C4. CONSTRUCTION PLAN

C4.1 General

(1) Types and Kinds of Works

The following kinds of works are included in the Priority Projects:

1) Lower Bone River Improvement: Bank protection work
2) Lower Bolango River Improvement: Channel excavation work, cut-off channel works, bank protection work, dike work, drainage sluice work, and bridge works
3) Tapodu River Improvement with Tapodu Gate: Channel excavation work, bank protection work, dike work, sluice work, Tapodu Gate work, and bridge work
4) Tamalate Floodway: Floodway excavation work, bank protection work, dike work, sluice work, diversion weir work, and bridge works
5) Sediment Trap Works is Lake Limboto: Sediment trap work and channel realignment work

(2) Basis of Planning

For discussions of the construction plan, the following assumptions and principles were introduced:

1) Execution method: Full contract system
2) Construction Period: 5 (five) years from 2005 to 2009 for actual work implementation at site
3) Principles: Use of local materials as much as possible

C4.2 Lower Bone River Improvement

(1) Description of Works

Bank Protection work: Bank protection (Type-1) is proposed considering the saline water, on critical right bank portion for a total length of 625.0 m.

(2) Site Conditions

The site is located in the narrow area between the hill and the Bone River.

(3) Procurement of Construction Material

Small quantity of stone material is required for this section. The stone materials required are possible to be supplied from local sources.

(4) Other Matters to be Considered during Construction

No specific matters needed to be considered during construction on this section. Bank protection work in the settlement area is generally welcome by the local community because it increases their safety against flood.

C4.3 Lower Bolango River Improvement

(1) Description of Works

Channel Excavation Work: Channel excavation is proposed for Tenda COC section, Stretch-II_R and III of the Bolango River. The stretch-II_R will be improved as main flood route. Silty sand and sandy clay are the materials for excavation.

Bank Protection Work: Gabion mattress, wet rubble masonry and concrete slab with concrete pile are adopted depending on the river conditions. Gabion mattress type was proposed for location that possible for 1: 1 of bank slope. Wet rubble masonry type was proposed for dense built-up area where bank slope only possible for 2:1. Concrete slab combined with concrete pile is proposed mainly for the lower reaches portion of the Bolango River affected by tides.

Dike Work: Floodwall and earth dike are adopted. As much as possible, the existing dikes are use with minor improvement required. Earth dike by 3.0 m width was proposed as a typical dike for upper reaches of Bolango. Flood masonry wall was proposed for the middle reaches where only a limited space available.

Cut-off Channel: A cut-off channel is proposed in Tenda at the confluence of the Right and Left Bolango River. Proposed length of the COC is 150.0 m.

Appurtenant Structure: Bridges are the major structures. Two (2) bridges, i.e., Tenilo bridge (truss bridge) and Tenda bridge (girder type, pre-stress beam) need lifting up. Modification of abutments and adjustment of approach road are the major works.

Two (2) other bridges, i.e., Siendeng-2 bridge and Donggala bridge need to be reconstructed with enough span. One new bridge is constructed across the Tenda COC.

(2) Site Conditions

Along the upper reaches of the Lower Bolango River for about 3.0 km length not so many settlements nor community structures exist. Access road will be not a problem for construction. Asphalt paved road already constructed in parallel with the river alignment. On other hand, densely built-up settlement are found in the downstream reaches from the division point of the Bolango and Siendeng rivers up to junction with Bone river.

There are 2 (two) reference benchmark applicable to the construction as shown below.

No.	Bench mark	X	Y	Z (m,MSL)	Location
1.	LBB-11	503,375.228	60,418.762	+8.641	Around bridge, junction between Bolango river and Tapodu river
2.	LBB-01	506,425.108	58,273.075	+2.564	Upstream of "short-cut" portion

(3) Procurement of Construction Materials

Requirement of main materials are listed.

No	Item of works	Quantity	Required Material			
			Sand (m^3)	Gravel (m^3)	Cement (kg)	Stone (m^3)
1	Concrete	4,900 m^3	2,695	4,165	2,450,000	
2	Wet Masonry	157,500 m^3	78,750		31,500,000	133,875
3	Rip rap	1,800 m^3				2,160
4	Gabion Mattress	302,000 m^3				362,400
5	Wooden pile @ 2m'	137,000 Nos				
6	Concrete pile	2,920 m	241	372	219,000	
Total requirement:			81,686	4,537	34,169,000	498,435

Sand: Natural sand is recommended to be taken from the Bone River. The natural sources are judged available to fulfill the required quantity.

Gravel: Gravel will be supplied from the river deposit and the quality is judged good for middle class concrete. For high quality concrete which is required for such as bridge beam, concrete pile, slab concrete wall, the crushed stone should be provided

Stone / Boulder: Stone material will be used for construction of wet rubble masonry and gabion. Boulder is proposed for rip-rap. Both materials are available near around Gorontalo from the river or from quarry in the hill.

Portland Cement: Cement for concrete works (in-situ and pre-cast) and wet rubble masonry works is available in the local market. Concrete piles are to be executed under fabrication license and need special handling.

Water: Water from Lake Limboto and Bolango river can be used during construction phase. Simple treatment may become necessary when the flows contain fine sediment during rainy season. Shallow dig-well is recommended as main sources of water for higher structural specification.

Embankment Material: Embankment materials are available from the excavated materials from river channel. In case special specification is required, the embankment material can be taken from a small hill near Buidu village around 12 km north-east of Gorontalo and from Buliide village, District Kota Barat about 3 km south of Gorontalo.

(4) Treatment of Construction Disposal

The balance of excavation and embankment work are shown as below:

Item of Works	Excavation (m^3)	Embankment (m^3)	Balance	Remark
River improvement	140,500	47,000	(+) 93,500	Surplus

The excavated materials that have proper quality should be used for embankment as much as possible. The remaining excess materials are proposed to be spread in the low-lying areas around Tapodu River.

(5) Other Matters to be Considered during Construction

Material Sources: Environmental impacts should be considered for taking materials from natural sources, mainly for sand, stone and embankment material and lands for disposal.

Land Acquisition: Land acquisition is predicted to be one of major social issues that could be a trigger of social problems and delay of the construction. Inventory, coordination and dissemination between Pemda / Kabupaten Gorontalo with land-owner should be prepared and handed carefully as early as possible.

Heavy Equipment: Operation of heavy equipments are required, mainly for earth excavation, hauling, and construction of pile protection.

Participation of Local Community: During construction stage, participation by local villagers or local contractor will be very important to build their sense of ownership. Cooperation and good relation should be kept compensating their sacrifice for land/ plant and disturbing during construction.

C4.4 Tapodu River Improvement with Tapodu Gate

(1) Description of Works

Tapodu Gates:

1) Structure: Main concrete slab (width B = 73.0 m with L = 15.0 m), aprons on both upstream and downstream side, rip-rap on outer section of apron
2) Foundation: Hollow concrete pile of dia. 45 mm, and length variable from 25m to 15m, with sheet pile at the edges of aprons
3) Gate: Rubber gate (2 spans @ 35.0 m, height 2.0 m), automatically deflated, with center pier and control house.

Channel Works: Excavation materials are clayey silt, clay and clayey sand. Total length is 2.820 m and bottom width of 70.0 m with 1 : 2 side slopes. Excavation depth from original ground level varies from 2.0 m to 4.50 m.

Bank Protection Work: Wet rubble masonry is proposed around main structure only.

Vegetation cover (reed/grass) is proposed to for the high-water beds of 15-m width.

Dike Work: Floodwall and earth dike are proposed.

Sluice Work: Four (4) new sluice structures were proposed at the head and ends of the existing canals.

Appurtenant Structure: Bridges, Mechanical, Electrical etc. Two (2) bridges with steel beam are constructed across the Tapodu River. One (1) bridge on down stream of main structure is also proposed for construction.

(2) Site Conditions

The proposed works cover about 24 hectare in total including river area, embankment, dikes, required structures, etc.

According to the geological investigation data, the soil in the work site is dominated by sedimentation deposit such as clay sand, gravel sand and sandy clay that contain organic matters.

According to the topographic survey data around the proposed site, ground elevation varies from + 4.20 to + 5.20 m,MSL.

Reference benchmark for this site is shown below.

No.	Bench mark	X	Y	Z (MSL)	Location
1.	LBB-11	503,375.228	60,418.762	+8.641	Around bridge, junction between Bolango river and Tapodu river

Access to the gate site is relatively easy with short construction road.

(3) Procurement of Construction Materials

Requirement of main construction materials is shown below.

No	Item of works	Quantity (m^3)	Required material			
			Sand (m^3)	Gravel (m^3)	Cement (kg)	Stone (m^3)
1	Concrete	10,700	5,900	9,100	5,350,000	
2	Wet masonry	14,000	7,000		2,800,000	11,900
3	Rip-rap	4,500				5,400
Total requirement:			12,900	9,100	8,150,000	17,300

Sand: Natural sand is easily available from the Bone River. The natural sources are enough to supply the required quantity.

Gravel: Gravel is also available from the river deposit and the qualities judged good for middle class concrete. For high quality concrete required for bridge beam, concrete pile, etc., the crushed stone should be used

Stone / Boulder: Stone material is used for construction of wet rubble masonry and gabion. Boulder is used for rip-rap. Both materials are available in Gorontalo area.

Portland Cement: Cement is used for concrete (in-situ and pre-cast) and wet rubble masonry. Cement available in the local market is used.

Water: Water from Lake Limboto and the Bolango River is used for construction. Simple treatment may be necessary to remove suspended solid during rainy season. Shallow dig-well is recommended as main sources of water required for higher structural specification.

Embankment Material: Embankment materials are taken from the excavated material from the river. For the construction requiring special specification, the embankment material can be taken from small hill near Buidu village, around 12 km north-east of Gorontalo and from Buliide village, District Kota Barat, about 3 km south of Gorontalo.

(4) Treatment of Construction Disposal

The balance of quantities of excavation and embankment materials are shown below.

Item of works	Excavation (m^3)	Embankment (m^3)	Balance	Remark
River channel	536,000	147.000	(+) 389,00	Surplus
Tapodu Gate	51,000	5,700	(+) 45,000	Surplus

The excavated materials that have proper quality should be used for embankment as much as possible. The excavated material should be used for lake dike embankment. The remaining disposal materials are to be spread over to reclaim the low-lying lakeside areas. The reclaimed area could be used for the re-settlement of the houses demolished under this project. The reclamation should be planned only outside the lake area. Otherwise the effective lake area may be reduced.

(5) Other Matters to be Considered in Construction

Material Sources: Natural sources should be exploited carefully considering the environmental impacts.

Material to be Taken from Overseas: A part of the structural materials should be import from overseas. These includes rubber weir with accessories, high quality steel beam for bridge.

Land Acquisition: Land acquisition could be one of the major social issues to cause delay of the construction.

Inventory and coordination between Pemda / Kabupaten Gorontalo with land-owner should be prepared and handed carefully as early as possible.

Heavy Equipment: Heavy construction equipment is required mainly for earth excavation and hauling, piling for gate and bridge foundation, etc.

Cofferdam: Even though the proposed gate is located on dry land, the site is subject to inundations due to the lake and the Bolango River.

Participation of Local Community: Participation of local villagers or local contractor for the construction and O and M activities is very important to grown-up their sense of ownership. Cooperation and good relation should be kept to compensate their sacrifice due to land acquisition and disturbance during the construction.

C4.5 Tamalate Floodway

(1) Description of Works

Channel Excavation Work: The excavation materials are silty sand and silty clay. Total length for channel excavation is 2.750 m. The excavation depth ranges from 2.0 m to 4.80 m below original ground level.

Bank Protection Work: Wet rubble masonry with gabion mattress are adopted. Wet rubble masonry is proposed for 700 m in floodway length, starting from diversion weir to proposed bridge No. 2. Gabion mattress is also provided with the masonry as sure-footing. Sodding works are proposed for new dike slope along the floodway.

Dike Work: Earth dike with crown width 3.0 m is installed for the floodway reaches where riverbank elevation is low.

Sluice Work: Four (4) drainage sluice gates are proposed across the floodway dike. One (1) sluice gate is proposed at the diversion across the existing Tamalate River.

Appurtenant Structure: Bridges, Aqueduct, Sluice Structures etc. Four (4) bridges with 4.0 m clear width and one (1) bridge with 7.0 m clear width are proposed across the floodway. Four (4) waterway bridges are also proposed to keep services for irrigation.

(2) Site Conditions

The proposed works cover about 14 hectare of residential and farming area (estimated square also include river area.

Reference benchmarks are available for the work along as shown below.

No.	Bench mark	X	Y	Z	Location
1.	RAT - 1	511,596.920	62,004.720	+9.12	Around bridge, u/s
2.	TB - 1	511,514.228	61,830.483	+9.69	U/s of Div. Structure, Po'owo Dalem village

No.	Bench mark	X	Y	Z	Location
3.	TB - 2	511,052.681	60,906.149	+9.34	Intersection road, Po'owo village
4.	TB - 3	511,029.364	60,335.626	+8.93	Road, Alale canal
5.	TB - 4	510,935.322	59,798.699	+9.41	Province road, Oluhuta village

According to the result of topographic survey around the proposed site, the ground elevation varies from + 8.20 to + 9.50 m,MSL while the floodway bed lays on elevation ranging from + 6.50 to + 4.35 m,MSL.

Access road for heavy equipment would not be problem because of enough existing road network.

(3) Procurement of Construction Materials

Requirement of construction material is listed below.

No	Item of works	Quantity (m^3)	Required material			
			Sand (m^3)	Gravel (m^3)	Cement (kg)	Stone (m^3)
1	Concrete	240	132	204	120,000	
2	Wet Masonry	9,300	4,650		1,860,000	7,900
3	Rip-Rap	50				60
4	Gabion mattress	2,600				3,100
Total requirement:			4,782	204	1,980,000	11,060

Sand: Natural sand easily available both from Tamalate and Bone rivers.

