{time}} \times 600 = 1800$$

Subtotal 73,800 US\$

## 3 Design of towers and foundation work

Tower design: 2 types

$$\text{Designer } 1^{\text{person}} \times 2^{\text{month}} \times 6000 = 12,000 \text{ US\$}$$

$$\text{" } 1 \times 2 \times 3000 = 6,000$$

Foundation work design

5 types

$$\text{Designer } 1^{\text{person}} \times 2^{\text{month}} \times 6000 = 12,000$$

$$\text{" } 2 \times 4 \times 3000 = 24,000$$

Survey 36 sites

Survey engineers

$$2^{\text{person}} \times 2^{\text{month}} \times 3000 = 12000$$

Transportation charge

$$4^{\text{persons}} \times 1^{\text{time}} \times 600 = 2,400$$

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Subtotal 68,400 US\$

Total-2 142,200 US\$

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Total 189,900 US\$

#### 4. Detail Design of Telecommunication Facilities

##### (1) Analysis of radio propagation characteristic

Subtotal 20,100 US\$

##### (2) Detail design

Subtotal 50,100 US\$

Total 70,200 US\$

## 5. On-the-job Training

(1) When the three systems are to be completed at the same time

After system completion engineers will be sent on the site to ensure proper operation and maintenance. One hydrologist and four telecommunication engineers will provide technical supervision for two years in the Philippines.

### 1 First year

. Salary, overhead, fee, living expense

Hydrologist	1 <sup>person</sup>	x 12 <sup>month</sup>	x 6,000 = 72,000
Telecommunication Engineer	1	x 12	x 6,000 = 72,000
"	3	x 12	x 3,000 = 108,000

o Transportation charge

	5 <sup>person</sup>	x 1 <sup>time</sup>	x 600 = 3000
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Subtotal 255,000 US\$

### 2 Second year

280,500 US\$

Total 535,500

(2) When the three systems are to be completed on a step-by-step basis

### 1 Agno River Basin

. Salary, overhead, fee, living expense

#### First year

Hydrologist	1 <sup>person</sup>	x 6 <sup>month</sup>	x 6,000 = 36,000
Telecom. Engr.	1	x 6	x 6,000 = 36,000
Telecom. Engr.	2	x 6	x 3,000 = 36,000

---

108,000 US\$

#### Second year

Hydrologist	0.5 <sup>person</sup>	x 12 <sup>month</sup>	x 6,000 = 36,000
Telecom. Engr.	1	x 3	x 6,000 = 45,000
	0.5	x 9	
Telecom. Engr.	2	x 12	x 3,000 = 72,000

---

153,000

153,000 x 1.1 = 154,100 US\$

Third year

Hydrologist	0.2 <sup>person</sup>	x 6 <sup>month</sup>	x 6,000 = 7,200
Telecom. Engr.	0.2	x 6	x 6,000 = 7,200
Telecom. Engr.	2	x 6	x 3,000 = 36,000

50,400

$$50,400 \times 1.21 = 60,984 \text{ US\$}$$

Transportation charge

First year	4 <sup>person</sup>	x 1 <sup>time</sup>	x 600 = 2400
Second year	4	x 1	x 600 = 2400 x 1.1 = 2,640
Third year	2	x 1	x 600 = 1200 x 1.21 = 1,452

6,492 US\$

Total

329,576 US\$

2 Bicol River Basin

Salary, overhead, fee, living expense

Second year

Hydrologist	0.5 <sup>person</sup>	x 6 <sup>month</sup>	x 6,000 = 18,000
Telecom. Engr.	0.5	x 6	x 6,000 = 18,000
Telecom. Engr.	2	x 6	x 3,000 = 36,000

72,000

$$72,000 \times 1.1 = 79,200 \text{ US\$}$$

Third year

Hydrologist	(0.3 x 6) (0.5 x 6)	x 6000 = 28,800
Telecom. Engr.	(0.5 x 9) (0.3 x 3)	x 6000 = 32,400
Telecom. Engr.	2 x 12	x 3000 = 72,000

133,200

$$133,200 \times 1.21 = 161,172 \text{ US\$}$$

Fourth year

Hydrologist	0.5 x 6	x 6000 = 18,000
Telecom. Engr.	0.5 x 6	x 6000 = 18,000
Telecom. Engr.	2 x 6	x 3000 = 36,000

72,000

$$72,000 \times 1.33 = 95,760 \text{ US\$}$$

. Transportation charge

Third year 4 person x 1 time x 600 = 2400 x 1.21 = 2,904  
 Fourth year 2 x 1 x 600 = 1200 x 1.33 = 1,596

