3.2.3 Disbursement Schedule of Construction Fund

The yearly disbursement of the required fund for the Stage-I construction works is set out as shown in TABLE-2.2.2 and as summarized below, based on the implementation schedule and construction cost breakdown.

Disbursement Schedule of Construction Fund

Year	Foreign Currency (1,000 Pesos)	Local Currency (1,000 Pesos)	Total (1,000 Pesos)
1983	4,590	10,936	15,526
1984	7,151	17,803	24,954
1985	9,144	23,655	32,799
1986	10,072	27,529	37,601
1987	13,005	37,611	50,616
Total	43,962	117,534	161,496

3.3 Disaster Prediction and Warning System Project

3.3.1 Implementation Method and Schedule

The Stage-I construction of the disaster prediction and warning system project includes the works as described hereunder in accordance with the degree of urgency of disaster prediction and warning. The construction works will be carried out on international competitive contract basis.

To complete the disaster prediction and warning system in a specified period as a crash program is not realistic. In the first place, the maintenance system organization requires careful consideration. In the second, the construction of water level observatory buildings and facilities are restricted by the rainy season.

As shown in the construction time schedule, detailed design and tender specifications will first be completed before the commencement of construction work.

The investigations concerning radio routes mainly consist of the map study. Therefore, when detailed design is made, radio interference to/from the existing radio system should be carefully examined. If necessary, propagation tests should also be carried out. And, based on the findings in such examination and tests, the radio frequency band to adopt should be determined.

The Stage-I construction works will take 3 years and the construction time schedule is presented in FIG.-3.3.1.

(a) Meteorological Observation Center

The meteorological observation center is to be established at Legazpi. This center analyzes data supplied from observatories in different places and, when danger is anticipated, issues alarm to the warning center. The suitable place where to locate the center is proposed at Legazpi Weather Station.

(b) Rainfall Observatories

Rainfall observatories, one each in the first to fourth quadrants, are to be established, centering upon Mayon Volcano, for the purpose of silt discharge forecast. All observatory buildings are to be the shelter type because, in this case, the construction period can be reduced.

(c) Warning Center

The warning center is to be established at Legazpi. This center is to issue evacuation advice to municipalities and barangays where disaster is anticipated and to instruct countermeasures when disater actually takes place. The optimum location of the center is at Legazpi OCD building. In this building, however, necessary floor space for the center is not available. Furthermore, building strength is not appropriate for the center. Thus the center must be located at another site.

(d) Warning Stations

Warning stations are to be established in municipalities and barangays where disasters are foreseen. The stations are planned

to relay disaster warning to inhabitants. At the first stage, warning stations are planned to construct at Matanag, Ligao and Libon where disaster potential is especially great. Other warning stations except for the above are also to be established in governmental offices in Legazpi. These warning stations function to maintain contact between the warning center and those governmental offices when disaster takes place. Such warning stations are to be established at two places.

(e) Warning Mobile

Forwarding of alerts, including evacuation advice, from the warning station to inhabitants in the area concerned is difficult because inhabitants are widely scattered. For this reason, vehicles with announcement speaker and radio equipment mounted aboard are to be assigned on duty in Legazpi, Ligao and Tabaco areas. Those vehicles are used to forward alerts to inhabitants and to report damage and casualties to the warning center. Four vehicles are to be provided at Legazpi and two each at Ligao and Tabaco.

(f) HF Radio Equipment Renewal

Presently, at Legazpi weather station and Manila PAGASA, HF radio equipment is installed for exchange of information. However, that equipment is obsolete and outside radio interference is frequent. Service is far from being satisfactory. To improve such situation, radio equipment and antenna facilities are to be renewed

(g) UHF/VHF Radio Stations

To connect each observatory and meteorological observation center and to connect each warning station and warning center, UHF/VHF radio stations are to be established.

3.3.2 Project Operation

Presently in Legazpi area, the disaster prediction and warning system does not exist. Hence, for the maintenance/operation of the system to be newly established, the maintenance system should be

organized without delay and, at the same time, the training of maintenance personnel should also be hastened.

Although the execution of construction works is to be on international competitive contract basis, the necessary preparatory works should be undertaken by the Philippine authority in charge of this Project, which include the following:

- Station site land acquisition, ground levelling and fencing
- Access road, land acquisition and road construction
- Legazpi R/S - communication cable installation
- Commercial power drop-in to station site

Participation of fully experienced foreign consultant for the project implementation is desirable from the viewpoint of smooth progress of construction work. Considering that this Project comprises construction not only of meteorological observation system but also of various kinds of emergency-use communication facilities, experience in the conventional meteorological observation system construction only will not be fully subservient.

3.3.3 Disbursement Schedule of Construction Fund

The yearly disbursement of the required fund for the Stage-I construction works is set out as shown in TABLE-2.2.11 and as summarized below, based on the implementation schedule and construction cost breakdown.

Disbursement Schedule of Construction Fund

Year	Foreign Currency (1,000 Yen)	Local Currency (1,000 peso)
1st Year	55,000	-
2nd Year	508,899	-
3rd Year	829,880	2,253
Total	1,393,779	2,253

CHAPTER IV

IV. RECOMMENDATIONS

For the successful implementation of the Project, the following are particularly recommended through the re-assessment and review of the Master Plan and re-study of the Sabo project and disaster prediction & warning system project.

1. Meteo-hydrological Data Collection

In the re-assessment and review of the Master Plan, it was found that the existing meteo-hydrological data were not fully sufficient for adequate engineering analysis. For further study, immediate steps should be taken to reinforce the data collection by the meteo-hydrological observation in accordance with the implementation of the proposed disaster prediction and warning system project.