Gravel: Gravel is available from the river deposit and the quality is judged good for middle class concrete. For high quality concrete required for bridge beam and other structural works, the crushed stone gravel should be used.

Stone / Boulder: Stone material is used for construction of wet rubble masonry and gabion mattresses. Boulder is used for rip-rap.

Portland Cement: Cement is used for Concrete works (in-situ and pre-cast) and wet rubble masonry. Cement available in the local market is used.

Water: Water from the Bone and Tamalate rivers is used for construction. Simple treatment may be necessary to remove suspended solid during rainy season.

Embankment Material: Embankment material are taken from the excavate material. For the construction requiring special specification, the embankment material can be taken from small hill near Buidu village, around 12 km on north-east of Gorontalo and from Buliide village, District Kota Barat, about 3 km south of Gorontalo.

(4) Treatment of Construction Disposal

The balance of quantities of excavation and embankment materials are shown below.

Location of works	Excavation (m^3)	Embankment (m^3)	Balance (m^3)	Remark
Floodway	210,000	30,000	(+) 180,000	Proposed to be dispose to lower portion, around bank of Bone river
Diversion facilities	4,400	3,700	(+) 700	

The excavated material should be used for embankment material as much as possible. The remaining excess materials are spread in the open areas downstream of the floodway and in the riverside areas of the Bone River.

(5) Other Matters to be Considered during Construction

Material: Natural sources should be exploited carefully considering the environmental impacts.

Location of disposed material should be confirmed and determined after consultation with landowner. Survey of land status, and socialization to community should be conducted by the Government agency in early stage.

Participation of Local Community: During construction stage, participation by local villagers or local contractor will be very important to build their sense of ownership. Cooperation and good relation should be keep to compensate their sacrifice due to land/plant acquisition and disturbing during construction.

Cofferdam / Dewatering: Due to proposed location of Diversion Weir is on the Tamalate River alignment, consideration should be taken when the construction stage on rainy season.

Preliminary Warning: Since the floodway alignment crosses paddy field, arrangement and warning should be made to so as not to disturb their farming.

C4.6 Sediment Trap Works in Lake Limboto

(1) Description of Works

Sediment Trap Works: A total length of 2,500 m of bamboo net are proposed to be installed with crest elevation +4.00 m,MSL to trap sediment.

Channel Excavation Work: Sand and clayey sand are the materials to be excavated. Lower end of the Alo-Pohu and Biyonga rivers are re-aligned for their lower portions for 1.6 km and 1.0 km in length, respectively. The excavation depth of these rivers ranges from 0.50 m to 1.20 m.

(2) Site Conditions

The work site distributes in Hunggalua Bawah village and Ilomangga village, Sub-District Limboto. For the execution of the sediment trap works and channel excavation of Alo-Pohu and Biyonga rivers, access road for the construction would be the main problem, because the work sites are located on the soft, swampy and submerged ground. All the excavated material should be hauled to the approved dispose area.

The bamboo nets are installed across a part of lake bottom with elevation ranging from +2.40 to +3.50 MSL. Reference benchmark is available as shown below.

No.	Bench mark	X	Y	Z	Location
1.	LBB-16	697,622.622	66,363.144	+9.195	End side of Hunggulua Bawah village

(3) Procurement of Construction Materials

The only material needed for this works is bamboo rod and bamboo net. Total estimated bamboo rod required is 290,000 nos with 4.0 m length and about 30,000 kg of string. All of these materials are available in local market in Gorontalo.

(4) Treatment of Construction Disposal

All the excavated material from both rivers should be hauled to approved disposed area outside of the lake.

(5) Other Matters to be Considered during Construction

No special matters need to be considered during construction as far as the works are implemented by local community/local contractor with simple equipment. Since the sediment trap works is implemented as a test work for sediment research and project development for sediment use, the work shall be carried out carefully in line with the research program to be prepared.

C5. ESTIMATION OF PROJECT COST

C5.1 Principles for Cost Estimation

(1) Sub-Projects and Works for Cost Estimation

The priority project subject to cost estimation includes following sub-projects:

1) Bone-Bolango-Tapodu River Improvement
   ① Lower Bone River
   ② Bolango Stretch-I
   ③ Tenda COC
   ④ Bolango Stretch-II_R
   ⑤ Bolango Stretch-II_L
   ⑥ Bolango Stretch-III
   ⑦ Tapodu River with Tapodu Gate
2) Tamalate Floodway
3) Sediment Trap Works in Lake Limboto

Major work items included in these sub-projects are listed below. The project and work costs will be estimated for these work items.

Earth works
1) Excavation
2) Embankment
3) Sediment trap

Stone works
1) Riprap
2) Gabion mattress

Structural work
1) Concrete
2) Pile
   - PC Concrete Pipe Pile
   - Steel sheet pile
3) Bridge
   - Br. type-1 (w = 4m)
   - Br. type-2 (w = 7m)

(2) Basis of Cost Estimate

Costs for the proposed priority projects were estimated on the basis of the following conditions.

1) **Price Level:** The project cost and other related unit costs are expressed under the economic conditions prevailing in November 2001.

2) **Exchange Rate of Currencies:** Exchange rate of currencies are assumed as follows:
   US$1.00 = Rp.9,600 = ¥124 (¥1 = Rp.77.4)

3) **Foreign Currency and Local Currency Portions:** Project cost is estimated dividing the cost into foreign currency (F.C.) and local currency (D.C.) portions. The F.C. portion is expressed in US dollar (US$) and the D.C. portion in Indonesian Rupiah (Rp.).

4) **Constitution of Project Cost:** Project cost is composed of direct cost, land acquisition and compensation cost, administration cost, engineering service cost, and physical contingency. The project cost is estimated based on the following procedures and assumptions:
   (1) Direct cost: Unit cost basis
   (2) Land acquisition and compensation cost: Unit cost basis
   (3) Administration cost: 5% of (1) + (2)
   (4) Engineering service cost: 10% of (1)
   (5) Sub-total = (1) + (2) + (3) + (4)
   (6) Physical contingency = 10% of (5)
   (7) Price contingency: Assumed at 0 % for F.C. and 10 % for D.C.

(3) Unit Work Costs

The work cost is estimated based on the quantity of works multiplied by standard unit work cost. The unit work costs were assumed based on the cost data of similar works executed in Sulawesi. The unit work costs were broken-down to F.C. and D.C. portions with composition rates assumed respectively for the works. The standard work costs applied are as listed below.

Work	Specifications	Unit	Cost (Rp.)	Composition of F.C. portion (%)
1) Excavation		m^3	20,000	55
2) Embankment		m^3	27,000	55
3) Sediment trap:	(h=1.0m)	m	170,000	0
	(h=2.0m)	m	290,000	0
4) Wet rubble masonry		m^2	300,000	8
5) Riprap		m^3	100,000	5
6) Gabion mattress		m^3	270,000	3
7) Concrete		m^3	480,000	35
8) Pile	PC concrete pipe pile (ϕ450)	m	440,000	50
	Steel sheet pile	m^2	1,300,000	50
9) Bridge work	Type-1 (w = 4m)	m	19,000,000	60
	Type-2 (w = 7m)	m	37,000,000	60

As to the land acquisition and compensation cost, following unit prices were assumed based on the information obtained in Gorontalo.

1) Compensation for houses in urban area : Rp. 18,000,000/nos (D.C: 100 %)
   Compensation for houses in rural area : Rp. 7,700,000/nos (D.C: 100 %)
2) Land acquisition for residential land : Rp. 2,000/m^2 (D.C: 100 %)
   Land acquisition for agriculture land : Rp. 3,000/m^2 (D.C: 100 %)

C5.2 Project Costs

Project cost required for implementation of the Priority Projects was estimated as shown in Table C5.2.1, and the costs by sub-projects were shown in Table C5.2.2. The project cost of Bone-Bolango-Tapodu River Improvement was further broken down as shown in Table C5.2.3. The results of the estimated project costs are summarized below.

(Sub-project)	F.C. (US$'000)	D.C. (Rp.mil.)	Total (Rp.mil)
1) Bone-Bolango-Tapodu R. Improvement	6,546.0	57,322	120,164
① Lower Bone River	38.0	2,138	2,503
② Bolango Stretch-I	55.7	595	1,130
③ Tenda COC	76.6	1,259	1,994
④ Bolango Stretch-II_R	480.1	11,424	16,033
⑤ Bolango Stretch-II_L	124.2	1,616	2,808
⑥ Bolango Stretch-III	84.1	728	1,535
⑦ Tapodu River with Topdu Gate	5,688.1	39,565	94,170
2) Tamalate Floodway	931.4	11,850	20,792
3) Sediment Trap Works in Lake Limboto	94.2	1,760	2,665
TOTAL	7,571.8	70,933	143,622

The total project cost for the Priority Project was estimated at Rp.143,622 million (US$ 14.96 million or ¥ 1,856 million equivalent) at Nov.-2001 fixed price, of which breakdown is as follows:

(Cost items)	F.C. (US$'000)	D.C. (Rp.mil.)	Total (Rp.mil)
1) Direct cost	5,7387.7	54,907	109,988
2) Land acquisition and compensation cost	0	3,884	3,884
3) Administration cost	0	5,694	5,694
4) Engineering service cost	1,145.7	0	10,999
5) Physical contingency	688.4	6,448	13,057
TOTAL	7,571.8	70,933	143,622

C5.3 Fund Required

For the implementation of the project, required fund should include price contingency for fluctuation of construction costs until and during the construction period inconsideration of the trend of price indices. The price contingency was assumed at the annual rate of 0% for foreign currency (F.C.) portion and 10% for local currency (D.C: Rupiah) portion.

In consideration of the annual disbursement schedule of the project costs for both the F.C. and D.C. portions, the fund required for the implementation of the Priority Project

was estimated in Table C5.3.1. The total fund required were estimated at Rp.179,424 million (US$ 18.69 million or ¥ 2,318 million equivalent), of which breakdown is as follows:

(Sub-project)	F.C. (US$'000)	D.C. (Rp.mil.)	Total (Rp.mil)
1) Bone-Bolango-Tapodu R. Improvement	6,546.0	83,491	146,333
2) Tamalate Floodway	931.4	20,840	29,780
3) Sediment Trap Works in Lake Limboto	94.3	2,408	3,313
TOTAL	7,571.7	106,739	179,428

C5.4 Operation, Maintenance and Running Cost

In order to maintain constructed facilities in functional conditions as planned and designed, incessant operation and maintenance activities are inevitable. For these activities, 0.5 % of the construction cost was assumed as annual cost required for operation and maintenance. In case of Tapodu Gate which has running device such as engines and/or motors, 1.0 % of the weir work cost was assumed as annual cost required for operation, maintenance and running. Since the sediment trap works are the test work for researches and project development, a assumed annual amount to be required for these activities were accounted.

According to the assumptions mentioned above, the annual operation, maintenance and running costs for respective sub-projects were estimated as follows:

(Sub-project)	Total (Rp.mil/yr)
1) Bone-Bolango-Tapodu R. Improvement	612.6
2) Tamalate Floodway	77.8
3) Sediment Trap Works in Lake Limboto	100.0
TOTAL	790.4

