EXECUTIVE SUMMARY

(Part II : Feasibility Study)

CHAPTER 7 PRIORITY PROJECTS FOR FEASIBILITY STUDY

7.1 Priority Projects Selected in the Master Plan

In screening out the priority package projects and programs for feasibility study, an evaluation criteria were established and used, based on the basic concepts and strategies formulated in the Master Plan and through discussion with the authorities concerned. The criteria for prioritization of the projects are composed of the following four key indicators:

1) Urgency of Implementation
   Urgency might be assessed by the degree of imminence of the impeding disaster.
2) Economic Advantage
   The economic advantage can be represented by EIRR of the project.
3) Number of Beneficiaries and Affected People
4) Degree of Representation as a Model Project

The following are the five priority core projects on which the feasibility study was conducted:

1) Yawa River System Sabo Project
2) Legazpi City Urban Drainage Project
3) Forecasting and Warning System Strengthening Project
4) Evacuation System Strengthening Project
5) Resettlement Sites Development Project
6) Supporting Projects and Programs

7.2 Proposed Projects for Regional Economic Development to Enhance and Sustain the Disaster Coping Capacity

The following eight projects and programs are proposed for livelihood and area development and institutional strengthening to enhance and sustain the disaster prevention capacity:

(1) Livelihood Development for Resettlers

1) Organization and Strengthening of Multi-purpose Cooperatives with Micro-lending Component
2) Hollow Blocks Production

3) Agro-industry Development Project

(2) Area Economic Development

1) Aggregate Production Plant Project
2) Mineral Water Production Project
3) Productivity Enhancement Programs in the Protected Area

(3) Institutional Strengthening

1) Provincial Disaster Management System Strengthening
2) Community-based Disaster Management Strengthening

CHAPTER 8 PLANNING AND PRELIMINARY DESIGN OF SUBPROJECTS

8.1 Yawa River System Sabo Project

(1) Sabo Plan

1) Function of the Sand Pocket

In the Master Plan Study, the functions of sand pockets for the Pawa-Burabod, Budiao and Anoling rivers are studied considering the following (as to the layout plan of Sabo facilities, refer to Figures S.3 – S.5).

- Sand pocket is to be constructed in a fan area to trap mud debris.
- Sand pocket is designed to protect area within the estimated hazard area as much as possible.
- The existing structures are availed to the maximum extent,
  - taking advantage of natural topography to the maximum extent, and
  - observing the existing land use.
- The area to be occupied by the proposed sand pocket should be the devastated land by recent disasters.
- The angle of mud and debris flow incidence to the proposed training dike is preferable to be more than 30 degree.

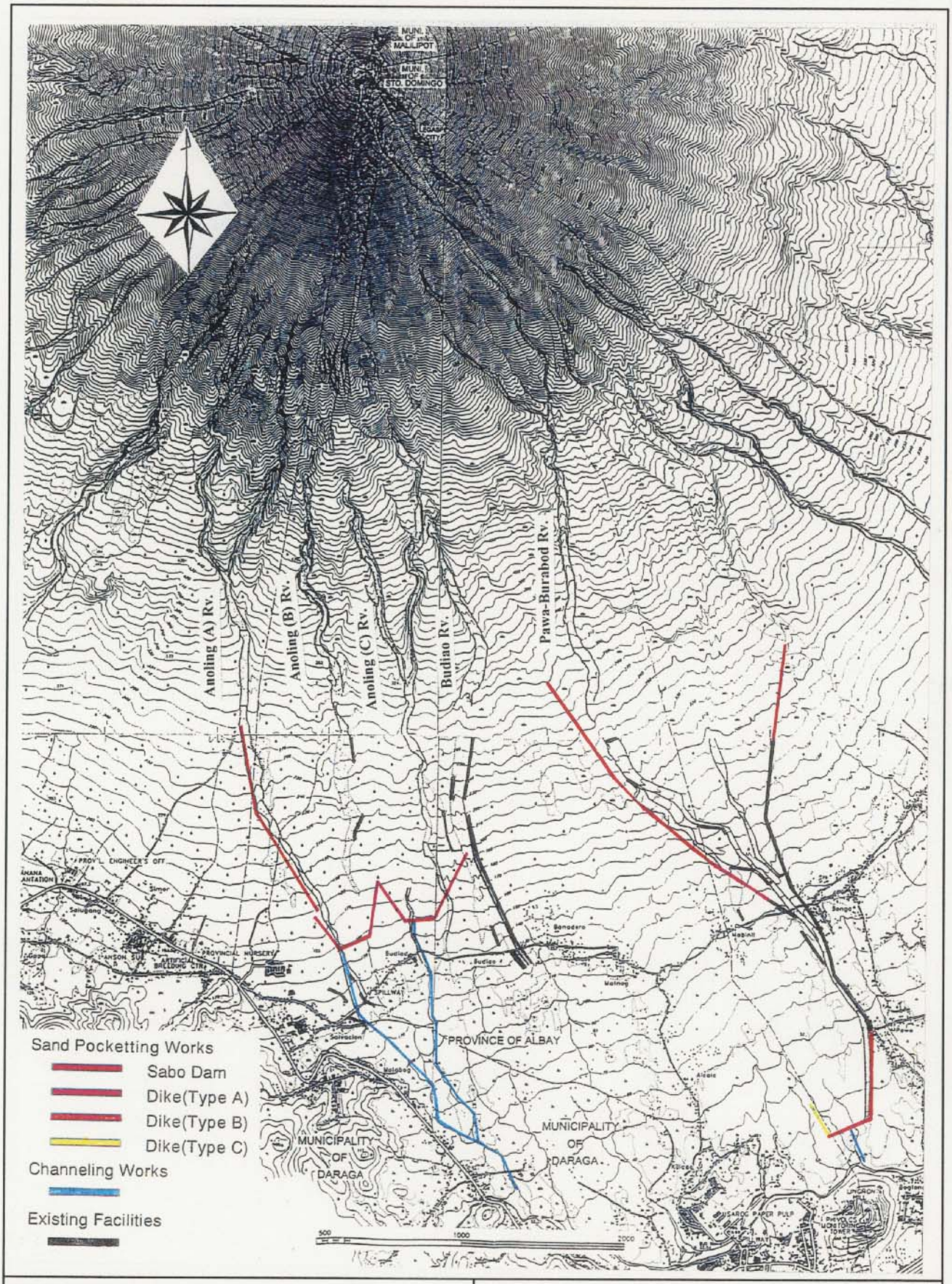
2) Total Sediment Volume

Total sediment volume in each of the proposed disaster prevention facilities during a 30-year life period is summarized below.

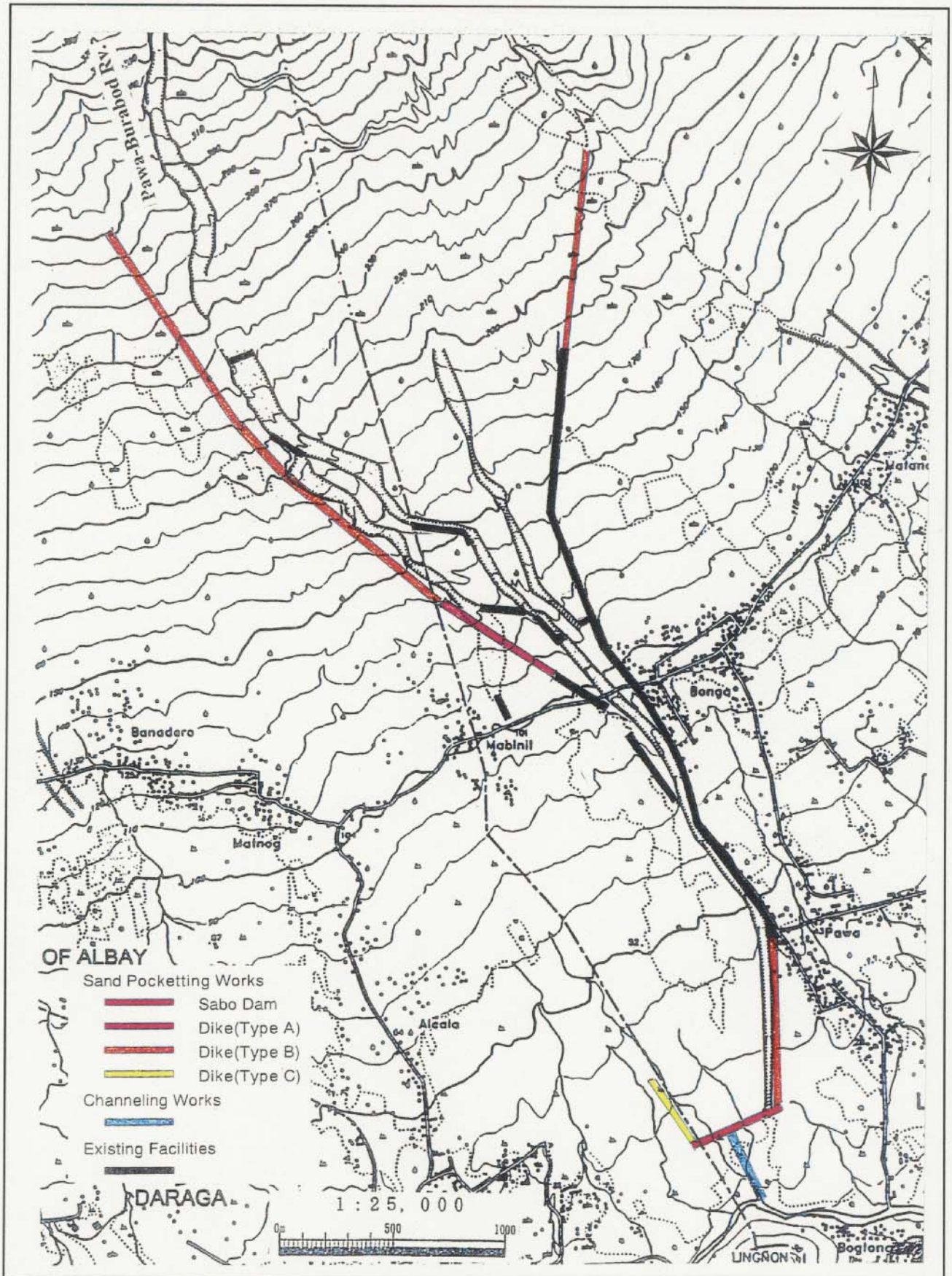
Estimated Total Sediment Volume during 30 years

(Unit: m^3)