2. Sabo Project

As a result of the re-study of the Sabo project, the Stage-I construction works should be implemented urgently in order to prevent the direct disaster due to mud/debris flows.

Each Sabo facility proposed in the yearly program should be constructed without delay. For this purpose, it is recommended that the Project Management Office should be established as soon as possible to execute the Sabo project successfully.

Sabo project should be implemented in a long term. The proposed Sabo plan was made based on the present river conditions and the recent disaster due to typhoon "Daling". Therefore, if there is any change of topographic conditions due to heavy rain and unforeseen mud/debris flows in future, the Sabo plan and design should be modified timely and properly prior to and during implementation period.

3. River Improvement Works

River improvement works should be performed based on the Master Plan, considering direct flood damage reduction and land enhancement.

Through the re-assessment and review of the Master Plan, it is recommended that urgent flood control works such as Oas diversion, Tagpo-Cavasi shortcut, improvement of the Guinobatan reaches, Tagas River section, Binatagan Bridge section, Ligao-Tabaco National Highway Bridge section, etc. should be accorded high priority for earlier implementation. They should be carried out within the framework of the MPWH river improvement program.

4. Disaster Prediction and Warning System

The system plan was formulated based on the study by limited information and data. More detailed studies are recommended to perform in both hydrologic and telecommunication engineering fields before the actual implementation of the project as follows: the influence of tropical storm to the rainfall in the project area; the relationship between the rainfall and mud/debris flow; flood runoff analysis; flood routing analysis; institutional studies on warning organization; studies to establish additional evacuation centers in the vicinities of each barangay; and the detailed study for the system and equipment in the project area.

For the implementation of the disaster prediction and warning system project, it is recommended that this project should be performed by stagewise construction that the equipment proposed in each stage should be installed according to the progress of the implementation of the Sabo project.

5. Shelter Zones and Emergency Evacuation Areas

The shelter zones and emergency evacuation areas were selected temporarily by the risk analysis only based on the interpretation of aerophotos. Accordingly, these areas should be finally determined in due consultation with the relevant Authorities such as MPWH, OCD, DCC, PAGASA, COMVOL, etc. Also, further study should include site reconnaissance for obtaining criteria to establish these areas, existing evacuation centers, proposed disaster prediction and warning system, conciousness of the people concerning disaster prevention, etc.

6. Watershed Management

Reforestation on the slope of Mayon Volcano should be considered as supplement to the Sabo project to increase a function of watershed management.

Deforestation should be restricted in both private and governmental lands. If the deforestation is effected in the project area, the reforestation should be implemented in a systematic manner under obligation. Necessary step should be taken by the Government concerned to avoid deforestation without any control as well as to promote afforestation and reforestation.

As the vast cogon grass land extending over the mountain-skirt of Mayon Volcano provides an adverse condition for Sabo, it is recommended that the tree planting should be promoted to transform such grass land into a vegetated land well resistible for soil erosion. From the experience in the Philippines, Agoho and Giant Ipil-Ipil are the recommendable species to be planted.

TABLES

TABLE-1.3.1 LIST OF TYPHOONS AFFECTING PROJECT AREA

Year	Name of Typhoon	Occurrence Date
1970	Atang	Feb. 23 - Feb. 27
	Yoning	Nov. 17 - Nov. 20
1971	Herming	May 25 - May 27
1972	Konsing	Jan. 23 - Jan. 26
1973	Luming	Oct. 2 - Oct. 9
1974	Bising	Jan. 8 - Jan. 11
	Iling	Jun. 22 - Jul. 2
	Tening	Oct. 14 - Oct. 17
	Aning	Nov. 4 - Nov. 7
1976	Huaning	Jun. 22 - Jul. 2
1977	Unding	Nov. 10 - Nov. 17
1978	Atang	Apr. 18 - Apr. 26
	Weling	Sept.24 - Sept.28
	Yaning	Oct. 7 - Oct. 14
	Kading	Oct. 25 - Oct. 29
1979	Bebeng	Apr. 13 - Apr. 19
	Etang	Jun. 30 - Jul. 1
	Pepang	Sept.16 - Sept.20
	Yayang	Nov. 4 - Nov. 7
1980	Nitang	Jul. 19 - Jul. 22
	Osang	Jul. 22 - Jul. 27
	Yoning	Oct. 28 - Oct. 30
	Aring	Nov. 1 - Nov. 7
1981	Yeyeng	Nov. 17 - Nov. 21
	Dinang	Dec. 23 - Dec. 27
	Daling	Jun. 28 - Jul. 2

TABLE-1.3.2 INUNDATED BARANGAYS DUE TO FLOOD BY TYPHOON "PEPANG" IN 1979

River Basin	Municipality	Name of Barangay
Quinali (A) River Basin	Polangui	Centro Occidential, Basud, Obaliw, Alomon, Balangibang, Kinali
	Libon	Zone 2, Zone 3, Zone 4, Zone 5, Bacolod, Buga, Bulusan, Carisac-East, Carisac-West, Marayag, San-Agustin, San Isidro, Sta Cruz
	Oas	Centro Poblacion, Bagumbayan, Bongoran, Busac, Ilaor-Sur, Iraya-Sur, Mayao, Obaliw-Rinas, Rizal, San Agustin, Talongog
	Ligao	Bagumbayan, Binatagon, Calzada, Dunao, Guilid, Bobonsuran, Tinago, Bonga, Busay, Cavasi, Pandan, Tagpo
	Guinobatan	Ilawod, Iraya
	Camalig	Ilawod, Ligban, Tagaytay
Yawa River Basin	Daraga	Kilicao, Banag
	Legazpi	San Roque, Houses along Yawa River
Quinali (B) River Basin	Malinao	Balading, Bagumbayan, Balza, Malolos, Libod, Matalipni

Remarks: Above inundated barangays is re-assessed by the inundation area due to typhoon "Daling" in 1981. The inundation area due to typhoon "Daling" is assumed to be almost the same as the area of typhoon "Pepang".