4,500US\$

Total 340,632 US\$

3 Cagayan River Basin

. Salary, overhead, fee, living expense

Third year

Hydrologist 0.5 person x 6 month x 6000 = 18,000  
 Telecom. Engr. 0.5 x 6 x 6000 = 18,000  
 Telecom. Engr. 2 x 6 x 3000 = 36,000

72,000

72,000 x 1.21 = 87,120 US\$

Fourth year

Hydrologist (0.5 x 6) x 6000 = 54,000  
 1 x 6

Telecom. Engr. (0.5 x 6) x 6000 = 54,000  
 1 x 6

Telecom. Engr. 2 x 12 x 3000 = 72,000

180,000

180,000 x 1.33 = 239,400 US\$

Fifth year

Hydrologist 1 person x 6 month x 6000 = 36,000

Telecom. Engr. 1 x 6 x 6000 = 36,000

Telecom. Engr. 2 x 6 x 3000 = 36,000

108,000

108,000 x 1.46 = 157,680 US\$

. Transportation charge

Fourth year 4 person x 1 time x 600 = 2,400 x 1.33 = 3,192

Fifth year 4 x 1 x 600 = 2,400 x 1.46 = 3,504

6,696US\$

Total 490,896 US\$

## 6. Cost of Engineering Service (Local Cost)

### (1) Expenditure for training

$$19^{\text{person}} \times 2^{\text{month}} \times 2,500 = 95,000$$

### (2) Detail design of civil works (stilling wells, Station house, etc.)

Civil Engineer  $1^{\text{person}} \times 3^{\text{month}} \times 1,500 = 4,500$

Architect  $1^{\text{person}} \times 3^{\text{month}} \times 1,300 = 3,900$

Draftsman  $1^{\text{person}} \times 3^{\text{month}} \times 800 = 2,400$

Survey Teams  $2^{\text{person}} \times 2^{\text{month}} \times 3,000 = 12,000$

Travelling and other Incidental

Expenses, Supplies and Materials, etc. 25,000

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Sub total P 48,000

Total P 143,000

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## **§-5. Cost of Operation and Maintenance**

### **1. Maintenance of Communication Facilities**

### **2. Maintenance of Flood Forecasting Facilities**

For maintenance of these facilities it is a normal practice to appropriate a sum equal to 3-5% of the costs of civil engineering works and telecommunications facilities. For the present systems a 3% sum will be appropriated.

## X. Benefit of the Project

The benefit of the Flood Forecasting and Warning System, being generally intangible, is not adaptable to an economic analysis in terms of monetary values. Flood control works are of vital importance in the endeavor to eliminate the potential substantial damages to the human life and the properties in the applicable basin areas as described below. The works, however, will require an enormous amount of money and a long period of time from inception on completion. The Flood Forecasting and Warning System, while its benefit is intangible, will prove efficient at less cost and in a shorter period and continue to play an important role after the Flood control works are completed. The system will provide timely, accurate flood information for more efficient evacuation of residents, moving of their properties, and proper flood control as well as rescue activities, thereby stabilizing the livelihood of the residents in the basin areas and enhancing their welfare.

### §-1. Damage Potentiality

The properties of the target areas in these three basins as well as the damage potentiality are summarized as follows:

#### 1. Properties and Population within the Target Area

The population living in the Target Areas of the Agno, Bicol, and Cagayan Rivers is as follows:

Population Living in the Target Areas

River Basin	Target Area	Population
	km <sup>2</sup>	persons
Agno	1,540	500,000
Bicol	570	200,000
Cagayan	1,420	180,000
Total	3,530	880,000

The values of the major properties in the Target Areas are as follows:



Values of Properties in the Target Areas

Item	River Basin			Total
	Agno	Bicol	Cagayan	
I. General property	1,240,000	301,000	285,000	1,826,000
1) Private building construction	70,000	17,000	4,000	91,000
2) Household	519,000	159,000	89,000	767,000
3) Mineral production	15,000	---	---	15,000
4) Manufacturing production	140,000	21,000	13,000	174,000
5) Commercial trade	196,000	35,000	41,000	272,000
6) Fish pond production	61,000	4,000	1,000	66,000
7) Crops production	178,000	52,000	112,000	342,000
8) Livestock and poultry on farms	61,000	13,000	25,000	99,000
II. Public property	648,000	252,000	296,000	1,196,000
9) Road railway reconstruction cost	572,000	231,000	275,000	1,078,000
10) School reconstruction cost	71,000	19,000	20,000	110,000
11) Transportation	5,000	2,000	1,000	8,000
Total (x10 <sup>3</sup> P)	1,888,000	553,000	581,000	3,022,000
Total (x 10 <sup>3</sup> US\$)	257,000	75,000	79,000	411,000

Note: Items (1), (2), (9) and (10) are real estate properties, and other items indicate annual production.