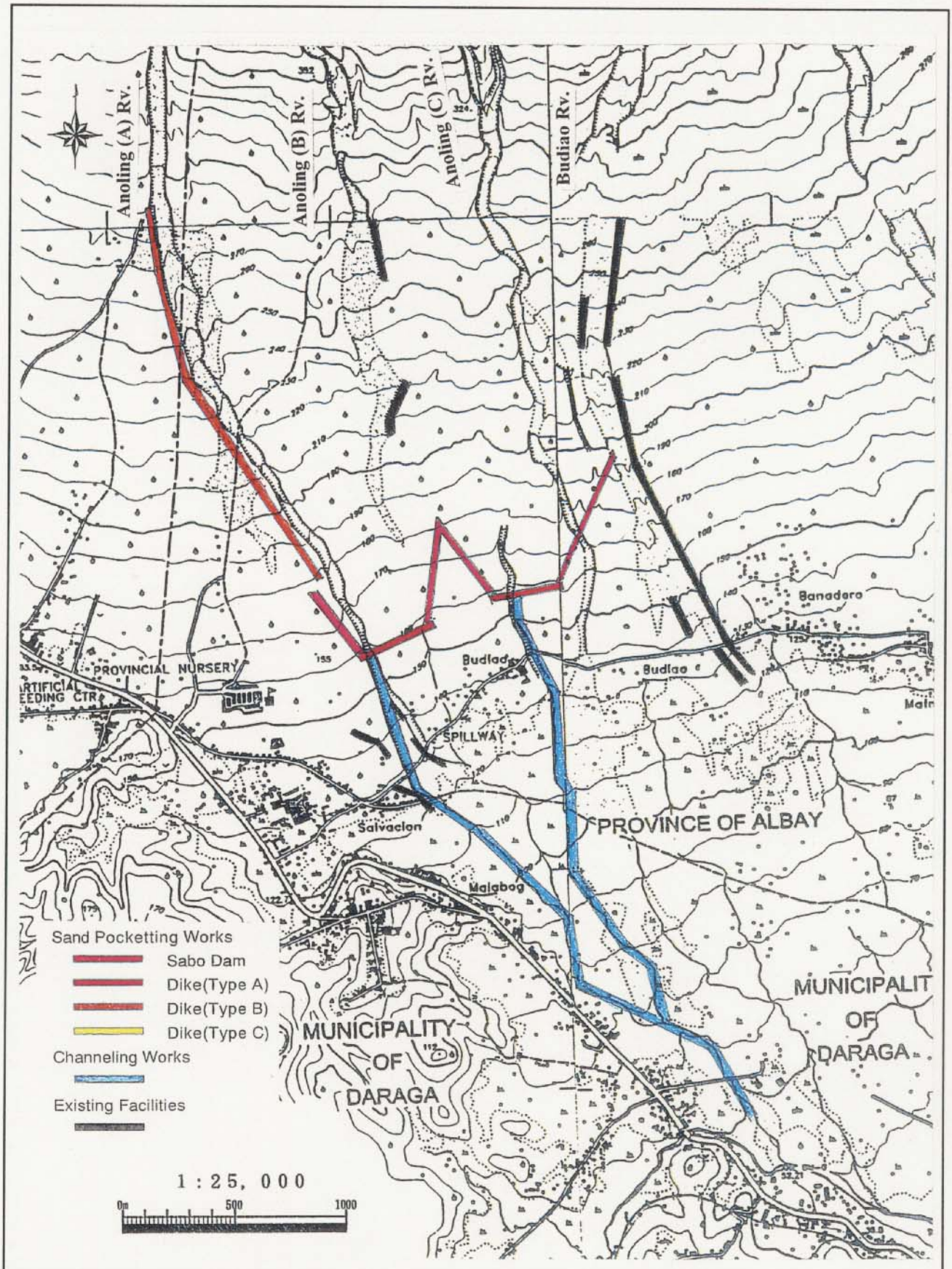
River	Volume of 30 years		
	Normal Period	After Eruption	Total
1. Pawa-Burabod	3,096,000	3,161,400	6,257,400
2. Anoling-Budiao	8,9005,500	9,093,600	17,999,100
・ Anoling A	2,794,800	2,853,900	5,648,700
・ Anoling B	2,263,500	2,311,200	4,574,700
・ Anoling C	2,263,500	2,311,200	4,574,700
・ Budiao	1,583,700	1,617,300	3,201,000



COMPREHENSIVE DISASTER PREVENTION AROUND MAYON VOLCANO IN THE REPUBLIC OF THE PHILIPPINES	**Figure S.3** **Layout Plan of Sabo Facilities in Yawa River System**
JAPAN INTERNATIONAL COOPERATION AGENCY	



COMPREHENSIVE DISASTER PREVENTION AROUND MAYON VOLCANO IN THE REPUBLIC OF THE PHILIPPINES	**Figure S.4** **Layout Plan of Sabo Facilities in Pawa-Burabod River**
JAPAN INTERNATIONAL COOPERATION AGENCY	



COMPREHENSIVE DISASTER PREVENTION AROUND MAYON VOLCANO IN THE REPUBLIC OF THE PHILIPPINES	**Figure S.5** Layout Plan of Sabo Facilities in Anoling Rivers and Budiao River
JAPAN INTERNATIONAL COOPERATION AGENCY	

(2) Yawa River System Preliminary Structural Design

1) Reasons for Adopting CSG Method to Yawa River Sabo Planning

Reasons for adopting CSG method to the Yawa River project are as follows.

- The construction scale is big (450,000-500,000m^3 in CSG amount) and suitable for the construction using large construction machines and vehicles.
- There are a large amount of construction materials which can be obtained in the sites.
- The large construction yard is suitable for the roller compact method.
- The characteristics of these materials will assure desirable structural strength.
- The destroyed Sabo structures indicate that conventional cross dike using concrete is subject to destruction at downstream parts, because of scouring or piping. But, if the width of dam body is enough, the structure built with CSG method will be less vulnerable to destruction than that of concrete structures.
- Also, in the case of insufficient width and with little maintenance and operation, the conventional training dike, whose soil is packed materials and which has 1.0m depth of embankment, was destroyed due to gravel bump and runoff of packed soil by scouring. If CSG is applied to the packed materials, it will reduce maintenance and operation works because the strength of the materials increases.

2) Structural Details

a. Sabo Dam

- Comparing the characteristics of concrete gravity dam with that of the dam using CSG as internal concrete, CSG dam was adopted mainly due to its economical efficiency and the advantage of exploiting the materials which can be obtained in construction sites.

Dimensions of Dams

Dam Name	Dam Height (m)	Dam Length (m)	Crown Width (m)	Waterway Width (m)
Pawa Sabo Dam	6.0	450.0	5.0	55.0
Budiao Sabo Dam	6.0	375.0	5.0	50.0
Anoling Sabo Dam	6.0	300.0	5.0	70.0

- Slit: In order to prevent lowering of the downstream riverbed by flood, and overflowing of debris flow by trench fluctuation, slit is to be adopted.

Name	Slit Height (m)	Slit Width (m)	Number	Total Width (m)
Pawa Sabo Dam	4.0	5.0	2	10.0
Budiao Sabo Dam	4.0	4.0	2	8.0
Anoling Sabo Dam	4.0	4.0	2	12.0

- Dam Body: Cross section of the structure of main body is represented as follows so that CSG may be constructed with non-formwork.
  - Crown Depth: 5.0m (due to the width of Construction Machine)
  - Slope Gradient: 1:1.2 (due to the slope grading and construction feature of compaction) Downstream slope gradient is generally 1:1.2, a steep gradient, but in this plan erosion protection using boulders at gentle gradient is necessary due to the non-framework construction method. Also, the downstream slope gradient is to be 1:2.0 from the experiences of consolidation work in downstream regarding gentle gradient installations.
- Front Apron: The length of the protective works in the front apron was discussed and examined with empirical formula and Bligh's Formula. The length of the apron is 22.0m at the Pawa-Burabod river, and 23.5m at the Budiao and Anoling river.

b. Dike

The three types of dikes are proposed as types A, B, and C for the types of training dike. These types are adopted respectively according to the flowing form of gradient and soil or the variation of the riverbed with the impact pressure and erosion. The characteristics of the three types are as follows:

- CSG type is basically adopted in the section where gradient of the mountain stream is steeper than 1/30 and thereby debris flow is expected. This CSG type is divided into the two types (A & B).
- The type A use CSG entirely, in the sections of upstream sand pocketing and along the trench which have the possibility of overflowing the crown.
- The type B use CSG only for the riverside, in the sections which have little possibility of overflowing the crown.
- The type C protects the riverside of embankment with the riprap, in the sections for bed-load transport or traction, whose bed slope of the riverbed is gentle (less than 1/30).

The detail design of the structure for each part is as follows.

- Crown Width: The crown width should be 4.0m or above taking into consideration the constructional feature of the roll and the fact that the crown

is used as a road. Especially, the embankment must be 6.0m with 1.0m allowable width on each edge.

- Effective Height: The basic effective height of dike is to be 5.0 m, according to the fact that previous fluctuations of the riverbed were from 1.0m to 2.0m, and to the calculation based on the formula : deposit depth 2.0m + water depth 2.0m + allowable height 1.0m.
- Embankment Depth: Due to the 1.0-2.0m riverbed fluctuation, the depth of embankment of the existing installations are short of 1.0m, thus the depth of embankment of this plan is to be 2.0m.
- Slope Gradient: CSG is adopted to the case in which the slope gradient is 1:1.2 and the construction with non-framework is possible. The maximum standard slope gradient value 1:2.0 is adopted for embankment.
- Slope Protection against Erosion: At the riverside riprap is done with boulder facing, and at inland vegetation the mat is built as embankment in order to prevent erosion.

c. Training Dike

- Type of Training Dikes
  Different types of training dikes are adopted according to the flowing form and the topography of the construction site.
- CSG type area is found where riverbed slope is more than 1/30, trench is not formed, and inundation is expected due to the accumulation of material.
- Bank protection type area is found where riverbed slope is less than 1/30, bed-load transport or traction occurs, and trench is likely to be formed.

d. Detailed Structures

- Crown Width: Since the design discharge is less than 500m^3/s, the crown width in this plan is to be 3.0m, in relation to the crown width of embankment.
- Dike Height: The effective height is set by the formula (water depth＋ allowable height), to which the 2.0m depth of embedment is added to set the dike height.
- Slope Gradient: The slope gradient is to be 1:1.2 so that non-framework construction may be possible.

(3) Maintenance and Monitoring Works

1) Dredging works in sand pocket as maintenance works

There are two types of dredging works. The first one is to secure available storage of the proposed sand pocket. The other is to maintain a channel within the proposed sand pocket. The dredged materials are suitable for aggregate of concrete and the river bed materials have been exploited by private enterprises.

The total dredging volume is summarized in the following table.

Total Dredging Volume

Sand Pocket	A Sand Pocket Capacity (m^3)	B Sediment Flow Deposit in 30 year (m^3)	(B-A) (Total Excess Material Volume)/30 Annual Dredged Material (m^3)	Removal of Deposited Materials in the Original River (m^3)	Total (m^3)
Pawa-Burabod	14,960,000	6,257,400	-	13,200	13,200
Anoling, Budiao	13,600,000	17,999,100	146,637	28,800	146,637
Total	28,560,000	24,256,500	146,637	42,000	159,837

2) Other maintenance and monitoring works

Monitoring and inspection around Mayon Volcano are to be conducted on the following items:

- Surface of dike and revetment works of channel works
- Foundation of dike and revetment work of channel works
- Fluctuation of riverbed and riprap at the cutoff wall of apron
- Deposition on apron
- Abrasion on spillway surface
- Clogging of slit
- Deposition immediately upstream from dam
- Surfaces of training dike of both rivers
- Riprap of spur dike
- Silting along the channel in the sand pocket
- Deposition in the sand pocket
- Channel upstream from the rivet of fan

3) Modification from the Master Plan to the Feasibility Study

Type of Sabo Facility	Modefication from the Master Plan to the Feasibility Study	Description	Unit (m3)		Total Length (m)	
			Master Plan	Feasibility Study	Master Plan	Feasibility Study
Sabo Dam (Over Flow Portion)	Waterway dimension of instration has been determined to caluculated the design discharge in the F/S. Structural detail of over flow portion has been modified on the points of dimension and unit volume.	C.S.G	78	66	150	180
Sabo Dam (Non Over Flow Portion)	Dam dimension of instration has been determined to consider an anduration of land surface in the F/S. Structural detail of non over flow portion has been modified unit volume of CSG.	C.S.G	145	117	970	925
Spur Dike (Type A)	Considering functionability and workability about instration planning of spur dike, alignment of sand pocket work has been modified from echelon type to continuous type. As the result of that, total length of dikes has been changed.	-	-	-	1,900	2,325
Spur Dike (Type B)	Modification items are as follows; No excavation under the embankment side only of dike body, Change of slope gradient from 1:2.5 to 1:2.0, Coco fiber erosion control net with seed on the consrete face.	Excavation	48	23	5,100	5,875
		Embankment	72	40		
		Coco Fiber Net	0	15		
Spur Dike (Type C)	Modification items are as follows; No excavation under the whole dike body, Change of slope gradient from 1:2.5 to 1:2.1, Coco fiber erosion control net with seed on the consrete face.	Excavation	51	8	600	375
		Embankment	118	68		
		Coco Fiber Net	0	18		
Training Dike (CSG Type)	CSG type has been planned where river bed slope is more than 1/30, river channel is unstable, and inundation is expected due to an accumulation of sediment material.	-	-	-	5,100	4,125
Training Dike (General Type)	General type has been planned where river bed slope is less than 1/30, river channel is stable, and bed load transport occurs.	-	-	-	0	925

"-" means No Change.

8.2 Legazpi City Urban Drainage Project

(1) Basic Plan of Urban Drainage

1) Basic Plan for Alignment of Drainage System

The selected alternative plan has the following subprojects.