TABLE-1.3.3 DAMAGE TO HOUSES DUE TO MUD/DEBRIS FLOW CAUSED BY TYPHOON "DALING" IN 1981

	Name of River	Totally Destroyed		Partially Damaged		Total Damage	
		Houses	Value (₱10^3)	Houses	Value (₱10^3)	Houses	Value (₱10^3)
I)	Quinali (A)	39	113	335	67	374	180
	1) Quirangay	20	58	200	40	220	98
	2) Tumpa	4	12	100	20	104	32
	3) Maninila	10	29	15	3	25	32
	4) Masarawag	5	14	20	4	25	18
	5) Ogsong	-	-	-	-	-	-
	6) Nasisi	-	-	-	-	-	-
II)	Yawa	196	568	605	121	801	689
	1) Anuling	23	67	130	26	153	93
	2) Budiao	142	411	373	75	515	486
	3) Pawa-Burabod	31	90	102	20	133	110
III)	Quinali (B)	-	-	-	-	-	-
IV)	East and North-east	65	189	188	38	253	227
	Total	300	870	1,128	226	1,428	1,096

Note: Damage value per house at the foot of Mayon Volcano is estimated as below, on the basis of the result of field interview survey in 1982.

- Totally destroyed : ₱2,900/house
- Partially damaged : ₱ 200/house

Source: Result of field interview survey in 1982.

TABLE- 1.3.4 FLOOD DAMAGE TO ROAD STRUCTURE

(Unit: Pesos)

River Basin Kinds of Road	1975	1976	1977	1978	1979	1980	1981
Quinali (A) River Basin							
National	800,000	-	1,500,000	351,000	722,500	-	1,993,000
Provincial	368,000	-	-	-	103,900	-	800,000
Municipal & City	-	52,500	302,000	-	-	-	-
Barangay	100,000	170,000	323,500	328,500	7,500	-	-
Sub-Total	1,268,000	222,500	2,125,500	679,500	833,900		2,793,000
	(2,984,000)	(463,000)	(3,915,000)	(1,108,000)	(1,203,000)		(3,156,000)
Yawa River Basin							
National	-	-	27,000	96,000	30,500	-	-
Provincial	30,000	-	-	-	45,000	-	70,000
Municipal & City	170,000	22,500	62,500	40,000	40,000	-	20,000
Barangay	10,000	82,500	108,000	209,500	277,500	-	235,000
Sub-Total	210,000	105,000	197,500	345,500	393,000		325,000
	(494,000)	(219,000)	(364,000)	(563,000)	(567,000)		(367,000)
East and North-East Area							
National	150,000	-	-	-	46,000	-	-
Provincial	150,000	-	-	-	26,000	-	69,000
Municipal & City	-	39,700	220,700	-	-	-	-
Barangay	95,000	296,000	228,000	178,000	330,000	-	-
Sub-Total	395,000	335,700	448,700	178,000	402,000		69,000
	(929,000)	(699,000)	(827,000)	(290,000)	(580,000)		(78,000)

- Continued -

River Basin Kinds of Road	1975	1976	1977	1978	1979	1980	1981
Quinali (B) River Basin							
National	51,000	-	204,000	45,000	47,000	-	230,000
Provincial	45,000	-	-	-	121,500	-	120,000
Municipal & City	-	5,100	43,700	-	-	-	-
Barangay	30,000	81,000	90,000	155,000	300,000	-	-
Sub-Total	126,000 (296,000)	86,100 (179,000)	337,700 (622,000)	200,000 (326,000)	468,500 (676,000)		350,000 (396,000)
Total	1,999,000 (4,703,000)	749,300 (1,560,000)	3,109,400 (5,728,000)	1,403,000 (2,287,000)	3,097,400 (3,026,000)		3,537,000 (3,997,000)

Remarks: Amounts in the parentheses are estimated at 1982 price level.

TABLE-1.3.5 FLOOD DAMAGE TO RAILWAY STRUCTURE

(Unit: Pesos)

River Basin	1975	1976	1977	1978	1979	1980	1981
Quinali (A) River Basin	634,000 (1,492,000)	-	-	-	320,000 (462,000)	200,000 (255,000)	1,500,000 (1,695,000)
Yawa River Basin	3,700,000 (8,706,000)	-	-	-	-	-	-
Total	4,334,000 (10,198,000)				320,000 (462,000)	200,000 (255,000)	1,500,000 (1,695,000)

Remarks: Amounts in the parentheses are estimated at 1982 price level.

TABLE- 1.3.6 FLOOD DAMAGE TO RIVER FACILITIES

(Unit: Pesos)

River Basin	1975	1976	1977	1978	1979	1980	1981
Quinali (A) River Basin	455,000 (1,071,000)	-	115,000 (212,000)	327,000 (533,000)	801,000 (1,156,000)	2,861,000 (3,653,000)	7,439,000 (8,406,000)
Yawa River Basin	60,000 (141,000)	50,000 (104,000)	-	100,000 (163,000)	170,000 (245,000)	-	-
East & North-East Area	-	-	-	-	-	27,000 (34,000)	350,000 (396,000)
Quinali (B) River Basin	45,000 (106,000)	-	-	133,000 (217,000)	-	90,000 (115,000)	150,000 (170,000)
Total	560,000 (1,318,000)	50,000 (104,000)	115,000 (212,000)	560,000 (913,000)	971,000 (1,401,000)	2,978,000 (3,802,000)	7,939,000 (8,972,000)

Remarks: Amounts in the parentheses are estimated at 1982 price level.