Table C5.2.1 TOTAL COST OF PRIORITY PROJECTS

						Priority Project			
No.	ITEM	UNIT	UNIT COST	RATE			AMOUNT		TOTAL
			D.C.(Rp.)	F.C.(%)	D.C.(%)	Q'TY	F.C.(Rp.)	D.C.(Rp.)	D.C.(Rp.)
(1)	DIRECT COST						55,081,445,000	54,906,555,000	109,988,000,000
1.1	PREPARATORY WORKS			58%	42%		5,007,495,000	4,991,505,000	9,999,000,000
1.2	CHANNEL WORKS						16,769,200,000	32,358,800,000	49,128,000,000
1.2.1	Earth Works						12,523,500,000	11,702,500,000	24,226,000,000
	Excavation	cu.m	20,000	55%	45%	882,000	9,702,000,000	7,938,000,000	17,640,000,000
	Embankment	cu.m	27,000	55%	45%	190,000	2,821,500,000	2,308,500,000	5,130,000,000
	Sodding	sq.m	14,000	0%	100%	104,000	0	1,456,000,000	1,456,000,000
1.2.2	Stone Works						855,660,000	11,874,340,000	12,730,000,000
	Bank Protection (Type-1)	m	2,770,000	3%	97%	1,900	157,890,000	5,105,110,000	5,263,000,000
	Wet Rubble Masonry	cu.m	300,000	8%	92%	21,600	518,400,000	5,961,600,000	6,480,000,000
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%	4,000	159,120,000	152,880,000	312,000,000
	Gabion Mattress	cu.m	270,000	3%	97%	2,500	20,250,000	654,750,000	675,000,000
1.2.3	Concrete Works						2,076,700,000	5,272,300,000	7,349,000,000
	Bank Protection (Type-2)	m	1,660,000	8%	92%	2,000	265,600,000	3,054,400,000	3,320,000,000
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%	1,800	308,700,000	573,300,000	882,000,000
	Concrete	cu.m	480,000	35%	65%	4,700	789,600,000	1,466,400,000	2,256,000,000
	Reinforcement Bar	ton	8,910,000	80%	20%	100	712,800,000	178,200,000	891,000,000
1.2.4	Sluice, Drainage Sluice Works						712,320,000	2,679,680,000	3,392,000,000
	U/s. Sluice.	L.S	320,000,000	21%	79%	2	134,400,000	505,600,000	640,000,000
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%	4	435,120,000	1,636,880,000	2,072,000,000
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%	1	16,800,000	63,200,000	80,000,000
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%	4	126,000,000	474,000,000	600,000,000
1.2.5	Miscellaneous			42%	58%		601,020,000	829,980,000	1,431,000,000
1.3	WEIR WORKS						21,760,590,000	9,086,410,000	30,847,000,000
1.3.1	Earth Works						753,500,000	616,500,000	1,370,000,000
	Excavation	cu.m	20,000	55%	45%	55,000	605,000,000	495,000,000	1,100,000,000
	Embankment	cu.m	27,000	55%	45%	10,000	148,500,000	121,500,000	270,000,000
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						64,210,000	924,790,000	989,000,000
	Wet Rubble Masonry	cu.m	300,000	8%	92%	1,700	40,800,000	469,200,000	510,000,000
	Riprap	cu.m	100,000	5%	95%	4,520	22,600,000	429,400,000	452,000,000
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%	100	810,000	26,190,000	27,000,000
1.3.3	Concrete Works						5,276,800,000	3,506,200,000	8,783,000,000
	Concrete	cu.m	480,000	35%	65%	8,100	1,360,800,000	2,527,200,000	3,888,000,000
	Reinforcement Bar	ton	8,900,000	80%	20%	550	3,916,000,000	979,000,000	4,895,000,000
1.3.4	Pile Works						2,255,000,000	2,255,000,000	4,510,000,000
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%	7,000	1,540,000,000	1,540,000,000	3,080,000,000
	Steel Sheet Pile	sq.m	1,300,000	50%	50%	1,100	715,000,000	715,000,000	1,430,000,000
1.3.5	Rubber Gate						12,353,400,000	1,372,600,000	13,726,000,000
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%	1	12,353,400,000	1,372,600,000	13,726,000,000
1.3.6	Miscellaneous			72%	28%		1,057,680,000	411,320,000	1,469,000,000
1.4	SEDIMENT TRAP WORKS						0	616,000,000	616,000,000
1.4.1	Sediment Trap Works						0	598,000,000	598,000,000
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%	1,300	0	221,000,000	221,000,000
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%	1,300	0	377,000,000	377,000,000
1.4.2	Miscellaneous			0%	100%		0	18,000,000	18,000,000
1.5	APPURTENANT WORKS						8,799,600,000	5,866,400,000	14,666,000,000
1.5.1	Bridge Works						8,356,200,000	5,570,800,000	13,927,000,000
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%	453	5,164,200,000	3,442,800,000	8,607,000,000
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%	130	2,886,000,000	1,924,000,000	4,810,000,000
	Heightening of Bridge	L.S	255,000,000	60%	40%	2	306,000,000	204,000,000	510,000,000
1.5.2	Waterway	L.S	850,000,000	20%	80%	1	170,000,000	680,000,000	850,000,000
1.5.3	Miscellaneous			60%	40%		443,400,000	295,600,000	739,000,000
1.6	MISCELLANEOUS WORKS			58%	42%		2,744,560,000	1,987,440,000	4,732,000,000
(2)	LAND ACQUISITION						0	3,884,000,000	3,884,000,000
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%	28	0	504,000,000	504,000,000
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%	100	0	770,000,000	770,000,000
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%	87,000	0	174,000,000	174,000,000
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%	812,000	0	2,436,000,000	2,436,000,000
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	5,694,000,000	5,694,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		10,999,000,000	0	10,999,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						66,080,445,000	64,484,555,000	130,565,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						6,608,544,500	6,448,455,500	13,057,000,000
	GRAND TOTAL						72,688,989,500 (Rp.mil. 72,689) (US$'000 7,571.8)	70,933,010,500 (Rp.mil. 70,933)	143,622,000,000 (Rp.mil. 143,622)

Note :

1 JPYen1=Rp. 77.4

2 US$1=Rp. 9600

3 1. PREPARATORY WORKS 10%
2. CHANNEL WORKS 3%
3. WEIR WORKS (Topadu River) 5%
5. APPURTENANT WORKS 5%
6. MISCELLANEOUS WORKS 5%

Table C5.2.2 COST OF COMPONENT PROJECT (1/3)

No.	ITEM	UNIT	UNIT COST D.C.(Rp.)	RATE F.C.(%)	RATE D.C.(%)	Bone-Bolango-Topadu R. Improvement QTY	AMOUNT F.C.(Rp.)	AMOUNT D.C.(Rp.)	TOTAL D.C.(Rp.)
(1)	DIRECT COST						47,870,798,000	44,708,202,000	92,579,000,000
1.1	PREPARATORY WORKS			58%	42%		4,351,618,000	4,064,382,000	8,416,000,000
1.2	CHANNEL WORKS						12,940,220,000	26,011,780,000	38,952,000,000
1.2.1	Earth Works						9,243,850,000	8,893,150,000	18,137,000,000
	Excavation	cu.m	20,000	55%	45%	623,000	6,853,000,000	5,607,000,000	12,460,000,000
	Embankment	cu.m	27,000	55%	45%	161,000	2,390,850,000	1,956,150,000	4,347,000,000
	Sodding	sq.m	14,000	0%	100%	95,000	0	1,330,000,000	1,330,000,000
1.2.2	Stone Works						573,450,000	9,045,550,000	9,619,000,000
	Bank Protection (Type-1)	m	2,770,000	3%	97%	1,900	157,890,000	5,105,110,000	5,263,000,000
	Wet Rubble Masonry	cu.m	300,000	8%	92%	14,000	336,000,000	3,864,000,000	4,200,000,000
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%	2,000	79,560,000	76,440,000	156,000,000
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.2.3	Concrete Works						2,076,700,000	5,272,300,000	7,349,000,000
	Bank Protection (Type-2)	m	1,660,000	8%	92%	2,000	265,600,000	3,054,400,000	3,320,000,000
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%	1,800	308,700,000	573,300,000	882,000,000
	Concrete	cu.m	480,000	35%	65%	4,700	789,600,000	1,466,400,000	2,256,000,000
	Reinforcement Bar	ton	8,910,000	80%	20%	100	712,800,000	178,200,000	891,000,000
1.2.4	Sluice, Drainage Sluice Works						569,520,000	2,142,480,000	2,712,000,000
	U/s. Sluice.	L.S	320,000,000	21%	79%	2	134,400,000	505,600,000	640,000,000
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%	4	435,120,000	1,636,880,000	2,072,000,000
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%		0	0	0
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%		0	0	0
1.2.5	Miscellaneous			42%	58%		476,700,000	658,300,000	1,135,000,000
1.3	WEIR WORKS						21,496,520,000	8,443,480,000	29,940,000,000
1.3.1	Earth Works						650,100,000	531,900,000	1,182,000,000
	Excavation	cu.m	20,000	55%	45%	51,000	561,000,000	459,000,000	1,020,000,000
	Embankment	cu.m	27,000	55%	45%	6,000	89,100,000	72,900,000	162,000,000
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						22,500,000	427,500,000	450,000,000
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%	4,500	22,500,000	427,500,000	450,000,000
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.3.3	Concrete Works						5,188,800,000	3,457,200,000	8,646,000,000
	Concrete	cu.m	480,000	35%	65%	8,000	1,344,000,000	2,496,000,000	3,840,000,000
	Reinforcement Bar	ton	8,900,000	80%	20%	540	3,844,800,000	961,200,000	4,806,000,000
1.3.4	Pile Works						2,255,000,000	2,255,000,000	4,510,000,000
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%	7,000	1,540,000,000	1,540,000,000	3,080,000,000
	Steel Sheet Pile	sq.m	1,300,000	50%	50%	1,100	715,000,000	715,000,000	1,430,000,000
1.3.5	Rubber Gate						12,353,400,000	1,372,600,000	13,726,000,000
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%	1	12,353,400,000	1,372,600,000	13,726,000,000
1.3.6	Miscellaneous			72%	28%		1,026,720,000	399,280,000	1,426,000,000
1.4	SEDIMENT TRAP WORKS						0	0	0
1.4.1	Sediment Trap Works						0	0	0
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%		0	0	0
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%		0	0	0
1.4.2	Miscellaneous			0%	100%		0	0	0
1.5	APPURTENANT WORKS						6,757,800,000	4,505,200,000	11,263,000,000
1.5.1	Bridge Works						6,436,200,000	4,290,800,000	10,727,000,000
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%	343	3,910,200,000	2,606,800,000	6,517,000,000
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%	100	2,220,000,000	1,480,000,000	3,700,000,000
	Heightening of Bridge	L.S	255,000,000	60%	40%	2	306,000,000	204,000,000	510,000,000
1.5.2	Waterway	L.S	850,000,000	20%	80%		0	0	0
1.5.3	Miscellaneous			60%	40%		321,600,000	214,400,000	536,000,000
1.6	MISCELLANEOUS WORKS			58%	42%		2,324,640,000	1,683,360,000	4,008,000,000
(2)	LAND ACQUISITION						0	2,642,000,000	2,642,000,000
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%	28	0	504,000,000	504,000,000
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%	50	0	385,000,000	385,000,000
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%	59,000	0	118,000,000	118,000,000
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%	545,000	0	1,635,000,000	1,635,000,000
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	4,761,000,000	4,761,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		9,258,000,000	0	9,258,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						57,128,798,000	52,111,202,000	109,240,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						5,712,879,800	5,211,120,200	10,924,000,000
	GRAND TOTAL						62,841,677,800 (Rp.mil. 62,842) (US$'000 6,546.0)	57,322,322,200 (Rp.mil. 57,322)	120,164,000,000 (Rp.mil. 120,164)

Note :

1 JPYen1=Rp. 77.4

2 US$1=Rp. 9600

3 1. PREPARATORY WORKS 10%
2. CHANNEL WORKS 3%
3. WEIR WORKS (Topadu River) 5%
5. APPURTENANT WORKS 5%
6. MISCELLANEOUS WORKS 5%

Table C5.2.2 COST OF COMPONENT PROJECT (2/3)

No.	ITEM	UNIT	UNIT COST	RATE		Tamalate Floodway			
							AMOUNT		TOTAL
			D.C.(Rp.)	F.C.(%)	D.C.(%)	Q'TY	F.C.(Rp.)	D.C.(Rp.)	D.C.(Rp.)
(1)	DIRECT COST						6,571,949,000	8,994,051,000	15,566,000,000
1.1	PREPARATORY WORKS			58%	42%		597,359,000	817,641,000	1,415,000,000
1.2	CHANNEL WORKS						3,277,800,000	5,889,200,000	9,167,000,000
1.2.1	Earth Works						2,740,650,000	2,368,350,000	5,109,000,000
	Excavation	cu.m	20,000	55%	45%	210,000	2,310,000,000	1,890,000,000	4,200,000,000
	Embankment	cu.m	27,000	55%	45%	29,000	430,650,000	352,350,000	783,000,000
	Sodding	sq.m	14,000	0%	100%	9,000	0	126,000,000	126,000,000
1.2.2	Stone Works						282,210,000	2,828,790,000	3,111,000,000
	Bank Protection (Type-1)	m	2,770,000	3%	97%		0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%	7,600	182,400,000	2,097,600,000	2,280,000,000
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%	2,000	79,560,000	76,440,000	156,000,000
	Gabion Mattress	cu.m	270,000	3%	97%	2,500	20,250,000	654,750,000	675,000,000
1.2.3	Concrete Works						0	0	0
	Bank Protection (Type-2)	m	1,660,000	8%	92%		0	0	0
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%		0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,910,000	80%	20%		0	0	0
1.2.4	Sluice, Drainage Sluice Works						142,800,000	537,200,000	680,000,000
	U/s. Sluice.	L.S	320,000,000	21%	79%		0	0	0
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%		0	0	0
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%	1	16,800,000	63,200,000	80,000,000
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%	4	126,000,000	474,000,000	600,000,000
1.2.5	Miscellaneous			42%	58%		112,140,000	154,860,000	267,000,000
1.3	WEIR WORKS						264,070,000	642,930,000	907,000,000
1.3.1	Earth Works						103,400,000	84,600,000	188,000,000
	Excavation	cu.m	20,000	55%	45%	4,000	44,000,000	36,000,000	80,000,000
	Embankment	cu.m	27,000	55%	45%	4,000	59,400,000	48,600,000	108,000,000
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						41,710,000	497,290,000	539,000,000
	Wet Rubble Masonry	cu.m	300,000	8%	92%	1,700	40,800,000	469,200,000	510,000,000
	Riprap	cu.m	100,000	5%	95%	20	100,000	1,900,000	2,000,000
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%	100	810,000	26,190,000	27,000,000
1.3.3	Concrete Works						88,000,000	49,000,000	137,000,000
	Concrete	cu.m	480,000	35%	65%	100	16,800,000	31,200,000	48,000,000
	Reinforcement Bar	ton	8,900,000	80%	20%	10	71,200,000	17,800,000	89,000,000
1.3.4	Pile Works						0	0	0
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%		0	0	0
	Steel Sheet Pile	sq.m	1,300,000	50%	50%		0	0	0
1.3.5	Rubber Gate						0	0	0
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%		0	0	0
1.3.6	Miscellaneous			72%	28%		30,960,000	12,040,000	43,000,000
1.4	SEDIMENT TRAP WORKS						0	0	0
1.4.1	Sediment Trap Works						0	0	0
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%		0	0	0
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%		0	0	0
1.4.2	Miscellaneous			0%	100%		0	0	0
1.5	APPURTENANT WORKS						2,041,800,000	1,361,200,000	3,403,000,000
1.5.1	Bridge Works						1,920,000,000	1,280,000,000	3,200,000,000
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%	110	1,254,000,000	836,000,000	2,090,000,000
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%	30	666,000,000	444,000,000	1,110,000,000
	Heightening of Bridge	L.S	255,000,000	60%	40%		0	0	0
1.5.2	Waterway	L.S	850,000,000	20%	80%	1	170,000,000	680,000,000	850,000,000
1.5.3	Miscellaneous			60%	40%		121,800,000	81,200,000	203,000,000
1.6	MISCELLANEOUS WORKS			58%	42%		390,920,000	283,080,000	674,000,000
(2)	LAND ACQUISITION						0	953,000,000	953,000,000
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%		0	0	0
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%	40	0	308,000,000	308,000,000
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%	27,000	0	54,000,000	54,000,000
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%	197,000	0	591,000,000	591,000,000
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	826,000,000	826,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		1,557,000,000	0	1,557,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						8,128,949,000	10,773,051,000	18,902,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						812,694,900	1,077,305,100	1,890,000,000
	GRAND TOTAL						8,941,643,900 (Rp.mil. 8,942) (US$'000 931.4)	11,850,356,100 (Rp.mil. 11,850)	20,792,000,000 (Rp.mil. 20,792)