2. Anticipated Maximum Damage Rates

2-1 Anticipated maximum damage rates

The following table gives a listing of anticipated maximum damage rates in the target areas along the Agno, Bicol and Cagayan basins classified by the kind of properties, worked out on the basis of past statistics in Philippines and Japan.

Anticipated Maximum Damage Rates by the  
Kind of Properties

Kind of Properties \ Sacle of Flooding	1.0 m Average Flood or Higher
Houses (wooden and non-wooden)	0.40
Household	0.10
Business establishments	0.40
Cattle and cultured fish	0.40
Crops production	0.20
Highways and railways	0.20
Schools	0.10
Transportation	0.40

Anticipated Maximum Damage

x10<sup>6</sup>

Maximum Damage Rate Kind of Properties	Agno		Bicol		Cagayan	
	Value of proper- ties	Maximum damage rate	Value of proper- ties	Maximum damage rate	Value proper- ties	Maximum damage rate
I. General property						
1) Private building construction	70	0.4	17	0.4	4	0.4
2) Household	519	0.3	159	0.3	89	0.3
3) Mineral production	15	0.4	-	0.3	-	0.4
4) Manufacturing produc- tion	140	0.4	21	0.4	13	0.4
5) Commercial trade	196	0.4	35	0.4	41	0.4
6) Fish pond production	61	0.4	4	0.4	1	0.4
7) Crops production	178	0.2	52	0.2	112	0.2
8) Livestock and poultry on farms	61	0.4	13	0.4	25	0.4
II. Public property						
9) Road and railway reconstruction cost	572	0.2	231	0.2	215	0.2
10) School reconstruction cost	71	0.1	19	0.1	20	0.1
11) Transportation	5	0.4	2	0.4	1	0.4
III. Total	1,888	0.28	553	0.26	581	0.24
			143			
					215	0.2
					2	0.1
					1	0.4
					581	0.24
					139	

Total anticipated damages in the three river basins: Value of properties 411,000 x 10<sup>3</sup> US\$  
 Value of damages 111,000  
 Damage rate 0.27

## 2-2 Anticipated Maximum Damages

The following table shows the estimated maximum damages within the Target Areas in the Agno, Bicol, and Cagayan Rivers. In times of major floods, 27% of the properties are expected to be damaged.

In addition, significant loss of human lives would result which are not convertible in monetary values.

Anticipated Maximum Damages

River Basin	Value of Properties	Damage Rate	Maximum Damage
Agno	1,888,000 ₱	0.28 ₱	531,000
Bicol	553,000	0.26	143,000
Cagayan	581,000	0.24	139,000
Total (x10 <sup>3</sup> P)	3,022,000	0.27	813,000
Total (x10 <sup>3</sup> US\$)	411,000	0.27	111,000

Further development along the Rivers would concentrate more people in the particular areas with increasing properties being accumulated.

Therefore, if a flood of the same magnitude occurred, the extent of damages would be much more amplified.

## §-2. Benefit of the Project

In general, the direct purpose of the Flood Forecasting and Warning system is to estimate the extent of coming floods timely, and to spread such information over as large an area as possible and to lessen damages by evacuation flood defense and rescue operation, etc. Besides this, indirect purpose will be to remove unnecessary fears among inhabitants and thus to stabilize their livelihood.

Since the benefits of the project are intangible because of the particular characteristics of the project, it is difficult to indicate its feasibility by a general economic approach. Yet, in order to lessen the potential vast damages as stated, it is essential to put the Flood Forecasting and Warning System into practice in the Agno, Bicol and Cagayan River Basins having enormous population and industry adjacent to their banks.

Specifically, following benefits are expected to accrue:

- 1) According to the Flood Forecasting and Warning System, evacuation preparations will not be just a waste of labor, and due to the increase in the time for preparations, a large number of harvested products, personal belongings, household utensils, etc. can be removed from the affected areas.
- 2) The extent of damages can be narrowed by efficient implementation of flood defense and rescue by timely forecasting and warnings.
- 3) The lessened damages can lead to increase in personal properties and indirectly help improve the residents' motivation for work and life.
- 4) Smooth implementation of regional development projects is expected.