Basic Plan of Legazpi City Urban Drainage

Subproject	River	Composition of Structural Measures
River Improvement	Tibu	1. Construction of new dike (L=834 m) 2. Raising dike height (L=277 m)
	Macabalo	1. Construction of new dike (L=1,700 m) 2. Raising dike height (L=616 m) 3. Widening river channel (L=616 m)
	Ruran	1. Construction of new dike (L=95 m) 2. Raising dike height (L=95 m) 3. Widening river channel (L=95 m)
	Sagumayon	1. Construction of new dike (L=50 m) 2. Raising dike height (L=50 m) 3. Widening river channel (L=50 m)
	Sagumayon after Ruran	1. Construction of new dike (L=70 m) 2. Widening river channel (L=70 m)
	Panal	1. Construction of new dike (L=100 m) 2. Raising dike height (L=100 m) 3. Widening river channel (L=100 m)
Pump Drainage	Tibu	1. Pump station (4 units) 2. Floodgate (5 units) 3. Retention Pond (0.5 ha)
	Macabalo	1. Pump station (2 units) 2. Floodgate (3 units) 3. Retention Pond (12 ha)

2) Design Capacity of River Channels

Design capacity of river channels of Tibu and Macabalo and its tributaries to be improved to reduce the flood and inundation damages in those river basins is calculated as shown below.

Design Capacity of River Channels (10-Year)

River Name	River Length to be Improved (m)	Design Capacity (m^3/s)	Present Capacity (m^3/s)
Tibu	834	17	10 - 263
Ruran	95	34	4
Sagumayon	50	35	6
Sagumayon after Ruran	70	70	19
Panal	100	39	20
Macabalo	1,700	105	4 - 150

3) Design Capacity of Pumping Station

Design capacity of pump station is determined as follows.

Design Pump Capacity

River Name	Design Pumping Capacity (m^3/s)
Macabalo	10
Tibu	1

4) Design Capacity of Retention Pond

Design capacity of retention pond is determined as follows.

Design Retention Pond Capacity

River Name	Design Retention Pond Capacity (m^3)	Design Retention Pond Area (ha)	Design Retention Pond Depth (m)
Macabalo	444,600	12	3.7
Tibu	13,500	0.5	2.7

(2) Preliminary Structural Design of Selected Scheme

1) Channel Improvement

a. Alignment and Profile

The alignment of river channel is based on the following design considerations.

- In case of widening of the existing channels, the optimum design alignment is determined in order to minimize house evacuation and consequently, reduce cost.
- The design alignment will be as smooth as possible to attain uniform channel flow.

The profile of the river channels is designed on the following aspects.

- The design gradient of the channel bed approximately follows the slope of the ground line.
- The design channel bed is determined to start from the channel mouth which has the same elevation as that of the sea.
- The slope of the design high water level also approximately follows the adjacent ground and is as much as possible not higher than the predominant elevation of the adjoining ground.

b. Preliminary Design

Channel works

A single trapezoid section for the river channels is adopted with a single slope of 1:1.2 for all the sections to be improved in the Tibu and Macabalo rivers, considering highly congested land use along those rivers.

Dikes and revetments

The dikes are designed to have several functions/uses such as for maintenance and repair works, flood defense activities during high water stage of the river channels.

The channel revetments are provided for all the sections to be improved with a side slope of 1:1.2 to prevent the channel banks from being eroded and widened, hence, protecting the houses from possible damages.

The type of revetment is selected on the basis of the channel design requirement and conditions in the area in relation to the side slope. The selected type of revetment is shown below.

- Side slope : Single section
- Revetment : Grouted wet masonry

2) Pump Drainage

a. Pump Stations

The selection of a suitable pump type for the proposed pumping stations in the Tibu and Macabalo rives is made for the Study.

Pump type

Among several pump types, the following are preliminarily selected.

Selected Pump Type for Pump Stations

River Name	Pump Type	Reasons
Macabalo	Horizontal shaft axial flow pump	Most economical among conventional types of pump for large pumping capacity (= 10.0 m^3/s) required for Macabalo river.
Tibu	Submersible motor pump	Most suitable for small pumping capacity (= 1.0 m^3/s) required for Tibu river.

Unit capacity and number of pumps

Taking into consideration several premises, the following unit capacity and number of pumps are proposed.

Unit Capacity and Number of Pumps

River Name	Unit Capacity (m^3/s)	No. of Pumps
Macabalo	3.0 2.0	2 2
Tibu	0.5	2

Design of pumping station

Structural Features of Pumping Station

River Name	No. of Bay	Total Width (m)	Total Length (m)	Maximum Height (m)	Width of Surge Tank (m)
Macabalo	4	35	105	7.0	19.0
Tibu	2	22	105	7.0	9.0

b. Floodgates

Dimensions of opening

The opening of a box culvert in each floodgate is designed so that the flow velocity can be around 1.0 m/s to avoid both sedimentation and abrasion through the culvert.

The dimensions of opening are presented below.

Dimensions of Floodgates

River Name	Design Discharge (m^3/s)	Gate Height (m)	Gate Width (m)	No. of Gates
Macabalo	105	3.5	3.0	5
Tibu	17	3.5	3.0	3

3) Retention Pond

a. Alignment

The alignment of retention pond is selected based on the following design considerations.

- Unused open space or paddy field is used for retention pond to minimize land acquisition.
- Design alignment is determined in order to minimize house evacuation and consequently, reduce cost.

b. Preliminary Design

Excavation works

A single trapezoid section for the slope of retention pond is adopted with a single slope of 1v:1.5h for all the sections

The dimensions of the adopted cross-section of the slope are tabulated below.

Dimensions of Adopted Cross Section of Retention Pond

River Name	Length of Retention Pond (m)	Width of Retention Pond (m)	Free Board (m)	Water Depth (m)
Macabalo	400	300	1.0	3.7
Tibu	100	50	1.0	2.7

Dikes and revetment

The revetments are provided for all the slopes with a side slope of 1v:1.5h to prevent the banks from being eroded.

The type of revetment is selected on the basis of the design requirement and conditions in the area in relation to the side slope. The selected type of revetment is shown below.

- Side slope : Single section
- Revetment : Grouted wet masonry

8.3 Forecasting and Warning System Strengthening Project

The introduction of the following systems will strengthen the forecasting and warning systems which are proposed as the priority project.

(1) Forecasting and Warning for Volcanic Eruption

a. Monitoring

- Telemetered seismograph : 7 stations with 4 existing (Mayon Rest House, Upper Sto. Misericordia, Bgy. Anoling, Lignon Hill) and 3 additional (Bgy. Canaway, Upper Bgy. Muladbucad Grandei and U. Banadero)
- EDM and GPS : Existing EDM and additional GPS (4 directions at about El. 800m)
- Gas analysis : Collector and analyzer (Existing)

b. Judgement

• Analysis of seismic wave	:	Amplitude and frequency
	:	Type of travelling
• Analysis of SO_2	:	Concentration of SO_2 in air
• Assessment of internal Pressure	:	The FEM analysis on slope deformation

c. Warning

• Judgement and decision making	:	PHIVOLCS head office in Manila
• Transmission of warning	:	PHIVOLCS observatory in Lignon hill transmits the decision made by the head office to PDCC, MDCCs and CDCC through VHF and the public telephone line

(2) Forecasting and Warning for Flood, Inundation and Mud and Debris Flow

a. Monitoring

• Telemetered rainfall gauge	:	5 existing stations in Bgy. Maninila, Bgy. Mabinit, Bgy. Buyuan, Bgy. San Antonio, and Mayojn Rest House (Existing) 9 additional telemetered gauging stations tallying 14 stations to observe the rainfall in the area within the circle defined by 8km radius from crater of the Volcano (Additional)
• Telemetered water level gauge	:	6 in Yawa, Quinali B, San Vicente, Nasisi, Ogsong, and Quinali A (New)
• Tidal level gauge	:	Legazpi port

b. Judgement

(Flood)

• Analysis of water level	:	Water level at strategic site and downstream reach
• Runoff analysis		Measured rainfall

(Mud and Debris Flow)

• Analysis of measured rainfall	:	Accumulated rainfall and intensity of rainfall
• Standard for judgement	:	For watch and evacuation

(3) Forecasting and Warning for Typhoon

a. Monitoring (ongoing method)

- Satellite : GTS and GMS
- International information : RSM and TYM

b. Judgement

- Map : Meteorological map
- Chart : Weather chart, atmospheric pressure chart and typhoon track forecasting chart

c. Warning

- Judgement and Decision-Making : PAGASA head office in Manila
- Transmission of warning : From PAGASA Manila to Legazpi observatory by SSB
  : From the observatory to PDCC, MDCC and CDCC by VHF

(4) Warning Dissemination

a. Marine Route : M/CDCCs to BDCCs by celluar phone
  : BDCCs to each family by house to house visit
  : M/CDCCs to PDCC for monitoring by VHF radio

b. Other Route : PDCC to mass media

(5) Inter-agency disaster information : WEBB server system in PDCC, DPWH, PHIVOLCS, PAGASA, MDCC, CDCC and ROCD

8.4 Evacuation System Strengthening Project

The project is intended to protect life and property from a disaster caused by volcanic eruption, flood, inundation, mud and debris flow, or typhoon through evacuation to safer place.

(1) Basic Concepts

- The existing evacuation centers are expanded to accommodate the evacuees.
- The facilities of the existing evacuation centers are enhanced to provide a more comfortable accommodation for the evacuees.

- The provision of emergency shelters to those who may have lost the opportunity to go to the evacuation centers.
- The provision of livestock sanctuaries to give protection to the livestock of the evacuees

(2) Criteria for Planning

- Standard area for evacuation center is 3.52m^2 per person
- Standard number of toilet facilities in evacuation center is 1 per 25 persons
- Standard number of faucets in evacuation center is 1 per 50 persons
- Standard number of shower facilities is 1 per 50 persons for evacuees during the volcano eruption
- Standard number of emergency shelter is one per major river basin
- Standard number of livestock per sanctuary is one per municipality

(3) Basic System Design

1) Time Required for the Evacuation by Hazard

- Mayon Volcano Eruption: The residents of the affected areas are transferred to the evacuation centers or safe areas within 24 hours upon the issuance of Alert Level 3 by the PHIVOLCS.
- Mud and Debris Flow: The residents of the affected areas are transferred to the evacuation centers or safe areas within 2 hours upon the issuance of Alert Level 3 by the DPWH.
- Flood and Typhoon: The residents of the affected areas are transferred to the evacuation centers or safe areas within 24 hours upon the issuance of Alert Level 3 of PAGASA.

2) Procedures

- Timely issuance of warning through installation of appropriate equipment
- Provision of the means of communication between the C/MDCCs and the BDCCs
- Improvement of the coping mechanism of the community through the conduct of regular and disaster awareness and preparedness programs, i.e. regular drills.
- Improvement of the capability of the BDCCs in the performance of evacuation-related tasks.
- Preparation and updating of the BDCC Disaster Preparedness Plans.

3) Components

Extension of the Evacuation Centers and their Facilities

- 56 evacuation centers for 1 city and 9 municipalities with the area of 37,200m^2
- water supply system with 929 faucets (166 faucets existing)
- 1,324 sets of toilets
- 857 shower facilities

Construction of Emergency Shelters

- 16 emergency shelter sites in 1 city and 9 municipalities
- 16 sets of telecontrolled siren systems in 1 city and 9 municipalities

Preparation of Livestock Sanctuary

- 9 livestock sanctuary sites in 1 city and 9 municipalities (1 site existing)

4) Implementing Body : LGUs and DPWH

8.5 Resettlement Sites Development Project

In connection with the two priority structural projects selected in the Master Plan: Yawa River System Sabo Project and Legazpi City Urban Drainage Project, the issues of relocation and resettlement site development in the Feasibility Study pertain to Legazpi City (Banquerohan) and Daraga Municipality (Anislag). The numbers of households to be relocated due to implementation of these two projects are estimated at 65 households for the former and 303 households for the latter, respectively. The following table indicates the number of target beneficiaries of the resettlement site development projects to be accommodated in Banquerohan (Legazpi City) and Anislag (Daraga Municipality).