Note :

1 JPYen1=Rp. 77.4

2 US$1=Rp. 9600

3 1. PREPARATORY WORKS 10%

2. CHANNEL WORKS 3%

3. WEIR WORKS (Topadu River) 5%

5. APPURTENANT WORKS 5%

6. MISCELLANEOUS WORKS 5%

Table C5.2.2 COST OF COMPONENT PROJECT (3/3)

No.	ITEM	UNIT	UNIT COST D.C.(Rp.)	RATE F.C.(%)	RATE D.C.(%)	Sediment Trap in Lake Limboto QTY	AMOUNT F.C.(Rp.)	AMOUNT D.C.(Rp.)	TOTAL D.C.(Rp.)
(1)	DIRECT COST						638,698,000	1,204,302,000	1,843,000,000
1.1	PREPARATORY WORKS			58%	42%		58,518,000	109,482,000	168,000,000
1.2	CHANNEL WORKS						551,180,000	457,820,000	1,009,000,000
1.2.1	Earth Works						539,000,000	441,000,000	980,000,000
	Excavation	cu.m	20,000	55%	45%	49,000	539,000,000	441,000,000	980,000,000
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.2.2	Stone Works						0	0	0
	Bank Protection (Type-1)	m	2,770,000	3%	97%		0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.2.3	Concrete Works						0	0	0
	Bank Protection (Type-2)	m	1,660,000	8%	92%		0	0	0
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%		0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,910,000	80%	20%		0	0	0
1.2.4	Sluice, Drainage Sluice Works						0	0	0
	U/s. Sluice.	L.S	320,000,000	21%	79%		0	0	0
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%		0	0	0
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%		0	0	0
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%		0	0	0
1.2.5	Miscellaneous			42%	58%		12,180,000	16,820,000	29,000,000
1.3	WEIR WORKS						0	0	0
1.3.1	Earth Works						0	0	0
	Excavation	cu.m	20,000	55%	45%		0	0	0
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.3.3	Concrete Works						0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,900,000	80%	20%		0	0	0
1.3.4	Pile Works						0	0	0
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%		0	0	0
	Steel Sheet Pile	sq.m	1,300,000	50%	50%		0	0	0
1.3.5	Rubber Gate						0	0	0
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%		0	0	0
1.3.6	Miscellaneous			72%	28%		0	0	0
1.4	SEDIMENT TRAP WORKS						0	616,000,000	616,000,000
1.4.1	Sediment Trap Works						0	598,000,000	598,000,000
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%	1,300	0	221,000,000	221,000,000
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%	1,300	0	377,000,000	377,000,000
1.4.2	Miscellaneous			0%	100%		0	18,000,000	18,000,000
1.5	APPURTENANT WORKS						0	0	0
1.5.1	Bridge Works						0	0	0
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%		0	0	0
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%		0	0	0
	Heightening of Bridge	L.S	255,000,000	60%	40%		0	0	0
1.5.2	Waterway	L.S	850,000,000	20%	80%		0	0	0
1.5.3	Miscellaneous			60%	40%		0	0	0
1.6	MISCELLANEOUS WORKS			58%	42%		29,000,000	21,000,000	50,000,000
(2)	LAND ACQUISITION						0	289,000,000	289,000,000
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%		0	0	0
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%	10	0	77,000,000	77,000,000
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%	1,000	0	2,000,000	2,000,000
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%	70,000	0	210,000,000	210,000,000
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	107,000,000	107,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		184,000,000	0	184,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						822,698,000	1,600,302,000	2,423,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						81,969,800	160,030,200	242,000,000
	GRAND TOTAL						904,667,800 (Rp.mil. 905) (US$'000 94.2)	1,760,332,200 (Rp.mil. 1,760)	2,665,000,000 (Rp.mil. 2,665)

Note :

1 JPYen1=Rp. 77.4
2 US$1=Rp. 9600
3 1. PREPARATORY WORKS 10%
2. CHANNEL WORKS 3%
3. WEIR WORKS (Topadu River) 5%
5. APPURTENANT WORKS 5%
6. MISCELLANEOUS WORKS 5%

Table C5.2.3 BROKEN-DOWN COST OF BBT RIVER IMPROVEMENT (1/7)

No.	ITEM	UNIT	UNIT COST D.C.(Rp.)	RATE F.C.(%)	RATE D.C.(%)	Lower Bone River QTY	Lower Bone River AMOUNT F.C.(Rp.)	Lower Bone River AMOUNT D.C.(Rp.)	Lower Bone River TOTAL D.C.(Rp.)
(1)	DIRECT COST						133,014,000	1,844,986,000	1,978,000,000
1.1	PREPARATORY WORKS			58%	42%		12,274,000	167,726,000	180,000,000
1.2	CHANNEL WORKS						70,860,000	1,641,140,000	1,712,000,000
1.2.1	Earth Works						0	0	0
	Excavation	cu.m	20,000	55%	45%		0	0	0
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.2.2	Stone Works						49,860,000	1,612,140,000	1,662,000,000
	Bank Protection (Type-1)	m	2,770,000	3%	97%	600	49,860,000	1,612,140,000	1,662,000,000
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.2.3	Concrete Works						0	0	0
	Bank Protection (Type-2)	m	1,660,000	8%	92%		0	0	0
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%		0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,910,000	80%	20%		0	0	0
1.2.4	Sluice, Drainage Sluice Works						0	0	0
	U/s. Sluice.	L.S	320,000,000	21%	79%		0	0	0
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%		0	0	0
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%		0	0	0
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%		0	0	0
1.2.5	Miscellaneous			42%	58%		21,000,000	29,000,000	50,000,000
1.3	WEIR WORKS						0	0	0
1.3.1	Earth Works						0	0	0
	Excavation	cu.m	20,000	55%	45%		0	0	0
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.3.3	Concrete Works						0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,900,000	80%	20%		0	0	0
1.3.4	Pile Works						0	0	0
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%		0	0	0
	Steel Sheet Pile	sq.m	1,300,000	50%	50%		0	0	0
1.3.5	Rubber Gate						0	0	0
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%		0	0	0
1.3.6	Miscellaneous			72%	28%		0	0	0
1.4	SEDIMENT TRAP WORKS						0	0	0
1.4.1	Sediment Trap Works						0	0	0
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%		0	0	0
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%		0	0	0
1.4.2	Miscellaneous			0%	100%		0	0	0
1.5	APPURTENANT WORKS						0	0	0
1.5.1	Bridge Works						0	0	0
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%		0	0	0
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%		0	0	0
	Heightening of Bridge	L.S	255,000,000	60%	40%		0	0	0
1.5.2	Waterway	L.S	850,000,000	20%	80%		0	0	0
1.5.3	Miscellaneous			60%	40%		0	0	0
1.6	MISCELLANEOUS WORKS			58%	42%		49,880,000	36,120,000	86,000,000
(2)	LAND ACQUISITION						0	0	0
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%		0	0	0
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%		0	0	0
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%		0	0	0
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%		0	0	0
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	99,000,000	99,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		198,000,000	0	198,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						331,014,000	1,943,986,000	2,275,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						33,601,400	194,398,600	228,000,000
	GRAND TOTAL						364,615,400 (Rp.mil. 365) (US$'000 38.0)	2,138,384,600 (Rp.mil. 2,138)	2,503,000,000 (Rp.mil. 2,503)

Note :

1 JPYen1=Rp. 77.4

2 US$1=Rp. 9600

3 1. PREPARATORY WORKS 10%
2. CHANNEL WORKS 3%
3. WEIR WORKS (Topadu River) 5%
5. APPURTENANT WORKS 5%
6. MISCELLANEOUS WORKS 5%

Table C5.2.3 BROKEN-DOWN COST OF BBT RIVER IMPROVEMENT (2/7)

No.	ITEM	UNIT	UNIT COST	RATE		Bolango Stretch-I			
							AMOUNT		TOTAL
			D.C.(Rp.)	F.C.(%)	D.C.(%)	Q'TY	F.C.(Rp.)	D.C.(Rp.)	D.C.(Rp.)
(1)	DIRECT COST						397,142,000	495,858,000	893,000,000
1.1	PREPARATORY WORKS			58%	42%		35,922,000	45,078,000	81,000,000
1.2	CHANNEL WORKS						177,800,000	327,200,000	505,000,000
1.2.1	Earth Works						0	0	0
	Excavation	cu.m	20,000	55%	45%		0	0	0
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.2.2	Stone Works						0	0	0
	Bank Protection (Type-1)	m	2,770,000	3%	97%		0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.2.3	Concrete Works						171,500,000	318,500,000	490,000,000
	Bank Protection (Type-2)	m	1,660,000	8%	92%		0	0	0
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%	1,000	171,500,000	318,500,000	490,000,000
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,910,000	80%	20%		0	0	0
1.2.4	Sluice, Drainage Sluice Works						0	0	0
	U/s. Sluice.	L.S	320,000,000	21%	79%		0	0	0
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%		0	0	0
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%		0	0	0
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%		0	0	0
1.2.5	Miscellaneous			42%	58%		6,300,000	8,700,000	15,000,000
1.3	WEIR WORKS						0	0	0
1.3.1	Earth Works						0	0	0
	Excavation	cu.m	20,000	55%	45%		0	0	0
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.3.3	Concrete Works						0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,900,000	80%	20%		0	0	0
1.3.4	Pile Works						0	0	0
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%		0	0	0
	Steel Sheet Pile	sq.m	1,300,000	50%	50%		0	0	0
1.3.5	Rubber Gate						0	0	0
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%		0	0	0
1.3.6	Miscellaneous			72%	28%		0	0	0
1.4	SEDIMENT TRAP WORKS						0	0	0
1.4.1	Sediment Trap Works						0	0	0
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%		0	0	0
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%		0	0	0
1.4.2	Miscellaneous			0%	100%		0	0	0
1.5	APPURTENANT WORKS						160,800,000	107,200,000	268,000,000
1.5.1	Bridge Works						153,000,000	102,000,000	255,000,000
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%		0	0	0
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%		0	0	0
	Heightening of Bridge	L.S	255,000,000	60%	40%	1	153,000,000	102,000,000	255,000,000
1.5.2	Waterway	L.S	850,000,000	20%	80%		0	0	0
1.5.3	Miscellaneous			60%	40%		7,800,000	5,200,000	13,000,000
1.6	MISCELLANEOUS WORKS			58%	42%		22,620,000	16,380,000	39,000,000
(2)	LAND ACQUISITION						0	0	0
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%		0	0	0
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%		0	0	0
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%		0	0	0
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%		0	0	0
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	45,000,000	45,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		89,000,000	0	89,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						486,142,000	540,858,000	1,027,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						48,914,200	54,085,800	103,000,000
	GRAND TOTAL						535,056,200 (Rp.mil. 535) (US$'000 55.7)	594,943,800 (Rp.mil. 595)	1,130,000,000 (Rp.mil. 1,130)

Note :

1 JPYen1=Rp. 77.4

2 US$1=Rp. 9600

3 1. PREPARATORY WORKS 10%

2. CHANNEL WORKS 3%

3. WEIR WORKS (Topadu River) 5%

5. APPURTENANT WORKS 5%

6. MISCELLANEOUS WORKS 5%

Table C5.2.3 BROKEN-DOWN COST OF BBT RIVER IMPROVEMENT (3/7)