TABLE-1.3.7 DETAILED FLOOD DAMAGE TO RIVER FACILITIES

(Unit: Pesos)

Date and Typhoon	Quinali (A) River Basin	Yawa River Basin	East North-East Area	Quinali (B) River Basin	Total Damage Cost
Typhoon 'Denang' Dec. 1981	3,492,000	-	67,000	-	3,559,000
Typhoon 'Anding' Nov. 1981	3,470,000	-	70,000	-	3,540,000
Typhoon 'Daling' June, 1981	7,439,000	-	350,000	150,000	7,939,000
Typhoon 'Aring' Nov. 1980	2,861,000	-	27,000	90,000	2,978,000
Typhoon 'Pepang' Sep. 1979	801,600	170,000	-	-	991,000
Typhoon 'Kading' Oct. 1978	327,000	100,000	-	133,000	560,000
Typhoon 'Weling' Sep. 1978	-	100,000	-	-	100,000
Typhoon 'Elang' July 1977	115,000	-	-	-	115,000
Typhoon 'Aring' Dec. 1976	-	50,000	-	-	50,000
Typhoon 'Sisang' Dec. 1975	455,000	60,000	-	45,000	560,000

Remarks: Data Source - Ministry of Public Works and Highways, the District Engineering Office and City Engineering Office.

Amount - Damage costs are based on the price level in each year.

TABLE-1.3.8 FLOOD DAMAGE TO WATERWORKS

(Unit: Pesos)

Date and Typhoon	Quinali (A) River Basin	Yawa River Basin	East North-East Area	Quinali (B) River Basin	Total Damage Cost
Typhoon 'Dinang' Dec. 1981	97,000	-	-	147,000	244,000
Typhoon 'Anding' Nov. 1981	100,000	-	-	150,000	250,000
Typhoon 'Daling' June. 1981	420,000	350,000	-	200,000	970,000
Total	617,000 (697,000)	350,000 (396,000)	-	497,000 (562,000)	1,464,000 (1,655,000)

Remarks: Data Source - Ministry of Public Works and Highways

Amount in the parentheses are estimated at 1982 price level.

TABLE-1.3.9 FLOOD DAMAGE TO GOVERNMENT INFRASTRUCTURE

(Unit: Pesos)

Riber Basin	1975	1976	1977	1978	1979	1980	1981
Quinali (A) River Basin							
Roads	2,984,000	463,000	3,915,000	1,108,000	1,203,000	-	3,156,000
Railways	1,492,000	-	-	-	462,000	255,000	1,695,000
River Facilities	1,071,000	-	212,000	533,000	1,156,000	3,653,000	8,406,000
Water works	-	-	-	-	-	-	697,000
Total	5,547,000	463,000	4,127,000	1,641,000	2,821,000	3,908,000	13,954,000
Yawa River Basin							
Roads	494,000	219,000	364,000	563,000	567,000	-	367,000
Railways	8,706,000	-	-	-	-	-	-
River Facilities	141,000	104,000	-	163,000	245,000	-	-
Water works	-	-	-	-	-	-	396,000
Total	9,341,000	323,000	364,000	726,000	812,000		763,000

- Continued -

River Basin	1975	1976	1977	1978	1979	1980	1981
East & North-East Area							
Roads	929,000	699,000	827,000	290,000	580,000	-	78,000
Railways	-	-	-	-	-	-	-
River Facilities	-	-	-	-	-	34,000	396,000
Water works	-	-	-	-	-	-	-
Total	929,000	699,000	827,000	290,000	580,000	34,000	474,000
Quinali (B) River Basin							
Roads	296,000	179,000	622,000	326,000	676,000	-	396,000
Railways	-	-	-	-	-	-	-
River Facilities	106,000	-	-	217,000	-	115,000	170,000
Water works	-	-	-	-	-	-	562,000
Total	402,000	179,000	622,000	543,000	676,000	115,000	1,128,000
Total	16,219,000	1,664,000	5,940,000	3,200,000	4,889,000	4,057,000	16,319,000

Remarks: Amounts are estimated at 1982 price level.

TABLE-1.3.10 FLOOD DAMAGE TO THE IRRIGATION FACILITIES

(Unit: Pesos)

Date and Typhoon	Quinali (A) River Rasin	Quinali (B) River Basin	Yawa River Basin	East and North-East Area	Total Damage Cost
Typhoon 'Anding' Nov. 1981	349,800	36,800	36,800	105,800	529,200
Typhoon 'Aring' Nov. 1980	325,400	108,000	-	25,000	458,400
Typhoon 'Pepang' Sep. 1979	622,300	26,400	-	61,400	710,100
Typhoon 'Weling' Sep. 1979	414,200	43,400	-	150,500	608,100
Typhoon 'Kading' Oct. 1978	339,200	31,900	-	116,400	487,500
Typhoon 'Unding' Nov. 1977	195,000	-	-	54,200	249,200
Typhoon 'Didnag' May, 1976	71,800	19,200	-	60,300	151,300
Typhoon 'Sisang' Dec. 1975	228,300	5,200	-	-	233,500

Remarks: Data Source - National Irrigation Administration, Region V.
Damage cost is estimated at 1982 price level.

TABLE-1.3.11 RICE PRODUCTION DAMAGE BY TYPHOON "PEPANG", 1979

Municipality	Area of Standing Palay (ha)	Affected Area			Yield		Production Loss (cavan)
		Total (ha)	No Recovery (ha)	With Recovery (ha)	Potential (cavan/ha)	Actual (cavan/ha)	
Quinali (A) River Basin							
Polangui	964	292	0	292	86	49	10,804
Libon	1,773	1,773	1,291	482	89	48	134,061
Oas	1,411	1,411	52	1,359	85	70	24,805
Ligao	622	622	42	580	85	70	12,270
Total:	4,770	4,098	1,385	2,713	87	59	182,540 (9,127 ton)
Quinali (B) River Basin							
Malinao	1,369	1,369	15	1,354	80	75	7,970
Tabaco	41	41	8	33	75	45	1,590
Total:	1,410	1,410	23	1,387	80	74	9,560 (478 ton)

Source: BAEx, Municipal office, 1980.