Target Beneficiaries of the Resettlement Site Development Projects and Estimated Number of Relocatees

Total Number of the Target Resettlement Beneficiaries	Estimated No. of Households	Estimated Population
- Banquerohan Resettlement Site (Phase I)	600	3,180
- Banquerohan Resettlement Site (Plan/Phase II)	460	2,438
- Anislag Resettlement Site (Plan)	635	3,366
Total	1,695	3,366

(1) Present Condition and Problems

The profiles of the Banquerohan Resettlement Site and Anislag Resettlement Site Plan are given below.

Profiles of the Banquerohan Resettlement Site and Anislag Resettlement Plan

(as of November 1999)

Name	Banquerohan (Phase I)	Anislag (Plan)
1. Location	Banquerohan, Legazpi City	Anislag, Daraga Municipality
2. Distance from former residence (km)	20 km	8 km
3. Land area (ha)	Phase I: 18.93 ha (Phase II: 27.07ha)	21.35ha (Phase I: 12.57ha, Phase II: 8.78ha)
4. No. of houses	Phase I: 600 (Phase II: 460)	Planning for 635
5. Home lot size (m^2)	Phase I: 90-298m^2	100m^2 (10m x 10m)
6. House size (m^2)	Phase I: 20m^2 (4m x 5 m)	10.5m^2 (3.0m x 3.5m)
7. Establishment (year)	Phase I: 1994 (Phase II: Plan)	Construction started in 1998 for 80 units
8. Beneficiaries	Victims of Mayon eruption	Victims of Mayon eruption & typhoons
9. Actual no. of houses awarded	504 (No. of living households: 174)	Planning stage

Source: Data from the City and Municipal authorities concerned and JICA

From the results gathered in the People's Intention Survey conducted by the JICA Study Team, the following are the listed reasons why the majority of the respondents are not satisfied with the living conditions in the resettlement area:

- The size of the lot is small,
- The house was poorly built,
- The location is very elevated (Banquerohan),
- Water supply and drainage system are inadequate,
- Inadequacy of electricity,
- Lack of street lights,
- Absence of farm lots for farmer resettlers,
- No sources of livelihood,
- Sanitation such as lack of comfort rooms (Banquerohan),
- High transportation cost, and
- Others.

(2) Basic Concept

Considering the above present conditions, the basic conditions for resettlement sites development with livelihood programs are as follows:

a. A core house of 21.7m^2 will be provided free of charge to the eligible family by the LGU,
b. For expansion and betterment of the core house, financial assistance will be granted to the applicant resettlers (through a multi-purpose cooperative to be established in the site),
c. To those who are going to undertake a gradual expansion of their houses in a group of more than five families, the LGU will extend assistance to supervise its construction works,
d. Maintenance fund of the resettlement site including the public facilities and respective houses should be raised and contributed by the resettlers themselves.
e. To form an integrated community, the resettlement site will include almost all social infrastructures like road, water supply, power supply, drainage & sewerage, elementary school, parks & open space, and even a "productivity center" for livelihood development.

(3) Expected Number of Resettlers and Households by Job Category

The following table shows the expected numbers of resettlers, estimated numbers of economically active persons and number of these to be engaged in the livelihood projects in the resettlement sites.

Expected Number of Resettlers and Households by Job Category

Item	Banquerohan		Anislag
	Phase I	Phase II	
1. No. of Total Households (Total)	600	460	635
	1,060		
2. Estimated No. of Economically Active Persons (2.47 per HH)*	2,618		1,568
3. No. of Persons to be Engaged in Proposed Livelihood Projects (1.5 persons per HH)	1,590		953
(1) Abaca Handicrafts (20%)	318		191
(2) Pilinut Processing (15%)	239		143
(3) Coco Coir Production (20%)	318		191
(4) Hollow Block Making (5%)	80		48
Subtotal of (1) to (4) (60%)	955		572
(5) Others (40%)**	635		381

Notes: * 2.47 persons are economically active according to the results of the People's Intention Survey.

** Others include the jobs to be generated by the above livelihood projects like trade & commerce, transportation, public services, etc.

(4) Layout Design

The land use allocations for each of the three resettlement sites are as follows:

Land Use Allocation of the Banquerohan (Phase I & II) and Anislag Resettlement Sites

(Unit: ha)

Land Use	Banquerohan (Phase I)	Banquerohan (Phase II)	Anislag
A. Buildable Area			
1. Residential	7.89	7.62	8.15
2. Commercial	0.65	0.18	0.31
Sub-total	8.54	7.80	8.46
B. Public Common Area			
1. Open Space	7.74	1.75	6.87
2. Circulation	2.65	2.33	2.21
3. Farm Lots	0	8.83	0
4. Production Area	0	6.36	3.81
Subtotal	10.39	19.27	12.89
Grand Total	18.93	27.07	21.35

(5) Housing Lot Plan

Considering the respective family conditions, especially the number of household members and their economic situation, the following lot allocation and house size are schemed:

1) Typical Lot Allocation: The standard lot size is 120m^2 (10m x 12m). The total lot area occupies 70% of the total resettlement site and the remaining area (30%) will be reserved/used for communal facilities.

2) The standard house (floor) area proposed is 21.7m^2 = (4.8m x 4.2m) + (1.4m x 1.1m). Financial assistance for construction of a core house of 21.7m^2 will be granted to beneficiaries resettlers. The core house will consist of two bedrooms, multipurpose living room, kitchen, toilet and bath.

CHAPTER 9 SUPPORTING PROJECTS AND PROGRAMS

9.1 Present Conditions and Problems

To support and improve the resettlers' livelihood in the resettlement sites, several supporting services have been provided by the government agencies and NGOs in many sectors. The supporting services were too much limited to satisfy all demands and even piecemeal to comply with some immediate needs of the resettlers. These have been provided independently without continuity nor coordination among the competent authorities. Because of the limited capabilities of the resettlers, they need assistance to develop a strong and viable cooperative to avail of financing and government assistance programs.

According to the results of the People's Intention Survey, the respondent resettlers say that the support services needed to sustain their livelihood are lacking in the resettlement areas. A "productivity center" is a support facility that the resettlers feel can help them. As to the livelihood and area economic development projects, they were selected based on the basic strategy worked out for prioritization of them in Master Plan. These are: (a) labor intensive or employ generation scheme, (b) utilization of local resources (materials & expertise), (c) prospects of marketability, and (d) availability of the utilities (water & energy).

9.2 Livelihood Development Program and Projects for Resettlers

(1) Organization and Strengthening of Multi-purpose Cooperatives with Micro-lending Component

1) Rationale: Organizing cooperatives is one of the best ways for resettlers to avail of financing and government assistance programs. The cooperative members will be given trainings on community organization, team building principles and practices, and project management.

2) Beneficiaries: cooperative members of the Area including Banquerohan and Anislag resettlement sites

3) Expected Benefits: Provision of the basic knowledge and skills necessary to undertake standard cooperative activities.

   Provision of the micro-lending to the eligible members so that they can engage in self-help livelihood projects.

4) Conditions of the Project: Participants should be identified resettlers living in the resettlement site.

The beneficiaries of the micro-lending scheme have to be qualified members of the cooperative according the requirements of the CDA.

(2) Hollow Block Production

1) Rationale: The hollow blocks making will be operated under a recycling scheme so as to ensure sound and sustainable O&M of the Sabo facilities. The sand to be used for this making will be excavated inside the Sabo facilities.

2) Beneficiareis : Cooperative members who are unemployed resettlers and those residing in the neighbouring communities.

3) Market Aspect: Around 1,000 houses and several public facilities will be constructed in total at the Banquerohan and Anislag resettlement sites.

(3) Agro-industry Development Project

1) Rationale: To improve the resettlers' livelihood, it is essential to develop the agro-industry with a view to creating job opportunities. The agro-industry development project consists of the three subprojects related to the following crops processing: abaca, pilinut and coconuts.

2) Beneficiaries: Cooperative members of the Area including those residing in the resettlement sites

3) Expected Benefits:

a. Abaca
- Estimated net annual income of PHP30,000/ha of abaca production
- Estimated annual net income of PHP449,000/ha for abaca hand made paper

b. Pilinut
- Estimated annual net income of PHP50,000/ha of pili plantation

c. Coco coir
- Estimated annual net income of the cooperative with about 60 members :
  - PHP946,090 for coir production
  - PHP25,620 for per person/year for twine making
  - PHP110,694 per family/year for weaving

4) Conditions of the Project:

- Skills training and seed capital for livelihood are required.
- Productivity center with processing equipment is needed.

- As to abaca and pilinuts, their productions should be promoted to secure the raw materials for processing industries.

9.3 Area Economic Development Projects

(1) Aggregate Production Plant Project

1) Rationale: Excavation of the aggregate is an integral part of the Sabo project to ensure its sound O&M. It also contributes to creation of job opportunities for the local people and promotion of area economic development.

2) Plant Site: Pawa barangay in Legazpi City

3) Production Capacity: 356,000 m^3/year

4) Excavation Area: Inside the sand pocket facilities

5) Market: Provinces of Albay, Camarines Sur, Masbate and Sorsogon

6) Capital Investment: PHP81.4 million

7) Plant Components (required no.): Crushing plant (1), generator (3), pay loader (1), dump truck (10), backhoe (1), plant yard (1), bulldozer (1)

(2) Mineral Water Development Project

1) Rationale: Promising to do business with mineral water which is abundant in the area, for domestic use and exporting to foreign country in future.

2) Study Area: Sto. Domingo Municipality and the half of Legazpi City adjacent to Sto. Domingo.

3) Expected Benefits: Contribution to the other area in the country and contribution for saving of the foreign exchange reserve and stabilization of the oil price

4) Capital Investment: PHP49.9 million

5) Components of the Project: Construction of the facilities for water exploitation, pump, purification plant, storage tank, laboratory and buildings

(3) Productivity Enhancement Programs in the Protected Area

1) Rationale: Within the zone from 8 to 10 km from the crater, the soil is fertile and the water is abundant. Such strengths/opportunities will enhance the irrigation and agro-industrial development, once the areas are protected from the mud and debris flows by construction of the Sabo facilities.

2) Study Area: Foots of the volcano in Legazpi City and Daraga Municipality

3) Beneficiaries: Farming households and cooperatives, local communities & LGUs concerned, private investors (manufacturers, local processors, traders, etc.), area economy

4) Components of the Project: The project will include; (a) strengthening of the agro-management system, (b) pilot farms on the slopes of Mayon Volcano, (c) model rice farms, (d) technical support and training center, (e) farmer poultry & swine production, meat processing and soft drinks & mineral water plants, (g) market support program, and (h) pilot reforestation.

9.4 Institutional Strengthening Programs

(1) Provincial Disaster Management System Strengthening

1) Rationale: The functions of the PDMO/PDCC need to be strengthened to augment the disaster management capacity of Albay Province, especially in preparedness and recovery phases. The accurate data on casualties and damages will be collected and stored in the PDMO's data banking system.

2) Components of the Program:

- Capability building for the provincial officers and staff (especially PDMO)
- Upgrading of accuracy and reliability of the data and information on vulnerabilities to hazards, hazard areas and number of population at risk
- Provision of the disaster management training (ex. through APDMC)
- Improvement of an information network system by installing a set of facilities and equipment

(2) Community-based Disaster Management Strengthening

1) Rationale: The disaster management at the community level is also beset with various problems in such aspects as institutional/organizational, financial/economic, physical/material and social/motivational ones.

2) Components of the Program :

- Capacity building for city/municipality and barangay staff who have direct responsibility for disaster management
- Improvement of information network system to assure quality communications among the authorities concerned
- Vulnerable area mapping

- Preparation of disaster awareness programs and their implementation
- Strengthening of volunteer disaster operation groups through organizing and training

CHAPTER 10 PROJECT COST ESTIMATE

10.1 Constitution of Project Cost

Project cost comprises (a) construction cost, (b) government administration cost, (c) engineering services cost, (d) land acquisition cost, (e) physical contingency, and (f) price contingency.

10.2 Condition of Cost Estimate

(1) Basic Condition of Cost Estimate

1) Base Year : December 1999

2) Exchange Rates : US$ 1.0 = PHP 40.0 = ￥105.0

3) Price Escalation : 2.34% for foreign currency (F/C) portion, 7.85% for local currency (L/C) portion

(2) Local and Foreign Currency Portions

The cost estimate is made in local and foreign currency portions.