No.	ITEM	UNIT	UNIT COST	RATE		Tenda COC			
							AMOUNT		TOTAL
			D.C.(Rp.)	F.C.(%)	D.C.(%)	Q'TY	F.C.(Rp.)	D.C.(Rp.)	D.C.(Rp.)
(1)	DIRECT COST						529,651,000	855,349,000	1,385,000,000
1.1	PREPARATORY WORKS			58%	42%		48,241,000	77,759,000	126,000,000
1.2	CHANNEL WORKS						159,210,000	560,790,000	720,000,000
1.2.1	Earth Works						110,550,000	90,450,000	201,000,000
	Excavation	cu.m	20,000	55%	45%	6,000	66,000,000	54,000,000	120,000,000
	Embankment	cu.m	27,000	55%	45%	3,000	44,550,000	36,450,000	81,000,000
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.2.2	Stone Works						0	0	0
	Bank Protection (Type-1)	m	2,770,000	3%	97%		0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.2.3	Concrete Works						39,840,000	458,160,000	498,000,000
	Bank Protection (Type-2)	m	1,660,000	8%	92%	300	39,840,000	458,160,000	498,000,000
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%		0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,910,000	80%	20%		0	0	0
1.2.4	Sluice, Drainage Sluice Works						0	0	0
	U/s. Sluice.	L.S	320,000,000	21%	79%		0	0	0
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%		0	0	0
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%		0	0	0
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%		0	0	0
1.2.5	Miscellaneous			42%	58%		8,820,000	12,180,000	21,000,000
1.3	WEIR WORKS						0	0	0
1.3.1	Earth Works						0	0	0
	Excavation	cu.m	20,000	55%	45%		0	0	0
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.3.3	Concrete Works						0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,900,000	80%	20%		0	0	0
1.3.4	Pile Works						0	0	0
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%		0	0	0
	Steel Sheet Pile	sq.m	1,300,000	50%	50%		0	0	0
1.3.5	Rubber Gate						0	0	0
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%		0	0	0
1.3.6	Miscellaneous			72%	28%		0	0	0
1.4	SEDIMENT TRAP WORKS						0	0	0
1.4.1	Sediment Trap Works						0	0	0
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%		0	0	0
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%		0	0	0
1.4.2	Miscellaneous			0%	100%		0	0	0
1.5	APPURTENANT WORKS						287,400,000	191,600,000	479,000,000
1.5.1	Bridge Works						273,600,000	182,400,000	456,000,000
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%	24	273,600,000	182,400,000	456,000,000
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%		0	0	0
	Heightening of Bridge	L.S	255,000,000	60%	40%		0	0	0
1.5.2	Waterway	L.S	850,000,000	20%	80%		0	0	0
1.5.3	Miscellaneous			60%	40%		13,800,000	9,200,000	23,000,000
1.6	MISCELLANEOUS WORKS			58%	42%		34,800,000	25,200,000	60,000,000
(2)	LAND ACQUISITION						0	209,000,000	209,000,000
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%	11	0	198,000,000	198,000,000
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%		0	0	0
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%	5,500	0	11,000,000	11,000,000
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%		0	0	0
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	80,000,000	80,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		139,000,000	0	139,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						668,651,000	1,144,349,000	1,813,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						66,565,100	114,434,900	181,000,000
	GRAND TOTAL						735,216,100 (Rp.mil. 735) (US$'000 76.6)	1,258,783,900 (Rp.mil. 1,259)	1,994,000,000 (Rp.mil. 1,994)

Note :

1 JPYen1=Rp. 77.4

2 US$1=Rp. 9600

3 1. PREPARATORY WORKS 10%

2. CHANNEL WORKS 3%

3. WEIR WORKS (Topadu River) 5%

5. APPURTENANT WORKS 5%

6. MISCELLANEOUS WORKS 5%

Table C5.2.3 BROKEN-DOWN COST OF BBT RIVER IMPROVEMENT (4/7)

						Bolango Stretch-II$_R$			
No.	ITEM	UNIT	UNIT COST	RATE			AMOUNT		TOTAL
			D.C.(Rp.)	F.C.(%)	D.C.(%)	Q'TY	F.C.(Rp.)	D.C.(Rp.)	D.C.(Rp.)
(1)	DIRECT COST						2,946,498,000	9,478,502,000	12,425,000,000
1.1	PREPARATORY WORKS			58%	42%		268,318,000	861,682,000	1,130,000,000
1.2	CHANNEL WORKS						1,599,940,000	7,880,060,000	9,480,000,000
1.2.1	Earth Works						685,850,000	561,150,000	1,247,000,000
	Excavation	cu.m	20,000	55%	45%	61,000	671,000,000	549,000,000	1,220,000,000
	Embankment	cu.m	27,000	55%	45%	1,000	14,850,000	12,150,000	27,000,000
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.2.2	Stone Works						108,030,000	3,492,970,000	3,601,000,000
	Bank Protection (Type-1)	m	2,770,000	3%	97%	1,300	108,030,000	3,492,970,000	3,601,000,000
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.2.3	Concrete Works						581,360,000	3,256,640,000	3,838,000,000
	Bank Protection (Type-2)	m	1,660,000	8%	92%	1,700	225,760,000	2,596,240,000	2,822,000,000
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%	800	137,200,000	254,800,000	392,000,000
	Concrete	cu.m	480,000	35%	65%	1,300	218,400,000	405,600,000	624,000,000
	Reinforcement Bar	ton	8,910,000	80%	20%		0	0	0
1.2.4	Sluice, Drainage Sluice Works						108,780,000	409,220,000	518,000,000
	U/s. Sluice.	L.S	320,000,000	21%	79%		0	0	0
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%	1	108,780,000	409,220,000	518,000,000
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%		0	0	0
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%		0	0	0
1.2.5	Miscellaneous			42%	58%		115,920,000	160,080,000	276,000,000
1.3	WEIR WORKS						0	0	0
1.3.1	Earth Works						0	0	0
	Excavation	cu.m	20,000	55%	45%		0	0	0
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.3.3	Concrete Works						0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,900,000	80%	20%		0	0	0
1.3.4	Pile Works						0	0	0
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%		0	0	0
	Steel Sheet Pile	sq.m	1,300,000	50%	50%		0	0	0
1.3.5	Rubber Gate						0	0	0
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%		0	0	0
1.3.6	Miscellaneous			72%	28%		0	0	0
1.4	SEDIMENT TRAP WORKS						0	0	0
1.4.1	Sediment Trap Works						0	0	0
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%		0	0	0
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%		0	0	0
1.4.2	Miscellaneous			0%	100%		0	0	0
1.5	APPURTENANT WORKS						766,200,000	510,800,000	1,277,000,000
1.5.1	Bridge Works						729,600,000	486,400,000	1,216,000,000
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%	64	729,600,000	486,400,000	1,216,000,000
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%		0	0	0
	Heightening of Bridge	L.S	255,000,000	60%	40%		0	0	0
1.5.2	Waterway	L.S	850,000,000	20%	80%		0	0	0
1.5.3	Miscellaneous			60%	40%		36,600,000	24,400,000	61,000,000
1.6	MISCELLANEOUS WORKS			58%	42%		312,040,000	225,960,000	538,000,000
(2)	LAND ACQUISITION						0	272,000,000	272,000,000
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%	12	0	216,000,000	216,000,000
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%		0	0	0
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%	13,000	0	26,000,000	26,000,000
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%	10,000	0	30,000,000	30,000,000
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	635,000,000	635,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		1,243,000,000	0	1,243,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						4,189,498,000	10,385,502,000	14,575,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						419,449,800	1,038,550,200	1,458,000,000
	GRAND TOTAL						4,608,947,800 (Rp.mil. 4,609) (US$'000 480.1)	11,424,052,200 (Rp.mil. 11,424)	16,033,000,000 (Rp.mil. 16,033)

Note :

1 JPYen1=Rp. 77.4

2 US$1=Rp. 9600

3 1. PREPARATORY WORKS 10%

2. CHANNEL WORKS 3%

3. WEIR WORKS (Topadu River) 5%

5. APPURTENANT WORKS 5%

6. MISCELLANEOUS WORKS 5%

Table C5.2.3 BROKEN-DOWN COST OF BBT RIVER IMPROVEMENT (5/7)

						Bolango Stretch-II$_L$			
No.	ITEM	UNIT	UNIT COST	RATE			AMOUNT		TOTAL
			D.C.(Rp.)	F.C.(%)	D.C.(%)	Q'TY	F.C.(Rp.)	D.C.(Rp.)	D.C.(Rp.)
(1)	DIRECT COST						862,028,000	1,357,972,000	2,220,000,000
1.1	PREPARATORY WORKS			58%	42%		78,548,000	123,452,000	202,000,000
1.2	CHANNEL WORKS						428,400,000	994,600,000	1,423,000,000
1.2.1	Earth Works						0	0	0
	Excavation	cu.m	20,000	55%	45%		0	0	0
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.2.2	Stone Works						0	0	0
	Bank Protection (Type-1)	m	2,770,000	3%	97%		0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.2.3	Concrete Works						302,400,000	561,600,000	864,000,000
	Bank Protection (Type-2)	m	1,660,000	8%	92%		0	0	0
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%		0	0	0
	Concrete	cu.m	480,000	35%	65%	1,800	302,400,000	561,600,000	864,000,000
	Reinforcement Bar	ton	8,910,000	80%	20%		0	0	0
1.2.4	Sluice, Drainage Sluice Works						108,780,000	409,220,000	518,000,000
	U/s. Sluice.	L.S	320,000,000	21%	79%		0	0	0
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%	1	108,780,000	409,220,000	518,000,000
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%		0	0	0
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%		0	0	0
1.2.5	Miscellaneous			42%	58%		17,220,000	23,780,000	41,000,000
1.3	WEIR WORKS						0	0	0
1.3.1	Earth Works						0	0	0
	Excavation	cu.m	20,000	55%	45%		0	0	0
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.3.3	Concrete Works						0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,900,000	80%	20%		0	0	0
1.3.4	Pile Works						0	0	0
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%		0	0	0
	Steel Sheet Pile	sq.m	1,300,000	50%	50%		0	0	0
1.3.5	Rubber Gate						0	0	0
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%		0	0	0
1.3.6	Miscellaneous			72%	28%		0	0	0
1.4	SEDIMENT TRAP WORKS						0	0	0
1.4.1	Sediment Trap Works						0	0	0
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%		0	0	0
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%		0	0	0
1.4.2	Miscellaneous			0%	100%		0	0	0
1.5	APPURTENANT WORKS						299,400,000	199,600,000	499,000,000
1.5.1	Bridge Works						285,000,000	190,000,000	475,000,000
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%	25	285,000,000	190,000,000	475,000,000
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%		0	0	0
	Heightening of Bridge	L.S	255,000,000	60%	40%		0	0	0
1.5.2	Waterway	L.S	850,000,000	20%	80%		0	0	0
1.5.3	Miscellaneous			60%	40%		14,400,000	9,600,000	24,000,000
1.6	MISCELLANEOUS WORKS			58%	42%		55,680,000	40,320,000	96,000,000
(2)	LAND ACQUISITION						0	0	0
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%		0	0	0
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%		0	0	0
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%		0	0	0
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%		0	0	0
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	111,000,000	111,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		222,000,000	0	222,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						1,084,028,000	1,468,972,000	2,553,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						108,102,800	146,897,200	255,000,000
	GRAND TOTAL						1,192,130,800 (Rp.mil. 1,192) (US$'000 124.2)	1,615,869,200 (Rp.mil. 1,616)	2,808,000,000 (Rp.mil. 2,808)

Note :

1 JPYen1=Rp. 77.4

2 US$1=Rp. 9600

3 1. PREPARATORY WORKS 10%

2. CHANNEL WORKS 3%

3. WEIR WORKS (Topadu River) 5%

5. APPURTENANT WORKS 5%

6. MISCELLANEOUS WORKS 5%

Table C5.2.3 BROKEN-DOWN COST OF BBT RIVER IMPROVEMENT (6/7)

No.	ITEM	UNIT	UNIT COST	RATE		Bolango Stretch-III			
							AMOUNT		TOTAL
			D.C.(Rp.)	F.C.(%)	D.C.(%)	Q'TY	F.C.(Rp.)	D.C.(Rp.)	D.C.(Rp.)
(1)	DIRECT COST						622,494,000	484,506,000	1,107,000,000
1.1	PREPARATORY WORKS			58%	42%		56,954,000	44,046,000	101,000,000
1.2	CHANNEL WORKS						376,900,000	313,100,000	690,000,000
1.2.1	Earth Works						368,500,000	301,500,000	670,000,000
	Excavation	cu.m	20,000	55%	45%	20,000	220,000,000	180,000,000	400,000,000
	Embankment	cu.m	27,000	55%	45%	10,000	148,500,000	121,500,000	270,000,000
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.2.2	Stone Works						0	0	0
	Bank Protection (Type-1)	m	2,770,000	3%	97%		0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.2.3	Concrete Works						0	0	0
	Bank Protection (Type-2)	m	1,660,000	8%	92%		0	0	0
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%		0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,910,000	80%	20%		0	0	0
1.2.4	Sluice, Drainage Sluice Works						0	0	0
	U/s. Sluice.	L.S	320,000,000	21%	79%		0	0	0
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%		0	0	0
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%		0	0	0
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%		0	0	0
1.2.5	Miscellaneous			42%	58%		8,400,000	11,600,000	20,000,000
1.3	WEIR WORKS						0	0	0
1.3.1	Earth Works						0	0	0
	Excavation	cu.m	20,000	55%	45%		0	0	0
	Embankment	cu.m	27,000	55%	45%		0	0	0
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.3.3	Concrete Works						0	0	0
	Concrete	cu.m	480,000	35%	65%		0	0	0
	Reinforcement Bar	ton	8,900,000	80%	20%		0	0	0
1.3.4	Pile Works						0	0	0
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%		0	0	0
	Steel Sheet Pile	sq.m	1,300,000	50%	50%		0	0	0
1.3.5	Rubber Gate						0	0	0
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%		0	0	0
1.3.6	Miscellaneous			72%	28%		0	0	0
1.4	SEDIMENT TRAP WORKS						0	0	0
1.4.1	Sediment Trap Works						0	0	0
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%		0	0	0
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%		0	0	0
1.4.2	Miscellaneous			0%	100%		0	0	0
1.5	APPURTENANT WORKS						160,800,000	107,200,000	268,000,000
1.5.1	Bridge Works						153,000,000	102,000,000	255,000,000
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%		0	0	0
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%		0	0	0
	Heightening of Bridge	L.S	255,000,000	60%	40%	1	153,000,000	102,000,000	255,000,000
1.5.2	Waterway	L.S	850,000,000	20%	80%		0	0	0
1.5.3	Miscellaneous			60%	40%		7,800,000	5,200,000	13,000,000
1.6	MISCELLANEOUS WORKS			58%	42%		27,840,000	20,160,000	48,000,000
(2)	LAND ACQUISITION						0	116,000,000	116,000,000
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%	5	0	90,000,000	90,000,000
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%		0	0	0
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%	5,500	0	11,000,000	11,000,000
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%	5,000	0	15,000,000	15,000,000
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	61,000,000	61,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		111,000,000	0	111,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						733,494,000	661,506,000	1,395,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						73,849,400	66,150,600	140,000,000
	GRAND TOTAL						807,343,400 (Rp.mil. 807) (US$'000 84.1)	727,656,600 (Rp.mil. 728)	1,535,000,000 (Rp.mil. 1,535)