TABLE-1.3.12 RICE PRODUCTION DAMAGE BY TYPHOON "DALING", 1981

Municipality Affected	Area Planted (ha)	Stage of Crop	Affected Area		With Chance of Recovery (ha)	Estimated Yield		Production Loss/2 (ton)
			Total (ha)	Completely Damaged/1 (ha)		Before Calamity (ton/ha)	After Calamity (ton/ha)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Quinali (A)	6,217		2,054	1,554	500			6,010
- Polangui	1,231	Vegetative	578	405	96	3.80	3.50	1,570
- Libon	1,126	"	582	534	72	3.90	3.55	2,110
- Oas	1,188	"	388	265	123	3.50	3.00	990
- Ligao	1,170	"	276	213	116	3.50	3.25	770
- Camalig	770	"	90	61	29	3.50	2.50	240
- Guinobatan	732	"	140	76	64	3.75	3.00	330
Yawa	440		391	171	39			600
- Legazpi City	312	"	312	131	-	3.25	0	430
- Daraga	128	"	79	40	39	3.25	2.25	170
Total:	6,657		2,445	1,725	539			6,610

/1: No chance of recovery /2: $(8) = (4) \times (6) + (5) \times \{(6) - (7)\}$

Source: Crop Damage Survey, Regional Office of Ministry of Agriculture

TABLE-1.3.13 DAMAGE TO AGRICULTURAL PRODUCT DUE TO MUD/DEBRIS FLOW (1980 - 1982)

Basin	Palay		Coconut		Total (₱10³)
	Area (ha)	Value/1 (₱10³)	Area (ha)	Value/1 (₱10³)	
Quinali (A)	105	214	45	68	282
Quinali (B)	-	-	-	-	-
Yawa	91	142	23	35	177
Northeast Area	6	12	15	23	35
Total	202	368	83	126	494

/1 : Damage value per hectare is estimated as follows:

Crop	Unit Yield (ton/ha)	Price (₱/ton)	Damage Value (₱/ha)
Palay			
Quinali (A)	1.7	1,200	2,040
Quinali (B)	1.7	1,200	2,040
Yawa	1.3	1,200	1,560
Northeast Area	1.6	1,200	1,920
Coconut			
(Copra)	0.88	1,600	1,410
(Charcoal)	0.20	450	90

Source: Results of risk analysis

TABLE-1.3.14 DISASTER RELIEF
(TYPHOON "DALING")

(Unit: P10^3)

Area	Pepang	Daling
Quinali (A)	1.7	38.1
Quinali (B)	-	1.1
Yawa	-	2.0
Northeast	-	5.5
Total	1.7	46.7

Source: Regional Office of the
Philippine National Red Cross

TABLE-1.3.15 MEDICAL ASSISTANCE RENDERED TO VICTIMS OF TYPHOON "DALING" IN THE PROJECT AREA

Basin	No. of Health Personnel Involved (man-day)	Cost of Personnel /1 (₱10³)	Cost of Medicines /2 (₱10³)	Total (₱10³)
Quinali (A)	7,020	399	234	633
	Physicians - 1,080	162		
	Nurses - 1,080	43		
	Midwives - 4,050	162		
	Sanitary Inspectors - 810	32		
Yawa	220	11	10	21
	Physicians - 20	3		
	Nurses - 30	1		
	Midwives - 130	5		
	Sanitary Inspectors - 40	2		
Total	7,240	410	244	654

/1 : Unit cost of personnel is assumed as follows.

Physicians	:	₱150/day
Nurses	:	₱ 40/day
Midwives	:	₱ 40/day
Sanitary Inspectors	:	₱ 40/day

Source : Provincial Health Office

TABLE-1.3.16 TOTAL FLOOD AND MUD/DEBRIS FLOW DAMAGES BY TYPHOON "PEPANG" IN 1979 (1982 FINANCIAL PRICE LEVEL)

(Unit: P10^3)

Damage Category	River Basin				Whole Project Area
	Quinali (A)	Quinali (B)	Yawa	East and Northeast Area	
1) Infrastructure	2,821	676	812	580	4,889
- Road	1,203	676	567	580	3,026
- Railway	462	-	-	-	462
- River facilities	1,156	-	245	-	1,401
- Waterworks	*/1	*	*	*	*
2) Houses and Buildings	15,777	1,085	1,812	-	18,674
3) Irrigation Facilities	622	26	-	62	710
4) Agricultural Product	10,950	580	-	-	11,530
5) Indirect Damage/2	423	101	122	87	733
Total	30,593	2,468	2,746	729	36,536

/1 : No data

/2 : 15 % of total damage to infrastructure

TABLE-1.3.17 TOTAL FLOOD AND MUD/DEBRIS FLOW DAMAGES BY TYPHOON "DALING" IN 1981 (1982 FINANCIAL PRICE LEVEL)

Damage Category	River Basin				Whole Project Area
	Quinali (A)	Quinali (B)	Yawa	East and Northeast Area	
1) Infrastructure	13,954	1,128	763	474	16,319
- Road	3,156	396	367	78	3,997
- Railway	1,695	-	-	-	1,695
- River facilities	8,406	170	-	396	8,972
- Waterworks	697	562	396	-	1,655
2) Houses and Buildings	16,124	1,085	2,561	-	19,770
3) Irrigation Facilities	1,661	384	68	271	2,384
4) Agricultural Product	7,494	-	897	35	8,426
5) Indirect Damage/1	2,093	169	114	71	2,447
Total	41,326	2,766	4,403	851	49,346