10.3 Cost Estimate by Subproject

The project cost of each priority projects is summarized below.

(1) Yawa River System Sabo Project

(Unit: million PHP)

Description	Foreign Currency	Local Currency	Total
1. Construction Cost	164.4	547.9	712.3
2. Government Administration Cost	-	15.5	15.5
3. Engineering Services Cost	144.4	13.3	157.7
4. Land Acquisition	-	35.3	35.3
5. Physical Contingency	30.9	61.2	92.1
Subtotal (1. – 5.)	339.7	673.2	1,012.9
6. Price Contingency	38.1	318.7	356.8
Total	377.8	991.9	1,369.7

(2) Legazpi City Urban Drainage Project

(Unit: million PHP)

Description	Foreign Currency	Local Currency	Total
1. Construction Cost	205.6	129.1	334.7
2. Government Administration Cost	-	10.6	10.6
3. Engineering Services Cost	62.2	8.7	70.9
4. Land Acquisition	-	15.7	15.7
5. Physical Contingency	26.8	16.4	43.2
Subtotal (1. – 5.)	294.6	180.5	475.1
6. Price Contingency	35.4	83.4	118.8
Total	330.0	263.9	593.9

(3) Forecasting and Warning System Strengthening Project

(Unit: million PHP)

Description	Foreign Currency	Local Currency	Total
1. Construction Cost	210.8	37.0	247.8
2. Government Administration Cost	-	9.8	9.8
3. Engineering Services Cost	51.7	7.3	59.0
4. Physical Contingency	26.3	5.4	31.7
Subtotal (1. – 4.)	288.8	59.5	348.3
5. Price Contingency	33.8	25.3	59.1
Total	322.6	84.8	407.4

(4) Evacuation System Strengthening Project

(Unit: million PHP)

Description	Foreign Currency	Local Currency	Total
1. Construction Cost	0.0	291.9	291.9
2. Government Administration Cost	-	9.1	9.1
3. Engineering Services Cost	34.4	6.2	40.6
4. Physical Contingency	3.4	30.7	34.1
Subtotal (1. – 4.)	37.8	337.9	375.7
5. Price Contingency	3.3	127.4	130.7
Total	41.1	465.3	506.4

(5) Resettlement Sites Development Project

(Unit: million PHP)

Description	Foreign Currency	Local Currency	Total
1. Construction Cost	4.7	202.5	207.2
2. Government Administration Cost	-	9.1	9.1
3. Engineering Services Cost	37.3	6.3	43.6
4. Physical Contingency	4.2	21.8	26.0
Subtotal (1. – 4.)	46.2	239.7	285.9
5. Price Contingency	4.0	90.0	94.0
Total	50.2	329.7	379.9

10.4 Operation and Maintenance Cost Estimate

Each annual operation and maintenance cost for the priority projects is summarized below.

(Unit: million PHP)

Project Name	Total
1. Yawa River System Sabo Project	21.2
2. Legazpi City Urban Drainage Project	3.2
3. Forecasting and Warning System Strengthening Project	25.9
4. Evacuation system Strengthening Project	1.0
5. Resettlement Site Development Project	0.7
Total	52.0

10.5 Supporting Program for Capability Building

The following three supporting programs are designated as the components of capability building for cooperative members, provincial government staff, and city/municipality and barangay staff.

1) Organization and Strengthening of Multi-purpose Cooperatives with Micro-lending Component
2) Provincial Disaster Management System Strengthening
3) Community-based Disaster Management System Strengthening

The cost for capability building comprising of the above programs is summarized below.

(Unit: million PHP)

Supporting Programs	Foreign Currency	Local Currency	Total
1. Organization and Strengthening of Multi-purpose Cooperatives with Micro-lending Component			
Total	130.4	6.0	136.4
2. Provincial Disaster Management System Strengthening			
Total	130.4	67.2	197.6
3. Community-based Disaster Management System Strengthening			
Total	34.3	8.8	43.1
Grand Total	295.1	82.0	377.1

10.6 Summary of Estimated Project Cost

Total project cost for the priority projects is summarized below, with the supporting program for capability building.

Summary of Project Cost

(Unit: million PHP)

Description	Foreign Currency	Local Currency	Total
1. Yawa River System Sabo Project	377.8	991.9	1,369.7
2. Legazpi City Urban Drainage Project	330.0	263.9	593.9
3. Forecasting and Warning System Strengthening Project	322.6	84.8	407.4
4. Evacuation System Strengthening Project	41.1	465.3	506.4
5. Resettlement Site Development Project	50.2	329.7	379.9
Subtotal (1. – 5.)	1,121.7	2,135.6	3,257.3
6. Supporting Programs	295.1	82.0	377.1
Total	1,416.8	2,217.6	3,634.4

The following is the annual disbursement schedule of the priority projects during the period from 2000 to 2005 based on the implementation schedule of the priority projects.

Annual Disbursement Schedule

(Unit: million PHP)

Year	Foreign Currency Portion	Local Currency Portion	Total
2000	-	-	-
2001	110.4	28.2	138.6
2002	68.3	116.2	184.5
2003	217.1	643.6	860.7
2004	408.3	841.5	1,249.8
2005	317.6	506.1	823.7
Total	1,121.7	2,135.6	3,257.3

CHAPTER 11 IMPLEMENTATION PLAN

11.1 Issues in Project Implementation

Local governments are expected to play a greater role in development activities. Considerable efforts in devolution have been made since the enactment of the Local Government Code in 1991, however the process is incomplete. The progress in devolution so far has been made mostly in social welfare, agriculture, environment and health sectors but less in public works sector. There are some confusions at the three levels of government – national, provincial, and city/municipality – due to the absence of detailed guidelines on project implementation responsibility. Thus, the enactment of the Local Government Code and subsequent devolution of responsibilities for local government resulted to a new dimension of implementation issues.

11.2 Implementing Organization

(1) Implementing Agency for the Priority Projects

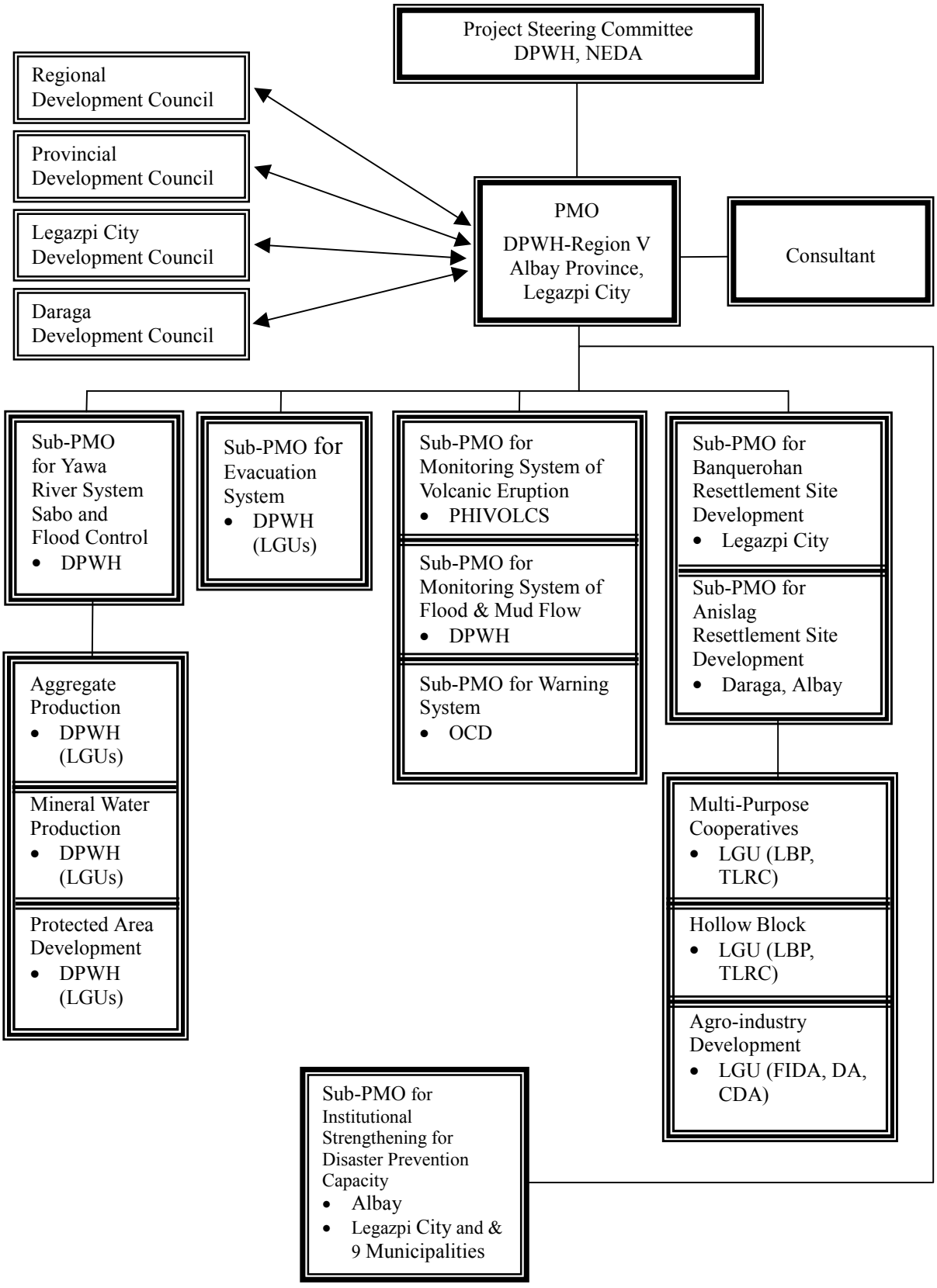
Project Name	Implementation Agency
1. Yawa River System Sabo Project	DPWH
2. Legazpi City Urban Drainage Project	DPWH
3. Forecasting and Warning System Strengthening Project	
- Monitoring system of volcanic activities	PHIVOLCS
- Monitoring system of flood and mud flow	DPWH
- Warning system	OCD
- Repeater station system	DPWH
- Inter-agency disaster mitigation network	OCD
4. Evacuation System Strengthening Project	
- Evacuation center	DPWH
- Emergency shelter	LGUs
- Livestock sanctuary	LGUs
5. Resettlement Site Development Project	
- Banquerohan	Legazpi
- Anislag	Daraga

As for the Project coordination and management structure, refer to Figure S.6.