Note :

1 JPYen1=Rp. 77.4

2 US$1=Rp. 9600

3 1. PREPARATORY WORKS 10%

2. CHANNEL WORKS 3%

3. WEIR WORKS (Topadu River) 5%

5. APPURTENANT WORKS 5%

6. MISCELLANEOUS WORKS 5%

Table C5.2.3 BROKEN-DOWN COST OF BBT RIVER IMPROVEMENT (7/7)

						Tapodu River with Tapodu Gate			
No.	ITEM	UNIT	UNIT COST	RATE			AMOUNT		TOTAL
			D.C.(Rp.)	F.C.(%)	D.C.(%)	Q'TY	F.C.(Rp.)	D.C.(Rp.)	D.C.(Rp.)
(1)	DIRECT COST						42,383,267,000	30,191,733,000	72,575,000,000
1.1	PREPARATORY WORKS			58%	42%		3,853,297,000	2,744,703,000	6,598,000,000
1.2	CHANNEL WORKS						10,126,690,000	14,294,310,000	24,421,000,000
1.2.1	Earth Works						8,078,950,000	7,940,050,000	16,019,000,000
	Excavation	cu.m	20,000	55%	45%	536,000	5,896,000,000	4,824,000,000	10,720,000,000
	Embankment	cu.m	27,000	55%	45%	147,000	2,182,950,000	1,786,050,000	3,969,000,000
	Sodding	sq.m	14,000	0%	100%	95,000	0	1,330,000,000	1,330,000,000
1.2.2	Stone Works						415,560,000	3,940,440,000	4,356,000,000
	Bank Protection (Type-1)	m	2,770,000	3%	97%		0	0	0
	Wet Rubble Masonry	cu.m	300,000	8%	92%	14,000	336,000,000	3,864,000,000	4,200,000,000
	Riprap	cu.m	100,000	5%	95%		0	0	0
	Gravel Bedding	cu.m	78,000	51%	49%	2,000	79,560,000	76,440,000	156,000,000
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.2.3	Concrete Works						981,600,000	677,400,000	1,659,000,000
	Bank Protection (Type-2)	m	1,660,000	8%	92%		0	0	0
	Concrete Dike (Type-3)	sq.m	490,000	35%	65%		0	0	0
	Concrete	cu.m	480,000	35%	65%	1,600	268,800,000	499,200,000	768,000,000
	Reinforcement Bar	ton	8,910,000	80%	20%	100	712,800,000	178,200,000	891,000,000
1.2.4	Sluice, Drainage Sluice Works						351,960,000	1,324,040,000	1,676,000,000
	U/s. Sluice.	L.S	320,000,000	21%	79%	2	134,400,000	505,600,000	640,000,000
	Drainage sluice str. (2gates x 2m x 1.5m)	L.S	518,000,000	21%	79%	2	217,560,000	818,440,000	1,036,000,000
	Sluice Gate (2m x 1m)	Pc.	80,000,000	21%	79%		0	0	0
	Drainage sluice str. (1m x 1m)	L.S	150,000,000	21%	79%		0	0	0
1.2.5	Miscellaneous			42%	58%		298,620,000	412,380,000	711,000,000
1.3	WEIR WORKS						21,496,520,000	8,443,480,000	29,940,000,000
1.3.1	Earth Works						650,100,000	531,900,000	1,182,000,000
	Excavation	cu.m	20,000	55%	45%	51,000	561,000,000	459,000,000	1,020,000,000
	Embankment	cu.m	27,000	55%	45%	6,000	89,100,000	72,900,000	162,000,000
	Sodding	sq.m	14,000	0%	100%		0	0	0
1.3.2	Stone Works						22,500,000	427,500,000	450,000,000
	Wet Rubble Masonry	cu.m	300,000	8%	92%		0	0	0
	Riprap	cu.m	100,000	5%	95%	4,500	22,500,000	427,500,000	450,000,000
	Gravel Bedding	cu.m	78,000	51%	49%		0	0	0
	Gabion Mattress	cu.m	270,000	3%	97%		0	0	0
1.3.3	Concrete Works						5,188,800,000	3,457,200,000	8,646,000,000
	Concrete	cu.m	480,000	35%	65%	8,000	1,344,000,000	2,496,000,000	3,840,000,000
	Reinforcement Bar	ton	8,900,000	80%	20%	540	3,844,800,000	961,200,000	4,806,000,000
1.3.4	Pile Works						2,255,000,000	2,255,000,000	4,510,000,000
	PC Concrete Pipe Pile (ϕ =450)	m	440,000	50%	50%	7,000	1,540,000,000	1,540,000,000	3,080,000,000
	Steel Sheet Pile	sq.m	1,300,000	50%	50%	1,100	715,000,000	715,000,000	1,430,000,000
1.3.5	Rubber Gate						12,353,400,000	1,372,600,000	13,726,000,000
	Rubber Gate Sets	L.S	13,726,000,000	90%	10%	1	12,353,400,000	1,372,600,000	13,726,000,000
1.3.6	Miscellaneous			72%	28%		1,026,720,000	399,280,000	1,426,000,000
1.4	SEDIMENT TRAP WORKS						0	0	0
1.4.1	Sediment Trap Works						0	0	0
	Bamboo mess Type 1 (h=1.0 m)	m	170,000	0%	100%		0	0	0
	Bamboo mess Type 2 (h=2.0 m)	m	290,000	0%	100%		0	0	0
1.4.2	Miscellaneous			0%	100%		0	0	0
1.5	APPURTENANT WORKS						5,084,400,000	3,389,600,000	8,474,000,000
1.5.1	Bridge Works						4,842,000,000	3,228,000,000	8,070,000,000
	Br. Type-1(W=4.00m)	m	19,000,000	60%	40%	230	2,622,000,000	1,748,000,000	4,370,000,000
	Br. Type-1(W=7.00m)	m	37,000,000	60%	40%	100	2,220,000,000	1,480,000,000	3,700,000,000
	Heightening of Bridge	L.S	255,000,000	60%	40%		0	0	0
1.5.2	Waterway	L.S	850,000,000	20%	80%		0	0	0
1.5.3	Miscellaneous			60%	40%		242,400,000	161,600,000	404,000,000
1.6	MISCELLANEOUS WORKS			58%	42%		1,822,360,000	1,319,640,000	3,142,000,000
(2)	LAND ACQUISITION						0	2,045,000,000	2,045,000,000
2.1	Compensation for Houses(urban)	nos	18,000,000	0%	100%		0	0	0
2.2	Compensation for Houses(rural)	nos	7,700,000	0%	100%	50	0	385,000,000	385,000,000
2.3	Land Acquisition for Residential Land	sq.m	2,000	0%	100%	35,000	0	70,000,000	70,000,000
2.4	Land Acquisition for Agriculture Land	sq.m	3,000	0%	100%	530,000	0	1,590,000,000	1,590,000,000
(3)	ADMINISTRATION COST 5% of (1)+(2)			0%	100%		0	3,731,000,000	3,731,000,000
(4)	ENGINEERING SERVICE COST 10% of (1)			100%	0%		7,258,000,000	0	7,258,000,000
(5)	SUB TOTAL = (1)+(2)+(3)+(4)						49,641,267,000	35,967,733,000	85,609,000,000
(6)	PHYSICAL CONTINGENCY 10% of (5)						4,964,226,700	3,596,773,300	8,561,000,000
	GRAND TOTAL						54,605,493,700 (Rp.mil. 54,605) (US$'000 5,688.1)	39,564,506,300 (Rp.mil. 39,565)	94,170,000,000 (Rp.mil. 94,170)

Note :

1 JPYen1=Rp. 77.4

2 US$1=Rp. 9600

3 1. PREPARATORY WORKS 10%

2. CHANNEL WORKS 3%

3. WEIR WORKS (Topadu River) 5%

5. APPURTENANT WORKS 5%

6. MISCELLANEOUS WORKS 5%

Table C5.3.1 DISBURSEMENT SCHEDULE

1) Bone-Bolango-Tapodu River Improvement (Unit Rp.million)

Work items	Cost		2003	2004	2005	2006	2007	2008	2009
1 Direct cost	F.C.	47,871	0	0	14,361	16,755	16,755	0	0
	D.C.	44,708	0	0	13,412	15,648	15,648	0	0
2 Land acquisition	F.C.	0	0	0	0	0	0	0	0
	D.C.	2,642	0	793	925	925	0	0	0
3 Administration	F.C.	0	0	0	0	0	0	0	0
	D.C.	4,761	952	952	952	952	952	0	0
4 Engineering	F.C.	9,258	1,852	1,852	1,852	1,852	1,852	0	0
	D.C.	0	0	0	0	0	0	0	0
(Sub-total: 1thru 4)	F.C.	57,129	1,852	1,852	16,213	18,606	18,606	0	0
	D.C.	52,111	952	1,745	15,289	17,525	16,600	0	0
5 Phisical contingency	F.C.	5,713	185	185	1,621	1,861	1,861	0	0
	D.C.	5,211	95	174	1,529	1,752	1,660	0	0
(Sub-total: 1thru 5)	F.C.	62,842	2,037	2,037	17,834	20,467	20,467	0	0
	D.C.	57,322	1,047	1,919	16,818	19,277	18,260	0	0
6 Price contingency	F.C.	0	0	0	0	0	0	0	0
	D.C.	26,169	105	403	5,567	8,947	11,148	0	0
TOTAL	**F.C.**	**62,842**	**2,037**	**2,037**	**17,834**	**20,467**	**20,467**	**0**	**0**
	(US$'000 eq)	**6,546.0**	**212.2**	**212.2**	**1,857.7**	**2,132.0**	**2,132.0**	**0.0**	**0.0**
	D.C.	**83,491**	**1,152**	**2,322**	**22,385**	**28,224**	**29,408**	**0**	**0**
	Total	**146,333**	**3,189**	**4,359**	**40,219**	**48,691**	**49,875**	**0**	**0**

2) Tamalate Floodway

Work items	Cost		2003	2004	2005	2006	2007	2008	2009
1 Direct cost	F.C.	6,572	0	0	0	0	1,972	2,300	2,300
	D.C.	8,994	0	0	0	0	2,698	3,148	3,148
2 Land acquisition	F.C.	0	0	0	0	0	0	0	0
	D.C.	953	0	0	0	286	334	334	0
3 Administration	F.C.	0	0	0	0	0	0	0	0
	D.C.	826	0	0	165	165	165	165	165
4 Engineering	F.C.	1,557	0	0	311	311	311	311	311
	D.C.	0	0	0	0	0	0	0	0
(Sub-total: 1thru 4)	F.C.	8,129	0	0	311	311	2,283	2,612	2,612
	D.C.	10,773	0	0	165	451	3,197	3,647	3,313
5 Phisical contingency	F.C.	813	0	0	31	31	228	261	261
	D.C.	1,077	0	0	17	45	320	365	331
(Sub-total: 1thru 5)	F.C.	8,942	0	0	343	343	2,511	2,873	2,873
	D.C.	11,850	0	0	182	496	3,517	4,011	3,644
6 Price contingency	F.C.	0	0	0	0	0	0	0	0
	D.C.	8,990	0	0	60	230	2,147	3,095	3,458
TOTAL	**F.C.**	**8,942**	**0**	**0**	**343**	**343**	**2,511**	**2,873**	**2,873**
	(US$'000 eq)	**931.4**	**0.0**	**0.0**	**35.7**	**35.7**	**261.6**	**299.2**	**299.2**
	D.C.	**20,840**	**0**	**0**	**242**	**727**	**5,664**	**7,106**	**7,102**
	Total	**29,782**	**0**	**0**	**584**	**1,069**	**8,175**	**9,979**	**9,975**

3) Sediment Trap Works in Lake Limboto

Work items	Cost		2003	2004	2005	2006	2007	2008	2009
1 Direct cost	F.C.	639	0	0	320	320	0	0	0
	D.C.	1,204	0	0	602	602	0	0	0
2 Land acquisition	F.C.	0	0	0	0	0	0	0	0
	D.C.	289	0	145	145	0	0	0	0
3 Administration	F.C.	0	0	0	0	0	0	0	0
	D.C.	107	21	21	32	32	0	0	0
4 Engineering	F.C.	184	46	46	46	46	0	0	0
	D.C.	0	0	0	0	0	0	0	0
(Sub-total: 1thru 4)	F.C.	823	46	46	366	366	0	0	0
	D.C.	1,600	21	166	779	634	0	0	0
5 Phisical contingency	F.C.	82	5	5	37	37	0	0	0
	D.C.	160	2	17	78	63	0	0	0
(Sub-total: 1thru 5)	F.C.	905	51	51	402	402	0	0	0
	D.C.	1,760	24	182	856	698	0	0	0
6 Price contingency	F.C.	0	0	0	0	0	0	0	0
	D.C.	648	2	38	283	324	0	0	0
TOTAL	**F.C.**	**905**	**51**	**51**	**402**	**402**	**0**	**0**	**0**
	(US$'000 eq)	**94.3**	**5.3**	**5.3**	**41.9**	**41.9**	**0.0**	**0.0**	**0.0**
	D.C.	**2,408**	**26**	**221**	**1,140**	**1,021**	**0**	**0**	**0**
	Total	**3,313**	**76**	**271**	**1,542**	**1,423**	**0**	**0**	**0**

GRAND TOTAL 1)+2)+3)	**F.C.**	**72,689**	**2,087**	**2,087**	**18,579**	**21,212**	**22,978**	**2,873**	**2,873**
	(US$'000 eq)	**7,571.7**	**217.5**	**217.5**	**1,935.3**	**2,209.6**	**2,393.6**	**299.2**	**299.2**
	D.C.	**106,739**	**1,178**	**2,543**	**23,767**	**29,971**	**35,072**	**7,106**	**7,102**
	Total	**179,428**	**3,265**	**4,631**	**42,346**	**51,183**	**58,050**	**9,979**	**9,975**

C6. OPERATION AND MAINTENANCE

C6.1 Operation and Maintenance Plan

(1) General

Public works development policy of the central government is addressed to following three (3) purposes:

1) To create infrastructure development which supports the national sectorial development.
2) To utilize the whole functions of infrastructure development product in optimum level, through activities of operation and maintenance and rehabilitation done by the central and regional governments or private corporations and direct beneficiaries.
3) To execute guidance and arrangement to the orderly development and the correct utilization of the development product.