/1 : 15 % of total damage to infrastructure

TABLE-1.3.18 CASUALTIES AND FAMILIES AFFECTED IN THE PROJECT AREA (TYPHOON "DALING" IN 1981)

Basin	Casualties (persons)				Families Affected	Population Affected (persons)
	Dead	Injured	Missing	Total		
Flood Damage	99	0	3	102	571	3,250
- Quinali (A)	96	0	2	98	482	2,750
- Quinali (B)	3	0	1	4	37	210
- Yawa	0	0	0	0	6	30
- Northeast	0	0	0	0	46	260
Mud/Debris Flow Damage	39	107	13	159	1,428	8,140
- Quinali (A)	10	12	0	22	576	3,280
- Quinali (B)	0	0	0	0	0	0
- Yawa	29	95	13	137	852	4,860
- Northeast	0	0	0	0	0	0
Total	138	107	16	261	1,999	11,390
- Quinali (A)	106	12	2	120	1,058	6,030
- Quinali (B)	3	0	1	4	37	210
- Yawa	29	95	13	137	858	4,890
- Northeast	0	0	0	0	46	260

Source : - Regional Office of Ministry of Social and Service Development
- Results of field interview survey

TABLE-1.3.19 CASUALTIES DUE TO MUD/DEBRIS FLOW CAUSED BY TYPHOON "DALING" IN 1981

City/Barangay	Dead	Missing	Injured	Total
Legazpi				
Mabinit	14	5	30	49
Bonga	4	-	30	34
Daraga				
Budiao	3	-	2	5
Salvacion	7	7	10	24
Banadero	1	1	3	5
Kilikao	-	-	20	20
Camalig				
Quirangay	2	-	6	8
Guinobatan				
Maninila	3	-	-	3
Muladbucad Pequeno	2	-	1	3
Ligao				
Batang	2	-	5	7
Nasisi	1	-	-	1
Total	39	13	107	159

Source: Result of field interview survey in 1982.

TABLE-1.3.20 CASUALTIES BY TYPHOONS IN THE PROJECT AREA

Name of Typhoon	Year	Number of Casualty			
		Dead	Missing	Injured	Total
Sening	1970	206	137	865	1,208
Herming	1971	3	3	-	6
Konsing	1972	11	4	-	15
Luming	1973	1	-	-	1
Sisang	1975	8	-	-	8
Daling	1981	138	16	107	261

Source: (1) The Philippine National Red Cross, Legazpi, 1980
(2) Regional Office of Ministry of Social and Service Development, Legazpi, 1982
(3) Result of field interview survey in 1982

TABLE-2.2.1 FINANCIAL CONSTRUCTION COST FOR THE SABO PROJECT, STAGE-I

(Unit: 1,000 Pesos)

Description	Foreign Currency Portion	Local Currency Portion	Total
1. Contract Cost			
(1) Direct Cost	23,622	43,926	67,548
(2) General	2,363	4,392	6,755
(3) Supervision & Miscellaneous	1,559	2,899	4,458
(4) Profit	2,755	5,122	7,877
(5) Contractor's Tax	910	1,689	2,599
Sub total	31,209	58,028	89,237
2. Right of Way/Site Acquisition	-	25	25
3. Resettlement	-	-	-
4. Engineering Cost	-	8,923	8,923
5. Project Management Cost	-	4,462	4,462
6. Contingency			
(1) Physical Contingency	4,681	8,704	13,385
(2) Price Escalation	8,074	37,390	45,464
Total	43,964	117,532	161,496

TABLE-2.2.2 FINANCIAL CONSTRUCTION COST DISBURSEMENT SCHEDULE FOR THE SABO PROJECT, STAGE-I

(Unit: 1,000 Pesos)

Description	1st Year (1983)		2nd Year (1984)		3rd Year (1985)		4th Year (1986)		5th Year (1987)		Total	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
1. Contract Cost												
(1) Direct Cost	2,848	5,376	4,180	7,829	5,213	9,293	5,219	9,657	6,342	11,771	23,622	43,926
(2) General	285	538	418	783	504	929	522	965	634	1,178	2,363	4,392
(3) Supervision & Miscellaneous	188	355	276	517	332	613	344	637	418	777	1,559	2,899
(4) Profit	332	627	487	913	587	1,083	609	1,126	739	1,373	2,755	5,122
(5) Contractor's Tax	110	207	162	301	194	357	201	372	243	453	910	1,689
Sub total	3,763	7,103	5,523	10,343	6,650	12,275	6,895	12,757	8,376	15,552	31,209	58,028
2. Right of Way/Site Acquisition	-	3	-	5	-	5	-	5	-	7	-	25
3. Resettlement	-	-	-	-	-	-	-	-	-	-	-	-
4. Engineering Cost	-	1,086	-	1,586	-	1,893	-	1,965	-	2,393	-	8,923
5. Project Management Cost	-	543	-	794	-	946	-	983	-	1,196	-	4,462
6. Contingency												
(1) Physical Contingency	564	1,065	828	1,551	998	1,841	1,034	1,914	1,257	2,333	4,681	8,704
(2) Price Escalation	263	1,136	800	3,524	1,496	6,695	2,143	9,905	3,372	16,130	8,074	37,390
Total	4,590	10,936	7,151	17,803	9,144	23,655	10,072	27,529	13,005	37,611	43,964	117,532

TABLE-2.2.3 ECONOMIC COST FOR THE SABO PROJECT, STAGE-I

(Unit: 1,000 Pesos)