(2) Form of the Implementation

1) Yawa River System Sabo Project by force account system and later by contract system

2) Others : Contract system



COMPREHENSIVE DISASTER PREVENTION AROUND MAYON VOLCANO IN THE REPUBLIC OF THE PHILIPPINES	**Figure S.6** **Project Coordination and Management Structure**
JAPAN INTERNATIONAL COOPERATION AGENCY	

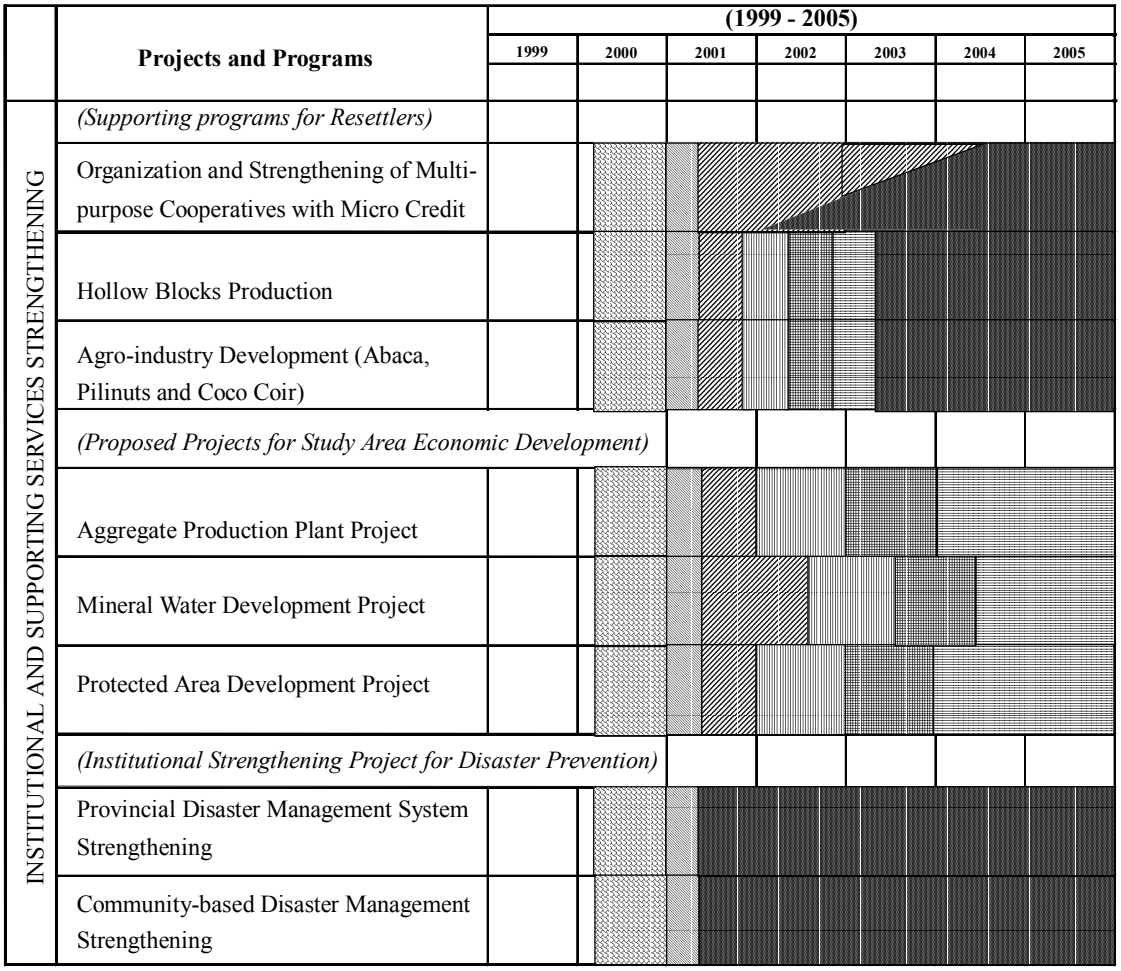
11.3 Implementation Schedule

(1) Implementation Schedule of the Priority Projects

	Projects and Programs	(1999 - 2005)						
		1999	2000	2001	2002	2003	2004	2005
PRIORITY PROPOJECTS	*(Sabo Facility Construction)*							
	Yawa River System Sabo Project							
	(Urban Drainage)							
	Legazpi City Urban Drainage Project							
	(Forecasting, Warning and Evacuation)							
	Forecasting and Warning System Strengthening Project							
	Evacuation System Strengthening Project							
	(Resettlement Sites Development)							
	Resettlement Sites Development Projects							

Notes :
- Feasibility Study
- Financial Arrangement
- Selection of Consultant
- Detailed Design
- Selection of Contractor
- Construction Works and/or Installation of Equipment

(2) Implementation of the Institutional and Supporting Services Strengthening Projects and Programs



Notes :

- Financial Arrangement
- Selection of Consultant
- Detailed Design
- Selection of Contractor
- Construction Works and/or Installation of Equipment
- Preparatory Works
- Operation

11.4 Project Cost Sharing by Implementing Agency

About 78% of the total cost for implementation of the five priority projects will be shouldered by DPWH. The remaining 22% of the total is to be shared as follows: 9.5% by Legazpi City, 5.5% by Daraga Municipality (mainly for land acquisition and resettlement development costs), 4.6% by OCD, 2% by PHIVOLCS, and 1.2% by other LGUs.

(Unit: million PHP)

Project	DPWH	PHIVOLCS	OCD	Legazpi City	Daraga	*LGUs	Total
1. Yawa River System Sabo	1,293.3			55.0	21.4		1,369.7
2. Legazpi City Urban Drainage	565.1			28.8			593.9
3. Forecasting and Warning System	193.3	64.6	149.5				407.4
4. Evacuation System Strengthening	460.4			4.1	1.2	40.7	506.4
5. Resettlement Site Development				222.4	157.5		379.9
Total	2,512.1	64.6	149.5	310.3	180.1	40.7	3,257.3

Note: *LGUs refer to Municipalities of Camalig, Guinobatan, Ligao, Malilipot, Sto. Domingo, and Tabaco.

CHAPTER 12 OPERATION AND MAINTENANCE

12.1 Basic Concept

It is necessary to have an O&M plan before commencing construction/installation of equipment in order to achieve sustainable disaster prevention capacity. Thus, the implementing organization for each project is required to provide an operations and maintenance plan before any disbursement begins. An annual review of O&M activities and needs will be carried out by PMO.

12.2 Operation and Maintenance

(1) Yawa River System Sabo Project

The scope of works for O&M of sand pocket are assumed as follows:

- Maintenance dredging to remove deposit
- Regular river survey including deposition in sand pocket
- Monitoring river deposit mining
- Regular inspection of Sabo structure
- Longitudinal profiling and Cross – sectioning survey

(2) Legazpi City Urban Drainage Project

The operation and maintenance works are required for the following structures and facilities.

a. River channels
b. Pumping station
c. Retention ponds

In particular, it is of extreme importance that the emergency drainage equipment of pumping station starts and is operable in situations such as during floods and heavy rain.

Therefore, the operation and maintenance works for pumping station extend to the following categories to achieve the proper operation of pump drainage.

a. Facilities	:	Sustaining the reliability Easiness of operation
b. Operation	:	Assured operation Sustaining capability of operators
c. Check and repair	:	Sustaining function of facilities Prevention of malfunction Repairing parts

d. Environmental conservation : Reduction of noise and vibration
Reduction of air pollution
Disposal of garbage
Harmonious facility to the surroundings

(3) Forecasting and Warning System Strengthening and Evacuation Project

The equipments to be installed for operation and maintenance are summarized as follow:

a. Eruption monitoring

- OMR for three telemetered seismograph and one repeater station, data processing unit
- One supervisory control and monitoring equipment
- GPS and deformation assessment system, elaboration and calibration of the assessment software

b. Mud and debris Flow monitoring

OMR for nine telemetered rainfall gauging stations, one repeater stations and one system supervisory control and monitoring equipment, data processing unit and elaboration and calibration of the assessment software

c. Flood monitoring

OMR of six telemeterd water level gauging stations and one tidal gauging station, one supervisory control and data processing unit and calibration and elaboration of the assessment soft ware

d. Warning system

OMR of inter agency disaster information network (IADIN) and VHF radio and elaboration of database for server

(4) Evacuation System Strengthening Project

Evacuation System Strengthening Project includes expansion of current evacuation centers – elementary schools-, toilet, shower, and water supply system, emergency shelters and livestock sanctuary. During non-hazard times, evacuation centers are used for their original purpose and maintenance work will be made by DECS. Emergency shelters may be used as trading center, office for agricultural extension workers and venues for rural farmers for training and meetings. The LGUs concerned will undertake maintenance work. Livestock sanctuaries can be

used as demonstration farm or training centers for cattle breeding during non-hazard times. Maintenance work will be made by the LGUs concerned.

(5) Resettlement Site Development Project

Maintenance and repair works of the public facilities in the resettlement sites will be carried out according to the following procedure and rules.

a. Repair inspection of the public facilities within the site,
b. Reporting on the trouble and preparation of an inventory of the facilities to be rehabilitated,
c. Identification of the authority in charge (depending on the kinds of facilities and works needed, and their degrees in trouble), and
d. Implementation of the maintenance and/or repair works.

The responsibilities for the respective maintenance and repair works will be made as follows:

- Roads and pathways (LGUs/Resettlement Committee concerned)
- Water supply system (Local Water Districts)
- Drainage system (LGUs/Resettlement Committee concerned)
- Electric power supply system (ALECO)
- Public buildings
- School (DECS)
    - Chapel (Resettlement Committee/Community)
    - Public hall (Resettlement Committee/Community)
    - Health and day care center (LGU/Resettlement Committee)
    - Productivity center (Resettlement Committee/Cooperative)
    - Multi-purpose warehouse (Resettlement Committee/Cooperative)
    - Park and open space (Resettlement Committee/Community)

Regarding the O&M cost for the Resettlement Sites, majority of the people interviewed in "People's intention survey" answered that they were willing to pay 60 pesos monthly. There are approximately 1,600 households to be dwelled in Banquerohan and Anislag Resettlement Sites.

If this O&M charge of 60 pesos a month is realized, cost recovery from user charge is realized for the Resettlement Sites.

12.3 Total Budget for Operation and Maintenance

The budgets required for operation and maintenance of the priority core projects are as summarized below:

(Unit: million PHP)

Project	DPWH	PHIVOLCS	OCD	Legazpi	Daraga	LGUs	DECS	Total
1. Yawa River System Sabo	21.2							21.2
2. Legazpi City Urban Drainage	3.2							3.2
3. Forecasting and Warning System Strengthening	12.4	4.0	6.5	0.3	0.3	2.4		25.9
4. Evacuation System Strengthening				0.01	0.01	0.05	0.9	1.0
5. Resettlement Site Development				0.4	0.3			0.7
Total	36.8	4.0	6.5	0.7	0.6	2.4	0.9	52.0

Note: *LGUs refer to Municipalities of Camalig, Guinobatan, Ligao, Malilipot, Sto. Domingo and Tabaco.

CHAPTER 13 PROJECT EVALUATION

13.1 Economic Evaluation

The evaluated plans are the proposed sabo plan, Legazpi city urban drainage plan and the proposed resettlement plan.

The direct benefits of the proposed sabo and Legazpi city urban drainage plans were estimated on the basis of the assumed damages to be incurred by assumed mud and debris flow and assumed inundation. The estimated reduction of budgets necessary for disaster fighting activities are the other components of the estimated direct benefits. Meanwhile the indirect benefits were assumed as the alleviation of impediment to economic activities through the previsions of the disaster prevention measures.

The direct benefit of the proposed resettlement plan was estimated to be the net benefit of the land use enhancement in the proposed area. The estimated reduction of budget necessary for disaster fighting is the other constituent of the direct benefit. The alleviation of economic impediment due to disaster is the main component of indirect benefit of the proposed resettlement plan.

The estimated annual benefits are as follows ;

Yawa river basin sabo plan	:	1,229 million PP
Legazpi city urban drainage plan	:	166 million PP
Legazpi and Daraga resettlement plan	:	24 million PP

The indicators for economic evaluation are figured out as follows.

Indicators for Economic Evaluation for Priority Projects

Name of Project	EIRR (%)	B/C	NPV (million PHP)
1. Yawa River System Sabo Project	23.75	1.57	1,304.6
2. Legazpi City Urban Drainage Project	21.56	1.64	213.1
3. Resettlement Sites Development Project			
- Banquerohan	16.21	1.02	8.7
- Anislag	15.27	1.01	1.3
Integrated Evaluation for All Priority Projects	17.77	1.17	676.9

Notes: Conditions for economic evaluation - ① Evaluation period: implementation period for construction works + 50 years, ② Discount rate: opportunity cost of capital (15%).

The Yawa River System Sabo Project indicates the highest economic viability among the above three projects, and the others have also high economic viability. The economic internal rates of return (EIRR) for the Resettlement Sites Development Project for both Banquerohan and Anislag are over 15% (or opportunity cost of capital) and the viability of each resettlement project was justified. Besides, the integrated evaluation for the packaged project including all the priority projects proposed in the Feasibility Study indicates enough economic viability as 17.8%.

13.2 Social Evaluation

(1) Yawa River System Sabo Project

The protected area from mudflow corresponding to 20-year return period is 2,366.4 ha and the population of 14,282 (2,621 households) will get the benefit generated by this project. The protection from mudflow by this project will bring the following social impacts on this area:

- Activation of socioeconomic activity by disaster prevention
- Mitigation of social anxiety and disorder,
- Cutting off vicious circle of poverty by rising up the income level by economic development projects,
- Promotion of the people's settlement (especially labor force),
- Improvement of welfare supported by the improvement of financial affordability of the local government, and
- The social benefit for relocating people from construction sites for Sabo dike depends on difference between the positive benefit and negative benefit.