Regarding the item-2), it is intended that the existing water resources infrastructure should function during the planned lifetime more efficiently by the operation and maintenance activity, so that:

- Safety against flood should be kept,
- Conditions of living environment should be better, and
- Functions of water and water resources could be conserved.

(2) Meaning of Operation and Maintenance

According to the Government Regulation No. 22/ 1982 concerning Water Resources Management and Government Regulation No. 35/ 1991, the scope of river guidance management covers:

1) **Protection** means an effort to mitigate river damage caused by human action and natural changes.
2) **Development** means an effort to increase the river function without any damage to the stability of river and the environment.
3) **Utilization** means any effort to use river for increasing the public prosperity.

4) **Control** means an effort to stabilize river stream throughout the year in order to extract the maximum utilization and to control the damage potential of the river and it's environment.

Operation and maintenance (O&M) of river constitute the activities for "protection, utilization and control" and are stated as follows:

Operation of river is an effort to regulate water resources and other natural resources therein for optimal utilization.

Maintenance is an effort to secure the functions of river and related structures including rehabilitation works which recover river/channel condition to the required condition.

(3) Operation Activity

Implementation of the river operation covers following tasks:

1) Water utilization including water allotment, water quality control, monitoring and supervising.
2) River channel utilization and safe guard regulation including:
   - Regulation of river channel, flood plain and flood retention for various necessities.
   - Construction of facilities such as dam, barrage, flood diversion, weir and other regulating gates which aim to mitigate water flow energy, damage during flood, and water allocation.
3) Sediment management in rivers: Mining activities have big impact to the river system, river structures and surroundings environment. The following efforts are very significant:
   - Identification of extra-active mining product
   - River geometric monitoring, supervision and control.
4) Management and safety guard of lake and reservoir: Reservoir and lake could have several functions as flood control, water supply and recreation. They should be managed by the following activities:
   - Planning of reservoir operation.
   - Monitoring of water level and sedimentation
   - Regulating the area around the lake as green belt.

(4) Maintenance Activity.

River maintenance covers following three (3) objects:

1) Maintenance of River Channel: River channel may change by the natural forces, human acts and animal influences. The changes of river channel may reduce the structural stability, functions and quality of surroundings environment. The maintenance of river channel aims to keep functions of the river channel without damaging the surrounding environment.

2) Maintenance of River Structures: Maintenance of river structure aims to keep the related structures in functional and appropriate conditions to the purpose and service standard or planned performance. The river structures to be maintained are:
   - River bank protection (revetment, retaining wall)
   - River training structure (groin, spur dike)
   - Riverbed protection (ground sill)
   - Flood regulation structure (flood diversion, overflow dike)
   - Flood channel (flood way, widening, deepening channel)
   - Flood reservoir
   - High-water channel
   - Barrage including the regulation gates
   - Dam and multi-purpose reservoir with regulation equipment.
   - Access road to the river

3) Supporting Facilities / Equipment: Implementation of river operation and maintenance needs various supporting facilities and equipment. Supporting facilities can be grouped into four (4) types as follows:
   (1) Civil structures: Office building, storehouse, workshop, guardhouse, communication station building, inspection road, etc.
   (2) Operational equipment: generator, vehicle, dump truck, shovel, backhoe, grass cutter, earth compactor, etc.
   (3) Data Monitoring and processing: survey instrument, water level recorder, rainfall recorder, computer, etc.
   (4) Communication instrument: transmitter and receiver, radio, telephone, handy talky, etc.

(5) Phasing of River Maintenance

Activities of river maintenance can be grouped technically into three phases as follows:

1) **Preventive Maintenance:** Preventive maintenance aims to keep river channel and the structures therein in optimal function way in accordance with the planned performance and lifetime. The preventive maintenance can be performed through routine, periodical and light reparation.
2) **Corrective Maintenance:** Corrective maintenance aims to repair the damage of river and the structures therein or correct the lack of structure without change their function. The activity of corrective maintenance can be performed through special maintenance and rehabilitation rectification.
3) **Emergency Maintenance:** Emergency maintenance need to be carried out in urgent situation, for instance flood fighting activities to stop the dike breach

Standard activities to be considered for the maintenance of the river and river structure are shown in table C6.1.1.

C6.2 Capacity Building

(1) Background

Gorontalo province and Kabupaten and Kota Gorontalo have just established new Public Works Office. In order to ensure that the flood mitigation works in LBB Basin are executed, operated and maintained by competent, qualified personnel, the regional Dinas for public works should establish a satisfactory organization for it as soon as possible. For this purpose strengthening of the existing institution is needed for Sub-Dinas water resources management at province level, Kabupaten as well as Kota Gorontalo. On the other hand, to fulfill the staff in number and capability, training should be conducted.

(2) Strengthening Sub-Dinas of Province

In the year of 2001 Sub-Dinas Water Resources Development of Gorontalo Province has two sections that are section of Technical Design and Irrigation and Section of River, Swamp and Coast and O&M.

To conduct the decentralization job (Government Regulation No. 25/2000) and deconcentration job (Gov. Regulation No. 39/2001 article 3) of the provincial Dinas in the year 2002, the Sub-Dinas of Water Resources has been expanded (1) Section of Planning, (2) Section of Irrigation and O&M, (3) Section of River, Swamp, Coast and Lake.

For more perfection in implementation, Technical Implementation Unit (TIU) need to be established. The TIU is needed for implementation of water resources management in the river basin covering more than one Kabupaten/Kota like the LBB River Basin. By the Minister of Home Affair Decree No. 179 / 1996, TIU has been established in several provinces under the name Balai Pengelolaan Sumber Daya Air (Balai PSDA). There are 4 in West Java, 1 in Banten, 9 in Central Java, 2 in Lampung, 2 in South Sumatra, 6 in North Sumatra, 2 in NTT and 5 in North Sulawesi respectively.

The obligation of TIU includes:

1) Main Job: Management of water resources by activities of water allocation, water quality control, flood management, maintenance of river course and the facilities therein and operation and maintenance of irrigation network inter Kabupaten/Kota.
2) Supporting job: Management data of hydrology, hydrometeorology, and database and supporting coordination inter institutions.

For the implementation of the above job, the TIU has following functions:

1) Operational services for communities in water resources sector
2) Operational services in conservation of water and water resources
3) Technical and administrative services covering finance, personnel and equipment.

The organization of TIU is shown in Figure C6.2.1. For the long-term program, the Sub-Dinas Water Resources Management need to be expanded as “Dinas Water Resources Management”.

(3) Strengthening Sub-Dinas of Kabupaten/Kota Gorontalo

Sub-Dinas related to water resources of Kabupaten/Kota Gorontalo is still in transition condition, and the operation and maintenance for the irrigation network located in Kabupaten/Kota Gorontalo and inter-kabupaten/kota are still implemented by the provincial level. In future when the job is transferred to Kabupaten from Province, the functions of Sub-Dinas Kabupaten Gorontalo must be enhanced more in human power, budget and equipment. In implementing the FM-MP, Sub-Dinas will share a part of the flood mitigation facilities. To conduct the job of Sub-Dinas in Water Resources Management, it should be strengthened in two ways in short term and long term measures. Sub-Dinas is needed to be expanded as Dinas of Water Resources.

(4) Training for Water Resources Development

Training activities should be emphasized on organization, planning, implementation, and management functions. It should cover the technical and management staff, operating personnel and unskilled workers as well. The staff profiles Dinas PU in Gorontalo are summarized below.

	PU Province		PU Kabupaten		PU City	
	Organic	**Non Org.**	**Organic**	**Non Org.**	**Organic**	**Non Org.**
Total Staff	99	237	73	29	53	3
Technical Professional	18%	2%	12.3%	-	22.7%	-
Non-Tech..Professional	6%	2%	-	-	3.8%	-
High School	76%	96%	87.7%	100%	75.5%	100%

The training should also give special attention to recent administrative changes in the direction and responsibility between the central and regional offices. The development and implementation of training program should be recognized as particular needs in developing human resources for operation and maintenance (O&M).

One of the important public works policy is to utilize the existing functions of infrastructure at optimum level. For this operation, maintenance and rehabilitation activities should be done appropriately by all relevant agencies such as central and regional governments public and private organizations, and the other direct beneficiaries. The policy intends to enable that the existing flood mitigation facilities function well during the planed lifetime, and the safety against the flood should be kept.

The scope of training in the field of O&M should cover operation of water use facilities, use and protection of river, and management of sediment. The maintenance activities of river should include river channel, flood plain, river structure and other river related facilities. Monitoring and observation also should be covered by the training. The activity of monitoring includes observation of water level, discharge measurement, and monitoring river conditions with periodical surveys of river channel and lake.

The practical knowledge and know how for patrol and inspection also should be given, since the maintenance activity start from the patrol and inspection of river facilities. These activities clarify the weak point of facilities. The proper repair works in time can elongate the durability of the facilities with lower costs and avoid damages to people's live and properties.

(5) Information and Dissemination to Community

Information and dissemination is needed for community, because the community have an important role in water resources sector as shown in Figure C6.2.2. Training activities should be emphasized on the practical activities for flood disaster prevention. The activities consist of three phases: before, during and after disaster, which would cover the activities for prevention, rescuing, rehabilitation and reconstruction. Campaign and training would be effective to build the readiness in community for disaster mitigation, evacuation and to utilize the community's potential and infrastructure which exist at the location.

Coming of flood should be informed to the people, commonly in several warning levels of emergency. In the case of such emergency, people should take proper actions to alleviate flood damages based on the information given within the limited time and manpower, together with the local authority.

The national and regional regulations concerning flood mitigation and river utilization also should informed to the community by any possible measures and occasions. Government Regulation No. 35/1991 states that any acts obstructing the normal function of river shall be restricted, any person either cooperation or individual who intends to perform any acts in the river area shall obtain the permission of river administrator. The following activities in the river area are in principle regarded as harmful from the view of maintaining river functions.

- Throwing solid waste into the river
- Building houses and other structures within river area
- Damaging river facilities such as dike, revetment, gates, etc.
- Placing or constructing river closing structures below design high water level (DHWL)
- Excavation of riverbank and riverbed without permission.

These information and guidance should be given to community continuously repeatedly by SATLAK through the related agencies by using various methods as follows:

- By oral directly to group of society.
- By radio, television, movie, etc.
- By newspaper, magazine, etc.
- Through functional and educational institutions, NGO, etc.

(6) Campaign to Forest Community

Campaign to the forest communities is also needed also needed to give information on the importance of watershed management for flood and sediment control and concerning the unknown matters to be done by the forest community in consideration of forest development in order to increase of farmer's welfare.

The target of the campaign mainly the beneficiaries of forestry development (individual or group) who are directly or indirectly related with the forestry development as follows:

- Regional authorities, from Governor, Bupati, Camat and Head of Village.
- Forestry official.
- Public Figures (Religious, traditions, politics, teachers)
- Information researcher which needed by farmers.
- Forest yield marketing boards, etc.

The scope of campaign covers multi-dimensional activities, appropriate to the local community as follows:

- Training of trainers and to organize village development.

- Manage small businessman and the moving capital.
- To establish the village nursery
- To carry out greening and people forest program.
- Development cooperative program, etc.

The level of forestry extension planning start from upper level up to the lowest level as shown below:

No	Stage of Planning	Manner of Planning	Composer
1.	Central Level	Strategic and Operational Planning of Forestry Extension	Central
2.	Province Level	Forestry Extension Program	Dinas Forestry Province
3.	Kabupaten Level	Forestry Extension Activity Plan	Dinas Forestry Kabupaten
4.	Local Level	Forestry Extension Work Program	Field Forestry Extension Staff

C6.3 Proposed Institutional Arrangements for Operation and Maintenance

(1) Project Implementation

An institution for project implementation should be established as a special project which is responsible to Directorate General of Water Resources and PU / Kimpraswil Gorontalo Province for its implementation.

(2) Operation and Maintenance Institution.

Alternative I: Operation and Maintenance by Government Institution

As soon as the structure are finished to be implemented by project, the activities of O&M must be carried out. For the first two year period it is suggested that the operation and maintenance works is implemented by project, and than the responsible for managing the structure to be handed over to the related institution. The related institution could Dinas PU Kota Gorontalo or Dinas PU Kimpraswil. Kabupaten Gorontalo according to the location of the structure, or since the flood mitigation facilities of LBB River Basin is located across Kabupaten and Kota Gorontalo the responsible of the structure management should be to Dinas PU / Kimpraswil Gorontalo province.

To implement this job Dinas PU / Kimpraswil Gorontalo province should establish the Technical Implementation Unit. The implementation of O & M of flood mitigation facilities in LBB river basin shown in Table C6.3.1

Alternative II: Operation and Maintenance by Management Corporation.