Description	Foreign Currency Portion	Local Currency Portion	Total
1. Contract Cost			
(1) Direct Cost	23,622	37,705	61,327
(2) General	2,362	3,771	6,133
(3) Supervision & Miscellaneous	1,558	2,490	4,048
(4) Profit	-	-	-
(5) Contractor's Tax	-	-	-
Sub total	27,542	43,966	71,508
2. Right of Way/Site Acquisition	-	-	-
3. Engineering Cost	-	7,152	7,152
4. Project Management Cost	-	3,575	3,575
5. Contingency			
(1) Physical Contingency	4,132	6,595	10,727
(2) Price Escalation	-	-	-
Total	31,674	61,288	92,962

TABLE-2.2.4 ECONOMIC COST DISBURSEMENT SCHEDULE FOR THE SABO PROJECT, STAGE-1

(Unit: 1,000 Pesos)

Description	1st Year (1983)		2nd Year (1984)		3rd Year (1985)		4th Year (1986)		5th Year (1987)		Total	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
1. Contract Cost												
(1) Direct Cost	2,848	4,627	4,180	6,730	5,033	7,966	5,219	8,282	6,342	10,100	23,622	37,705
(2) General	285	463	418	673	503	797	522	828	634	1,010	2,362	3,771
(3) Supervision & Miscellaneous	188	305	276	445	332	527	344	547	418	666	1,558	2,490
(4) Profit	-	-	-	-	-	-	-	-	-	-	-	-
(5) Contractor's Tax	-	-	-	-	-	-	-	-	-	-	-	-
Sub total	3,321	5,395	4,874	7,848	5,868	9,290	6,085	9,657	7,394	11,776	27,542	43,966
2. Right of Way/Site Acquisition	-	-	-	-	-	-	-	-	-	-	-	-
3. Resettlement	-	-	-	-	-	-	-	-	-	-	-	-
4. Engineering Cost	-	872	-	1,272	-	1,516	-	1,574	-	1,918	-	7,152
5. Project Management Cost	-	436	-	636	-	758	-	787	-	958	-	3,575
6. Contingency												
(1) Physical Contingency	498	809	731	1,177	881	1,394	913	1,448	1,109	1,767	4,132	6,595
(2) Price Escalation	-	-	-	-	-	-	-	-	-	-	-	-
Total	3,819	7,512	5,605	10,933	6,749	12,958	6,998	13,466	8,503	16,419	31,674	61,288

TABLE-2.2.5 MUD/DEBRIS FLOW DAMAGE TO AGRICULTURE CAUSED BY TYPHOON "DALING" IN 1981

Item		Quinali (A)	Yawa
I) Damage to Coconut			
1) Damage area	(ha)	45	23
2) Re-transplanting cost of coconut			
- Unit cost /1	(₱10³/ha)	3.18	3.18
- Total cost	(₱10³)	143	73
3) Loss of net return (net income)			
- Loss of net return per hectare /2	(₱10³/ha)	17.7	17.7
- Total loss	(₱10³)	797	407
II) Damage to Paddy Field			
1) Damage area		105	91
2) Rehabilitation cost per hectare /3	(₱10³/ha)	75	75
3) Total rehabilitation cost	(₱10³)	7,875	6,825
Total		8,815	7,305

/1: See TABLE-2.2.6.

/2: Loss of net return per hectare is estimated as below:

- Annual net return of coconut	:	₱2,950/ha
- Period of loss*	:	6 year
- Total loss per hectare	:	₱17,700/ha

* The period of loss is assumed at 6 years from re-transplanting to first production of coconut.

/3:

Average depth of sediment	:	0.5 m
Volume of sediment per hectare	:	5,000 m^3
Excavation cost per m^3	:	₱15.0/m^3
Rehabilitation cost per hectare:		₱75,000/ha

TABLE-2.2.6 RE-TRANSPLANTING COST PER HECTARE FOR COCONUT

(Unit: ₱/ha)

Item	Establishing Period			Total
	1-year	2-year	3-year	
A) Materials/Equipment				
1) Seedling: 143 at ₱1.0/ seedling	143	-	-	143
2) Fertilizer - N: 11 kg/ha	75	75	75	225
K: 38 kg/ha	122	122	122	366
3) Pesticide	200	200	200	600
4) Tools	200	-	-	200
5) Covercrop seeds: 20 kg at ₱10.0/kg	200	-	-	200
6) Replanting - 10% of stand seedlings: 14 at ₱1.0/ seedling	14	-	-	14
B) Labour				
1) Clearing, ready to plant	1,000	-	-	1,000
2) Layouting, staking and holing: 0.5 x 0.5 m at ₱0.75/hole	107	-	-	107
3) Planting: 143 at ₱0.2/ seedling including basal application of fertilizer	29	-	-	29
4) Replanting: 14 at ₱0.2/ seedling including basal application of fertilizer	3	-	-	3
5) Fertilizer/chemical application:				
- 6 months after planting at ₱0.1/palm	14	-	-	14
- 143 palms at ₱0.5/palm		72	72	144
6) Ringweeding: 143 at ₱0.3/palm	-	43	43	86
7) Rolling of covercrops: 2 man-animal day at ₱25.0/day	-	-	50	50
Total	2,107	512	562	3,181