(2) Legazpi City Urban Drainage Project

The protected area from flood corresponding to 10-year return period is 1,070.1 ha and the population of 70,309 (13,334 households) will get the benefit generated by this project. The protection from flood by this project will bring the following social impacts on this area:

- Activation of urban socioeconomic activities such as transportation of commuter, business such as trade and commercial activities,
- Improvement of sanitation,
- Promotion of the people's settlement (especially labor force),
- Improvement of welfare supported by the improvement of financial affordability of the local government, and

(3) Resettlement Site Development Project

The beneficiaries of this project are as follows:

Beneficiaries of Resettlement Sites Development Project

Indicators	Banquerohan	Anislag	Total
Area (ha)	45	22	67
No. of Population	5,618	3,366	8,934
No. of Household	1,060	635	1,695

This project is expected to realize the following social impacts:

- Improvement of living conditions including space of house lot, water, electricity and transportation,
- The friction or assimilation of social customs with the local people living in the surrounding areas of the resettlement site,
- Improvement of the living environment especially in security due to diminution of vulnerability against disaster, and
- Improvement of sanitary environment by installation of the sewerage and garbage disposal facilities.

CHAPTER 14 THE PILOT PROJECT

(1) Objective of the Pilot Project

The Specification of the Study prepared by JICA defines the objective of the Pilot Project as follows: "Through the execution of the Pilot Project, the Study shall identify the key issues to make the forecasting, warning and evacuation systems to be proposed in the Study to comply with the needs of the Study Area."

(2) Selected Hazard

Mud and debris flow was selected as the target hazard for the Pilot Project because mud and debris flow is :

1) Hazard which will bring about a considerable damage.
2) Hazard, the occurrence thereof is frequent.
3) Hazard which occurs commonly all over the Study Area.
4) Hazard forecasting system thereof will contribute much.

(3) Selection of the Barangay

The existing Bonga gully (channel) is most prominent and provides the deepest depression. Pyroclastic flow of the next eruption has highest probability of traveling down this channel. The flow may deposit the debris in the downstream reach of the gully such as the area along the Pawa-Burabod river. According to the preliminary surveys, the Pawa-Burabod river has the highest potential of mud and debris flow even now. And the area along the river is the most hazardous.

Barangay Mabinit is located at the right bank of the Pawa-Burabod river. The site reconnaissance survey identified that the right bank is the most critical against mud and debris flow. Consequently Barangay Mabinit was selected as the target barangay.

(4) Pilot Project

On 27 November 1999, the Pilot Project was conducted in line with the scenario prepared. Warning was issued from ROCD to CDCC. The warning was relayed to BDCC in accordance with the stipulation of the manual prepared using equipment. CDCC and BDCC acted as scheduled and 174 family with 507 persons evacuated in accordance with the stipulation of the prepared manual. The Pilot Project ended at 16:00 on that day. Participated agencies are DPWH, PHIVOLCS, PAGASA, DECS and PDCC.

(5) Assessment

The proposed procedures and the prepared manuals functioned well in general. Their availability was confirmed through the simulation. There were a few events to be noted for further enhancement as follows:

1) BDCC consumed 15 minutes to disseminate warning to each family by means of house to house visit although the 12 staffs in charge tried their best. The adopted method is reliable and not to be revised. In this connection, the problem is the communication between BDCC and the disseminating staff to provide the most updated information to the disseminator. All the disseminators who will scatter all over the barangay should be equipped with VHF radio terminal to receive the most updated information.

2) ROCD consumed 30 minutes to confirm the availability of the communication facility after receiving level-1 warning. This is because PDCC staff is not stationed yet at that time. This implies that the first warning should be sent to a 24-hour manned site like a guard house to shorten the time to 10 minutes.

3) BDCC spent 20 minutes to order evacuation after receiving the warning from CDCC. This should be shortened by 10 minutes.

4) It took 30 minutes by vehicle for about 6km. This is because only Kirikaw road was passable and it was too narrow to cross two vehicles. The necessary time is estimated to be 15 minutes if Bonga road is available,

5) The defect of Bonga road was found when the first batch of evacuees was directed to the evacuation center. It is apparent that emergency response of DPWH to inspect infrastructure and the emergency rehabilitation infrastructure is important.

6) The time period for warning and evacuation may be shortened by 30 to 45 minutes in total.

CHAPTER 15 RECOMMENDATIONS

In the Study on Comprehensive Disaster Prevention around Mayon Volcano whose target is set at the year 2020, the JICA Study Team formulated its Master Plan and conducted the Feasibility Study on the priority projects selected in the Master Plan. To implement the proposed priority projects, it is highly recommended that the Philippine Government undertake them in consideration of the following suggestions.

15.1 Earlier Implementation of the Priority Projects and Their Preparations

As a result of the Feasibility Study, all the priority projects and programs proposed by the JICA Study Team have been verified to be viable in terms of economic and socio-environmental aspects.

Consequently, it is recommended for the GOP to promote these projects and programs as soon as possible.

(1) Preparations for Implementation of the Projects and Programs

1) Formation of a Consensus through Discussions in the Related Communities

The disaster prevention projects and programs need to be implemented with the consent of the government agencies concerned (both central and local) and the related people. Prior to their implementation, it is advised to hold a series of meetings so as to make a consensus among all concerned.

2) Enlightenment of the People and Participation of the Communities

In addition to involvement of the government agencies, it is suggested to make more the Non-Government Organizations (NGOs) participate, and cooperate with them in enlightening the people and communities.

3) Promotion of the People's Self-preparedness

The disaster prevention activities depend on the willingness of the community members. So it is recommended to activate the voluntary participation of the people into disaster prevention activities.

(4) Appropriation of the Budget

1) Cost Sharing between Central Government and Local Government Units (LGUs)

Implementation of all priority projects and programs proposed in this Study requires a good deal of funds. In principle, the required costs should be shared in proportion to the amount of benefits to be received among the concerned. However, the fund raising capacity of LGUs is still limited and is much less that of the communities. Considering such situation, it is indispensable to implement these projects with an initiative of the central government to lead them to successful realization. As far as this Study is concerned, the Philippine Government agrees that the relevant LGUs share at least 10% of the total project cost. In this regard, it is advised for both the central and local governments to sit together with a view to discussing in detail the sharing of costs and works for the respective related projects.

2) Financial Assistance from International Institution or Foreign Country

To complement the financial deficit of the central government, it may be necessary to have recourse to a financial assistance from the international financing institution or foreign donor country. As the aid conditions of the above institution or country vary from one to another and its preparatory procedure takes time, it is suggested to start to sound the financing possibility and make a request at an early opportunity. In case that the Philippine Government makes a request for financing assistance, the following are supposed to be the basic conditions or requirements for foreign financial assistance:

a. The project or program should be justified to be feasible.
b. The project or program must be contributive to upgrading of the disaster prevention capacity of the people or its community, and improvement of their livelihood.
c. In principle, the local portion in the project or program cost is to be borne by the Philippine Government.
d. The Philippine Government commits the project implementation and it is to be done with its initiative (even though it depends on the technical and financial assistance).
e. After completion of the project or program, its operations and maintenance is to be properly done by the Philippine side.

Among these five conditions, the items a. and b. have been confirmed in this Study. As for the remaining items from c. to e., JICA Team understands that such

conditions were understood and accepted by the Philippine side through a series of explanations and discussions with the high officials of the competent agencies.

(3) Establishment of the Implementation Structure

1) Institutional Arrangements

In the Philippines, the decrees provide for the duties and responsibilities of each agency concerned with regard to the forecasting and warning of volcanic eruption, typhoon, and flood, but no legislation stipulates for the monitoring of the mud and debris flow. It is, therefore, recommended to prepare an executive order, which prescribes the mandate of DPWH as its main executor.

2) Creation of the Implementation Organization

As the priority projects and programs proposed comprise various works and activities in both the structural and non-structural aspects, it is strongly recommended to establish an "integrated implementation system" which is able to manage the whole structure, by entrusting the supervisory management power to DPWH.

3) Involvement of the Consultants including External Intellectuals

In view of a wide scope of works and activities of the proposed projects and programs, several competent government agencies need to be involved in implementing them. As to the general supervision of the whole projects and programs implementation, it was confirmed in the Steering Committee meeting that DPWH assume a role of the main executor.

Since DPWH has no experience yet in supervising and managing such integrated or packaged projects and programs, it is advised to hire a group of Qualified Consultants. It is, therefore, recommended to entrust them (as "ENGINEER" as prescribed in the FIDIC regulations) with full powers at the initial stage of the project implementation. In proportion as the project progresses, the power will be gradually transferred to the main executor and all powers finally belong to the designated authority. In this case, Consultants will be responsible for the quality control of the works and also provide the advisory services on work schedule and financial control in the project management.

15.2 Immediate Execution of the Practicable Matters with the Available Resources

It is really to be appreciated that the Philippine Government makes every effort to cope with the disasters and ensure the better life of the people with the limited

resources. To improve further the current situations, it is proposed to undertake the following to the utmost extent.

(1) Collection and Preparation of the Basic Data

The biggest bottleneck in the conduct of this Study was the lack of basic data and information, which are instrumental in clarifying the issues and formulating the planning. The Master Plan study on comprehensive disaster prevention in the Study Area is to be reviewed every ten years. To undertake this review, it is indispensable to do it based on the reliable data and accurate figures. Consequently, it is strongly suggested to consolidate the data management system by collecting and storing properly the data and information regarding the following:

1) Socioeconomic Statistics
   a. Population census
   b. Socioeconomic indicators in the Area (by Province, City/Municipality and Barangay)
   c. Land use
2) Hydrological and River Flow Observations
   a. Rainfalls
   b. Stream and water level gauging
   c. River bed changes (longitudinal leveling and traversal sectional surveying)
   d. Excavation volume of the sediment
3) Disaster Records
   a. Real situations in times of disaster occurrences regarding society, economy and physical conditions
   b. Extent, intensity and impacts of the disaster (general situations of the disaster, calamity and stricken areas, affected people, toll, amounts of damage by sector and category, number of days in economic abeyance due to disaster, etc.)
   c. Real state of evacuation (no. of evacuees by evacuation center, evacuation route, means of evacuation and its number, staying days in the shelter, procurement and distribution of emergency stockpiles, etc.)
   d. Disaster fund (amount by fund source, date of defrayal, details of actual disbursement)

4) Records on Relocation and Resettlement
   a. No. of resettlers by resettlement site, no. of permanent settlers, no. of settlers who abandoned the site, dates of settlement and departure
   b. Inventory of resettlement site facilities and records on their rehabilitation
5) Records on Training and Drills
   a. Practiced evacuation drills
   b. Educational programs for the people
   c. Educational campaigns conducted for school pupils
6) Establishment of Database

(2) Strengthening of the Disaster Prevention Activities by the People, NGOs and Volunteers

In the Study Area, several NGOs have been actively involved in the disaster prevention activities and play a very important part not only in them but also in area socioeconomic development. To promote further their effective participation, it is suggested to clarify the tie-up system with them, especially in the following issues and fields of activities.

1) Surveying and Assessment of the Dangerous Areas and Information Networking
2) Awareness Raising of the People and Educational Campaign for the School Pupils
   a. Utilization of the education curriculum and teaching manual prepared as a result of technical assistance of the Italian Government
   b. Pictures (cartoons) and posters
   c. Essay contest
   d. Talks and presentations using photos, films, videos, etc.
   e. Others
3) Preparedness for typhoon (clearing of drainage canals, cut-off of tree branches, etc.)
4) Reforestation
5) Practice of the Disaster Prevention Drills
6) Publication of the Information Bulletins and Accomplishment Reports
7) Others

(3) Inspection of the Disaster Prevention Facilities and Establishment of Emergency Response System

1) Periodical Inspections of the Disaster Prevention Facilities and Recordings (forecasting and warning, evacuation routes, evacuation centers, etc.)

2) Rehabilitation of the Disaster Prevention Facilities and Recording of the Emergency Responses

(4) Preparation of the Manuals for Disaster Coping

(5) Reliable Transmission of the Forecasting and Warning Information

1) Clarification of the Duties and Responsibilities

a. PAGASA : Forecasts on weather, typhoon and flood in a broad area
b. PHIVOLCS: Eruptions of Mayon Volcano
c. DPWH: Mud & debris flows and flood in a local aea

2) Accurate Data Collection and Forecasts

3) Timely Transmission of the Information

4) Periodical Inspections and O&M of the Facilities

(6) Grasp of the Land Use Situation

1) Survey for Grasping the Current and Future (Sustainable) Land Use

2) Update of the Land Tax Inventory

3) Preparation of the Land Use Maps and their Updating

4) Preparation of the Future Land Use Plan

5) Establishment of the Common Ownership System for the Collected Data and Records

15.3 Eruptions of Mayon Volcano in February – March 2000

At the final stage of the Study, Mayon volcano erupted in a series of explosions from the end of February to the beginning of March 2000. Although the stay period of the JICA Study Team in the Study Area was too much limited in the 3rd Field Work, the Team conducted the site inspections for three days from 25 to 28 June 2000, and collected the basic data from the agencies concerned including the PHIVOLCS.

Based on the findings in the site inspections and data collected from the agencies concerned, the views of the JICA Study Team on the latest eruptions of Mayon Volcano can be summarized as indicated below:

(1) Latest Eruptions of Mayon Volcano and Their Records

Just after its eruptions, the PHIVOLCS launched an investigation on them and prepared the preliminary report at the end of June 2000. This preliminary report is now under review and to be compiled as a final report after more detailed investigations. It is not yet confirmed when this final report will be finalized. According to the data in the preliminary report prepared by the PHIVOLCS and its explanations, the records of the latest eruptions are the following:

- February 1999 — Detection of the seismic tremors due to volcanic activities of Mayon Volcano
- April to May 1999 — Detection of several seismic tremors
- 22 June 1999 — Explosion due to steam and gases pressure. The volcanic ash reached the altitude of 10 to 12km. The southwestern quarter within 7km-radius from the crater including the Bonga gully was declared as "Danger Zone". Occurrences of small-magnitude pyroclastic flows.
- 22 September 1999 — Explosion due to steam and gases pressure. The volcanic ash reached the altitude of 5 to 6km. Occurrences of small-scale ash falls and pyroclastic flows.
- 23 February 2000 — Occurrences of volcanic tremors due to volcanic activities. Development of lava dome. Evacuation of 10,000 people
- 24 February 2000 — Pyroclastic flows in the Bonga gully
- 26 February 2000 — Commencement of a series of intensified eruptions and seismic tremors due to volcanic activities.
- 28 February 2000 — The volcanic ash reached the altitude of 5 to 6km. Commencement of the eruptions in a series of explosions and lava flows in the Bonga gully.
- 29 February to 1st March 2000 — Occurrence of the highest intensity explosion. A huge ash column reached up to 14km in the air and pyroclastic debris flowed down in all directions along the major gullies of the Volcano. The number of evacuees amounted to 63,000.
- 5 March 2000 — The number of evacuees rose to 65,000.

- 15 May 2000 Retraction of the alert state. Most evacuees returned to their houses, but those whose houses were destroyed still stay in the evacuations centers.

(2) Results of the Site Inspections

1) State of Mayon Volcano as of June 2000

- According to the information obtained through interview with the PHIVOLCS representative, the volcanic activity of the Volcano in the state of lull. By the Team's observation, the Volcano seemed to be normal in terms of smoke's volume, but it was still showing a sign of growing.
- The Team could observe the remains of a series of explosions like lava flows, pyroclastic deposits and ashes, especially on the upper portions of the Volcano.
- After a series of eruptions, the debris flows occur along the gullies and river channels flowing from the Volcano (The details are given below).
- In the barangays located at around 8km-radius from the crater, most of the people returned to their houses and seemed to make a living as before.
- The grayish traces of pyroclastic flows were found everywhere on the slope of this sector. Although the thickness of accumulated volcanic materials is unknown, it is evident that there are voluminous debris deposits, which may loosen.

2) Present Situations of the Rivers

The site inspections were carried out allover the Study Area around Mayon Volcano, especially focusing on the barangays and along the barangay roads located approximately at 8km-radius from the crater.

- Pawa-Burabod: In the area situated at about 8 km-radius from the crater, the traces of debris flows could not be founded. However, at the upstream area with the altitude of about 900m, the existence of thickly accumulated pyroclastic materials spewed in the latest eruptions was observed. These materials may be blocked by the lava flow deposits in 2000. In the upper part of alluvial fan just under this deposit area, it is reported that there exist a good deal of accumulated volcanic materials which are still "not compact" and are very likely to be loosened even by a moderate downpour.
- Budiao: The pyroclastic flows did not reach this time the Budiao river basin.
- Anoling: In the Anoling river A and B, the traces of debris flow were not confirmed, but it occurred in the Anoling C. Because of the debris flows, its river bed was strikingly elevated. In its upstream area, the pyroclastic flows came down along the gully and reached the area at the altitude of about 700m.

- Quirangay: There was no trace of debris flow in this river. However, in its upstream area, the pyroclastic materials were deposited.
- Tumpa: No changes were observed. This may be due to the same topographic reason as found in the Budiao river.
- Maninila: No occurrence of debris flow. The remarkable traces of pyroclastic flows could not be observed.
- Masarawag: No occurrence of debris flow. The remarkable traces of pyroclastic flows could not be found. The heavy ashfall severely affected in the western parts of the Volcano including Masarawag and it is reported that many farmlands were destroyed by heavy ash falls.
- Ogsong: No traces of debris flow could not be found, but in its upstream area, the pyroclastic materials were deposited.
- Nasisi: In the upper area of the Sabo dam, the traces of debris flow could not be found, but in its upstream area, the pyroclastic materials were deposited.
- Buang: There is a ground sill under construction at just downstream area of the bridge. This structure is not damaged by any debris flow. It means that no debris flow reaches this area. But it is confirmed that in its upstream area, the pyroclastic flows came down along the gully and reached the area at the altitude of about 800m.
- San Vicente: Any change could not be observed at the extremity of its alluvial fan. In the upstream area just under the crater, the pyroclastic materials were deposited.
- Bulawan: No traces of debris flow could not be found. The situations of its upstream area are unknown.
- Padang: In the area situated at about 8 km-radius from the crater, the traces of debris flows could not be founded. However, in the river basin, there must be voluminous pyroclastic materials deposited by the recent (second in its volume to that in Pawa-Brabod). It is advised to monitor their movements.
- Arimbay: No changes were observed. This may be due to the same reason as found in the Tumpa and Budiao.

(3) Findings and Recommendations

The ejecta volumes in the past eruptions are comparatively summarized below:

(Unit : million m^3)

Year	Ejecta Volume	Pyroclastic Flow	Lava Flow	Ash Fall
1968	35	15	8*	12*
1978	49	20	12*	7*
1984	70	53	10*	7*
1993	80 - 90	5 - 10	45	30
2000	40	14	10*	16*

Note: * Estimate of the JICA Study Team
Source: PHIVOLCS

The ejecta volume of the latest eruptions in 2000 was estimated at 14,000,000m^3 by the PHIVOLCS. This volume is by far less than 53,000,000m^3 in 1984 eruption, which was assumed to be the planning magnitude in this Study. Consequently, it is judged not necessary to revise the proposed plan.

On the other hand, the total volume of volcanic materials deposited in the Pawa-Burabod river basin is estimated at about 7,500,000m^3 and this corresponds to 38 times of the debris volume (200,000m^3) which might flow once and was assumed to be the design basis in the Study. From this respect, it is true that the volume of volcanic materials, which are not compact and very likely to be loosened, has increased because of the recent eruptions. According to the explanations of the PHIVOLCS, it is said that the pyroclastic deposits may not cause immediately a large-scale collapsing hazard, since they were covered with the subsequent lava flows.

All things considered, it should be noted that there still exist eventual occurrences of a large-scale collapse of the deposited materials and debris flows. Knowing that the PHIVOLCS monitors the geomorphological state of the Volcano's slopes using the telescope, it is however recommended to strengthen its monitoring system so as to avoid the unforeseen disaster, especially in the Bonga gully. This may enable the relevant authorities to prepare for an immediate evacuation in the event of the increased danger.

In the preliminary report prepared by the PHIVOLCS, the volumes of the volcanic materials deposited in each river basin are summarized as follows.

River System	Area (m^2)	Thickness (m)	Volume (m^3)
Basud-Lidong (Basud)	448,670	1	448,670
Upper Bulawan	185,130	1	185,130
San Vicente	372,440	1	372,440
Buang	287,500	1	287,500
Nasisi	154,640	1	154,640
Nabonton (Ogsong)	154,640	1	154,640
Maninila	330,510	1	330,510
Tumpa	302,740	1	302,740
Quirangay	119,790	1	119,790
Anoling	177,870	1	177,870
Mi-isi (Budiao)	728,900	1	728,900
Mabinit (Pawa-Burabod)	497,310	15	7,459,650
Buyuan-Padan (Padang)	424,370	7.5	3,182,775
Total	0	0	13,905,255

Source: PHIVOLCS

The volumes estimated in the preliminary report are not definitive figures. If the conclusion of the final report, which is under preparation by the PHIVOLCS, requires, it may be necessary to conduct a further detailed study.

Among the evacuees who fled to safer areas or sheltered in the evacuation centers, some households have no more houses to return. To support the people who lost their houses and livelihood, it is reported that the Philippine government and local government units (LGUs) concerned have jointly launched a scheme to promote the development of the resettlement sites. As recommended in this Study report, it is advised to implement immediately the resettlement sites development project coupled with the livelihood development program so as to enable their real settlements.

In connection with the basic data mentioned above, the checklist for reviewing the Master Plan and Feasibility Study is indicated below.

Checklist of the Data Required for Reviewing the Master Plan and Feasibility Study

No.	Category	Data/ Information to be Reviewed
1.	Socio-economy	- Population data (population growth rates and densities by Province, City/Municipality and Barangay)
		- Population forecast (growth rates by area and danger zone)
		- GDP/GRDP by industrial origin at constant and current prices (annual average growth rates)
		- GRDP projection (forecast growth rates)
		- Data on the area development plans and Investment Programs (Province, City/Municipality and Barangays)
		- Poverty indicators of the Area (Poverty incidence, poverty line, etc.)
		- Present land use condition and future land use plan
		- List of public facilities in the Area (roads & bridges, railways, ports and airport, flood control, sabo, schools, hospitals, markets, etc.)
		- Inventory data of the respective public facilities (capacity, conditions, operations, etc.)
2.	Disaster Management	- Disaster records on real situations in times of disaster occurrences - Periodical monitoring of the people who are working in the danger zone (no. of the people and their activities, etc.)
		- Data on extent, intensity and impacts of the disaster (general situations of the disaster, calamity and stricken areas, affected people, toll, amounts of damages by sector and category, number of days in economic abeyance due to disaster, etc.)
		- Regular review of the disaster management systems at each administrative level : PDCC/PDMO – C/MDCCs – BDCCs (for every phase of the disaster management cycle)
		- Real state of evacuation (no. of evacuees by evacuation center, evacuation route, means of evacuation and its number, staying days in the shelter, procurement and distribution of emergency stockpiles, etc.)
		- Calamity fund (amount by fund source, date of defrayal, details of actual disbursement)
3.	Hydrology, Hydraulics & River Planning	- Data on rainfalls and estimate of probable daily rainfalls (by basin, area, bed slope, design rainfall, etc.) - Conditions of catchment areas and their drainage capacities
		- Data on stream and water level gauging
		- Observations on river bed changes (longitudinal leveling and traversal sectional surveying)
		- Data on flooding (flooded area, depth, and duration) and debris flow (area covered by debris, depth)
		- Estimate of the sediment runoff and its volume
4.	Resettlement and Livelihood	- Conduct of the socioeconomic baseline survey among the resettlers to grasp their needs and problems
		- Review of the inventory of resettlement site facilities, and records on their rehabilitation
		- Regular review of resettlement data: no. of resettlers by resettlement site, no. of permanent settlers, no. of settlers who abandoned the site, dates of settlement and departure
		- Assessment and monitoring of the cooperatives established in the resettlement sites and preparation of a guidance for their sustainability
5.	Human Resources Development	- Monitoring and assessment of the training and drills carried out in the area for upgrading the disaster prevention capacity of the people
6.	Establishment of Database	- Feedback and storing of the above all data to update the database