Source: Regional office of PCA

TABLE- 2.2.7 SEDIMENT RUNOFF REDUCTION BENEFIT

Name of River	Sediment Runoff Volume ($10^3 m^3$)	Allowable Sediment Volume ($10^3 m^3$)	Reduction of Sediment Runoff/1 ($10^3 m^3$)	Dredging Cost/4 (₱10^3)	Annual Benefit/5 (₱10^3)
I) Quinali (A)	1,807.3	543.2	1,264.1	50,564	1,011
- Quirangay	260.1	82.6	177.5	7,100	142
- Tumpa	43.8	35.2	8.6	344	7
- Maninila	94.0	36.7/2	57.3	2,292	46
- Masarawag	276.8	77.6	199.2	7,968	159
- Ogsong	140.5	32.7	107.8	4,312	86
- Nasisi	992.1	278.4/3	713.7	28,548	571
II) Yawa	902.2	213.4	688.8	27,552	551
- Anuling	415.6	85.8	329.8	13,192	264
- Budiao	234.6	58.1	176.5	7,060	141
- Pawa-Burabed	252.0	69.5	182.5	7,300	146
Total	2,709.5	756.6	1,952.9	78,116	1,562

/1 Sediment runoff volume after the implementation of the Sabo project is reduced less than the allowable sediment volume, therefore, reduction volume of sediment for the project benefit is estimated at difference between them.

/2 For the Maninila river, the sediment runoff volume under with project condition is reduced to 42,600 m^3 which is over the allowable sediment volume, however, this excess is included in the reduction benefit because excess volume is regulated by sand retarding function of consolidation works of the Sabo project.

/3 Sediment runoff volume under with project condition is more than the allowable sediment volume, and this excess is regulated by the natural retarding function. Therefore, this excess volume is excluded from the reduction benefit.

/4 Unit dredging cost = ₱40/m^3

/5 Dredging cost/50 years (probable flood)

TABLE-2.2.8 PROJECT BENEFIT AND COSTS FOR THE SABO PROJECT

(Unit: P10^3)

Item	Total
I) Annual Project Benefit	5,064
1) Mud/debris flow damage reduction benefit	3,502
- Crops /1	3,224
- Houses /2	174
- Indirect benefit /3	104
2) Sediment runoff reduction benefit	1,562
II) Project Cost	
1) Construction Cost	152,128
- 1st stage	92,962
- 2nd stage	59,166
2) O & M cost	949
- 1st stage	580
- 2nd stage	369

/1: Total damage of crops (Quinali(A)and Yawa)/Return period of mud/debris flow = P16,120,000/5 years ÷ P3,224,000

/2: Total damage of houses (Quinali(A)and Yawa)/5 years = P869,000/5 years ÷ P174,000

/3: Number of population affected x cost of relief goods and medical assistence per person/5 years = 8,140 persons x P64/person/5 years ÷ P104,000

TABLE-2.2.9 BENEFIT AND COST STREAM FOR ECONOMIC EVALUATION OF THE SABO PROJECT

(Unit: ₱ 10^3)

Year in Order	Project Benefit			Project Cost				
				1st Stage		2nd Stage		
	Mud/debris Flow Damage Reduction Benefit	Sediment Runoff Reduction Benefit	Total	Construction Cost	O & M Cost	Construction Cost	O & M Cost	Total
1	-	-	-	11,331	-	-	-	11,331
2	-	-	-	16,538	71	-	-	16,609
3	-	-	-	19,707	155	-	-	19,862
4	-	-	-	20,464	297	-	-	20,761
5	-	-	-	24,922	425	-	-	25,347
6	3,502	1,562	5,064	-	580	25,133	-	25,713
7	3,502	1,562	5,064	-	580	22,799	157	23,536
8	3,502	1,562	5,064	-	580	11,234	299	12,113
9	3,502	1,562	5,064	-	580	-	369	949
10	3,502	1,562	5,064	-	580	-	369	949
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50	3,502	1,562	5,064	-	580	-	369	949

TABLE-2.2.10 CONSTRUCTION COST FOR THE DISASTER PREDICTION AND WARNING SYSTEM PROJECT, STAGE-I

	Description	Foreign Currency (Japanese Yen)	Local Currency (Peso)
1.	Telemetry System by 150 MHz Radio System	156,802,000	-
2.	Warning System by Multi-Access Radio System	300,083,000	-
3.	Multiplex Radio Communication System	249,348,000	-
4.	HF Communication System	9,800,000	-
5.	Installation Materials	93,560,000	-
6.	Installation Work	211,803,000	2,048,000
7.	Training (Factory & on the Job)	27,000,000	-
8.	Maintenance Service (on year)	73,000,000	-
9.	Consultancy Service	145,676,000	-
	Sub total 1 to 9	1,267,072,000	2,048,000
10.	Contingency	126,707,000	205,000
	Total	1,393,779,000	2,253,000

TABLE-2.2.11 FINANCIAL CONSTRUCTION COST DISBURSEMENT SCHEDULE FOR THE DISASTER PREDICTION AND WARNING SYSTEM PROJECT, STAGE-I

(Unit: 1,000 Yen, 1,000 Peso)

	1st Year		2nd Year		3rd Year		Total	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
1. Telemetry System by 150 MHz Radio System	-	-	78,401	-	78,401	-	156,802	-
2. Warning System by Multi-Access Radio System	-	-	150,042	-	150,041	-	300,083	-
3. Multiplex Radio Communication System	-	-	124,674	-	124,674	-	249,348	-
4. HF Communication System	-	-	4,900	-	4,900	-	9,800	-
5. Installation Materials	-	-	46,780	-	46,780	-	93,560	-
6. Installation Work			-	-	211,803	2,048	211,803	2,048
7. Training	-	-	10,000	-	17,000	-	27,000	-
8. Maintenance Service			-	-	73,000	-	73,000	-
9. Consultancy Service	50,000	-	47,838	-	47,838	-	145,676	-
Sub total	50,000	-	462,635	-	754,437	2,048	1,267,072	2,048
10. Contingency	5,000	-	46,264	-	75,443	205	126,707	205
Total	55,000	-	508,899	-	829,880	2,253	1,393,779	2,253