- **River Territory:** According to the Government Regulation No 22/1982 concerning water management, the unit of water resources management to be desire base on the river territory (wilayah sungai). River territory is a territory as outcome development of some river basins, and river basin sometimes located at more than one kabupaten or province. Ministerial of Public Works Regulation No. 39/PRT/189 divided territory of Indonesia into 90 river territories, and in Gorontalo province river territories there are Territory Limboto-Bone (05.02) and Paguyaman-Randangan (05.03)

  Recently water resources in LBB – River Basin is in the aggravated condition, and the problems are how to begin the operation and maintenance of the water resources facilities by involving water resources stakeholders.

- In arranging the institution for water resources management (O&M) has to involve local societies or stakeholders, and the regulation should to touch their aspiration. For implementation this matter a River Basin Management Board which has task to manage water resources in the river territory as Perum Jasa Tirta (PJT).

C6.4 Budget for Operation, Maintenance and Running

(1) Fund

The budget for operation and maintenance is prepare by the related agency base on planning and scheduling. There are two essential items for preparing the budget, that are work schedule and unit rates of activities involved. The operation and maintenance budget consist of the following components:

- General administrative budget
- Operational Budget and
- Maintenance budget

Each of component contains cost estimate for manpower supplies and material, transport and others.

(2) Cost Items for Operation and Maintenance

The required annual budget consisting of:

1) General and administrative budget
   - Cost for staff
   - Running cost of office
   - Maintenance cost of office
   - Running cost of equipment

2) Operation Cost
   - Monitoring and observation cost
   - Cost for operation of river structure
   - Flood fighting cost

3) Maintenance Cost
   - River survey cost
   - Patrol and inspection cost
   - Maintenance cost for river structure, water level and rainfall gauging station
   - Maintenance of warning system equipment.

Table C6.1.1 STANDARD ACTIVITIES FOR RIVER MAINTENANCE (1/4)

No.	Item / Sub Item To Be Maintained	Scope of Works and Maintenance Frequency								Remarks
		D	W	2W	M	3M	6M	Y	3Y	
I.	**River and Structure**									Scope of Works:
										C = Cleaning
1.1	River Channel and Flood Plain				C					R = Repair
										S = Sodding
1.2	Earth Dike :									P = Painting
	- Dike Body		M			R		G		L = Lubricating
	- Crest of Dike		M		C	R				G = Geodetical Survey
	- Slope of Dike		M		C, S	R				M = Monitoring
										O = Overhoul
1.3	Gabion Dike :			C	R, M			G		
1.4	Slope Protection :									Frequency :
	- Stone Masonry			C	R, M					D = Daily
	- Gabion			C	R, M					W = Weekly
	- Concrete				C			R		2W = Two Weekly
										M = Monthly
1.5	Retaining Wall :									3M = Three Monthly
	- Wooden Pile				M	R		G		6M = Six Monthly
	- Sheet Pile				M		R	G		Y = Year
										3Y = Three Yearly
1.6	Groyne :									
	- Wooden Block				M		R			
	- Gabin				M			R		
	- Concrete Block						M			
1.7	Check Dam :									
	- Gabion				C, M	R				
	- Concrete				C	M		R		
1.8	Flood Spillway									
	- Gabion				C, M	R				
	- Concrete				M	C		R		
1.9	Drainage Gate / Flap :									
	- Wood			C, L			R	P	O	
	- Steel			C, L				R, P	O	
1.10	Flood Pump			C			R		O	
1.11	Sabo Dam :									
	- Main Dam and Sub Dam				C					
	- Apron and Spillway			C		M	R			
	- Drip Hole			C		R				
	- Wing Wall			C		R				
	- Scouring Protection			C	R	R				
1.12	Ground Sill			C		R				

Table C6.1.1 STANDARD ACTIVITIES FOR RIVER MAINTENANCE (2/4)

No.	Item / Sub Item To Be Maintained	Scope of Works and Maintenance Frequency								Remarks
		D	W	2W	M	3M	6M	Y	3Y	
II.	**Dam and Reservoir**									Scope of Works:
										C = Cleaning
2.1	Dam :									R = Repair
	- Dam Crest			C, R						S = Sodding
	- Dam Slope			C, R						P = Painting
	- Rip Rap				C, R					L = Lubricating
	- Drain			C, R						G = Geodetical Survey
	- Parapet			C, R						M = Monitoring
										O = Overhoul
2.2	Inspection Gallery :									
	- Inspection Corridor			C, M	R					
	- Hollow Jet Valve			C, L	R				P	Frequency :
	- Illunination System			M, R						D = Daily
										W = Weekly
2.3	Intake :		C	M, L	R					2W = Two Weekly
	- Intake Gate		C	M		R		P	O	M = Monthly
	- Trash Rack							P		3M = Three Monthly
										6M = Six Monthly
2.4	Spillway:									Y = Year
	- Spillway Structure			C	R					3Y = Three Yearly
	- Spillway Gate	M	C		L, R			P	O	
	- Spillway Channel			C	R					
	- Stilling Basin			C	R					
2.5	Reservoir :									
	- Reservoir Area			C				G		
	- Tidal Area			M	C					
	- Trash Boom			C	R			P		
2.6	Diversion Tunnel :				C, M	R				
2.7	Control Station :									
	- Housing	C				R			P	
	- Equipment	C				R				
	- Garden	C								
2.8	Green Belt				M		C			

Table C6.1.1 STANDARD ACTIVITIES FOR RIVER MAINTENANCE (3/4)

No.	Item / Sub Item To Be Maintained	Scope of Works and Maintenance Frequency								Remarks
		D	W	2W	M	3M	6M	Y	3Y	
III.	**Barrage / Weir**									Scope of Works:
										C = Cleaning
3.1	Weir / Barrage Body			C, R				C		R = Repair
										S = Sodding
3.2	Left and Right Wing				C, R					P = Painting
										L = Lubricating
3.3	Weir / Barrage Pilar				C		R			G = Geodetical Survey
										M = Monitoring
3.4	Bridge		C		R				P	O = Overhoul
3.5	Stilling Basin			C	R					
										Frequency :
3.6	Scouring Protection			C	R					D = Daily
										W = Weekly
3.7	Weir / Barrage Gate	M	C	L	R			P	O	2W = Two Weekly
										M = Monthly
3.8	Trash Rack		C	M		R		P		3M = Three Monthly
										6M = Six Monthly
3.9	Gate Hoist Unit		C	R	L					Y = Year
										3Y = Three Yearly
3.10	Coverage				C	R			P	
3.11	Stoplog				C, L	R			P	
3.12	Staff Gauge	M	C					R	O	
3.13	Dike									
	- Dike Body		M			R				
	- Dike Slope		M		C, S	R				
	- Dike Crest		M		C	R				
3.14	Control Station :									
	- Housing	C				R			P	
	- Equipment	C				R				
	- Garden	C								

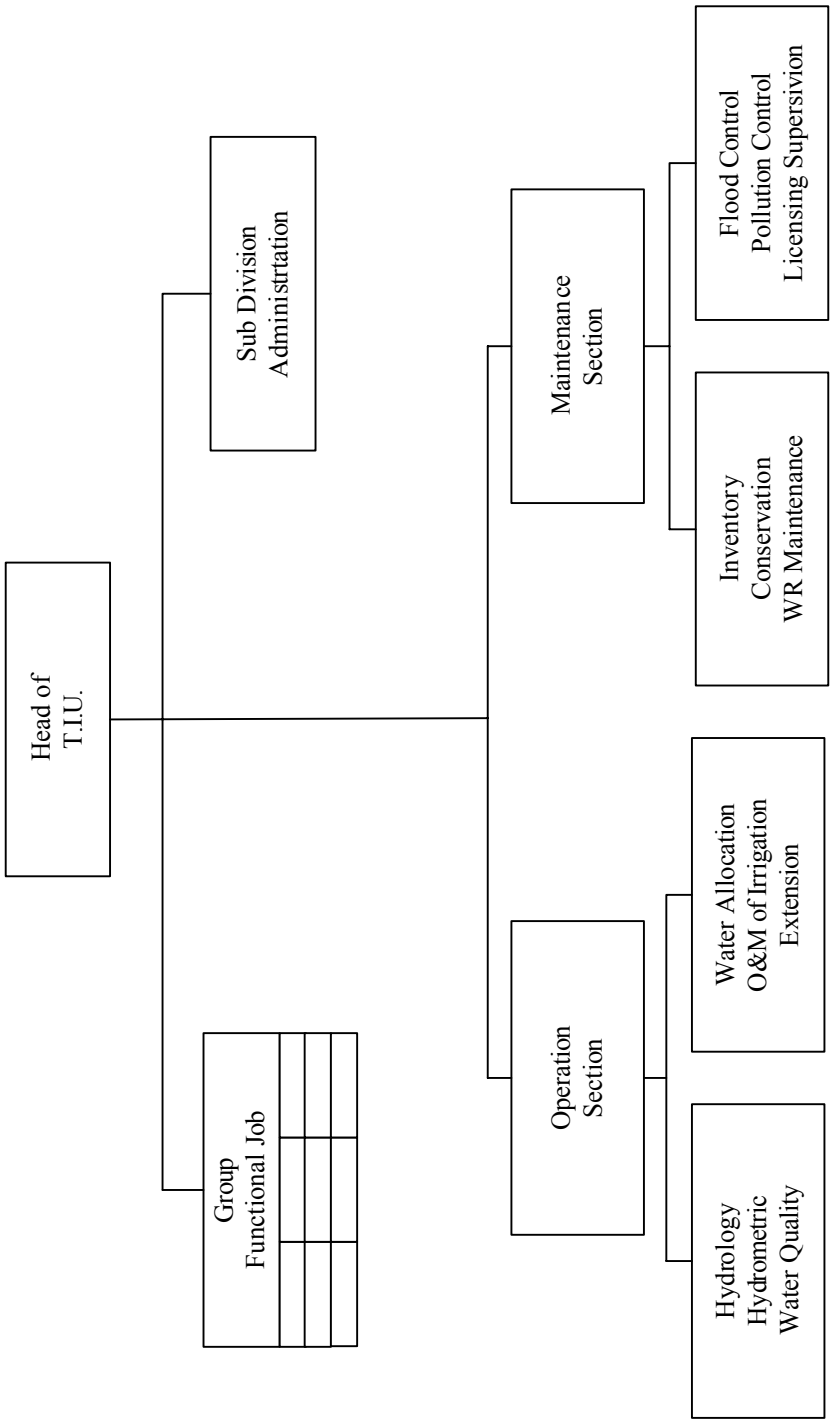
Table C6.1.1 STANDARD ACTIVITIES FOR RIVER MAINTENANCE (4/4)

No.	Item / Sub Item To Be Maintained	Scope of Works and Maintenance Frequency								Remarks
		D	W	2W	M	3M	6M	Y	3Y	
IV.	**Structure Facility**									Scope of Works:
										C = Cleaning
4.1	Water Level Recorder Unit:									R = Repair
	- Authomatic		C	L	M		R		O	S = Sodding
	- Manual	M	C				P	R		P = Painting
										L = Lubricating
4.2	Ring Gauge Unit :									G = Geodetical Survey
	- Authomatic		C	L	M		R			M = Monitoring
	- Manual	M	C				R			O = Overhoul
4.3	Inspection Road / Bridge		C		M		R			
										Frequency :
4.4	Housing	C				R		P		D = Daily
										W = Weekly
4.5	Office Building	C				R		P		2W = Two Weekly
										M = Monthly
4.6	Workshop / Warehouse	C				R			P	3M = Three Monthly
										6M = Six Monthly
4.7	Radar and Anthenna				C			R		Y = Year
										3Y = Three Yearly
4.8	Data Processing Unit	C					R			
4.9	Communication Equipment		C		R					
4.10	Topographic Survey Equipment				C			R		
4.11	Water and Sediment Measuring	Clean After Use								
	Equipment									
4.12	Temperature Regulator				C		R			
4.13	Guard House	C					R		P	
4.14	Office Yard	C								

Table C6.3.1. IMPLEMENTATION AND O&M OF FLOOD MITIGATION FACILITIES IN LBB BASIN

No	Flood Mitigation Fasilities	Location		Responsibility				Remarks
		Kabupaten Gorontalo	Kota Gorontalo	Central	Province	Kabupaten	Kota	
1	RIVER IMPROVEMENT							P = Planning D = Design L = Land Acquisition C = Construction O = Operation M = Maintenance Related Dinas: - River Imp = Dinas PU - Floodway/Dischannel = Dinas PU - Lake Limboto Manag.= Dinas PU - Watershed Mang.= Dinas Kehutanan/Pertanian - Flood Management = Other
1.1	Bone River Improvement	✓	✓					
1.2	Tamalate River Improvement	✓	✓					
1.3	Bolango River Improvement	✓	✓		D		L,C,O,M	
1.4	Biyonga River Improvement	✓	-	P	L			
1.5	Alo & Pohu River Improvement	✓	-	D*)	C**)	L,C,O,M		
1.6	Meluopo River Improvement	✓	-	C*)	O**)			
1.7	Marisa River Improvement	✓	-		M**)			
1.8	Rintenga River Improvement	✓	-					
2	FLOODWAY/DIVERSION CHANNEL				D**)			
2.1	Tamalate River Floodway	✓	✓	P	L	L,C,O,M	L,C,O,M	
2.2	Biyonga Realignment	✓	-	D*)	C**)	L,C,O,M	-	
2.3	Alopohu Realignment	✓	-	C*)	O**)	L,C,O,M		
					M**)			
3	LAKE LIMBOTO MANAGEMENT							
3.1	Ring Dike	✓	✓	P	D,L,C,O,M	L		
3.2	Control Gate	-	✓	D*)			L	
3.3	Sand Trap	✓	✓	C*)		L	L	
4	WATERSHED MANAGEMENT	✓	✓	P	D	C,O,M	C,O,M	
5	FLOOD MANAGEMENT	✓	✓	P	D	C,O,M	C,O,M	

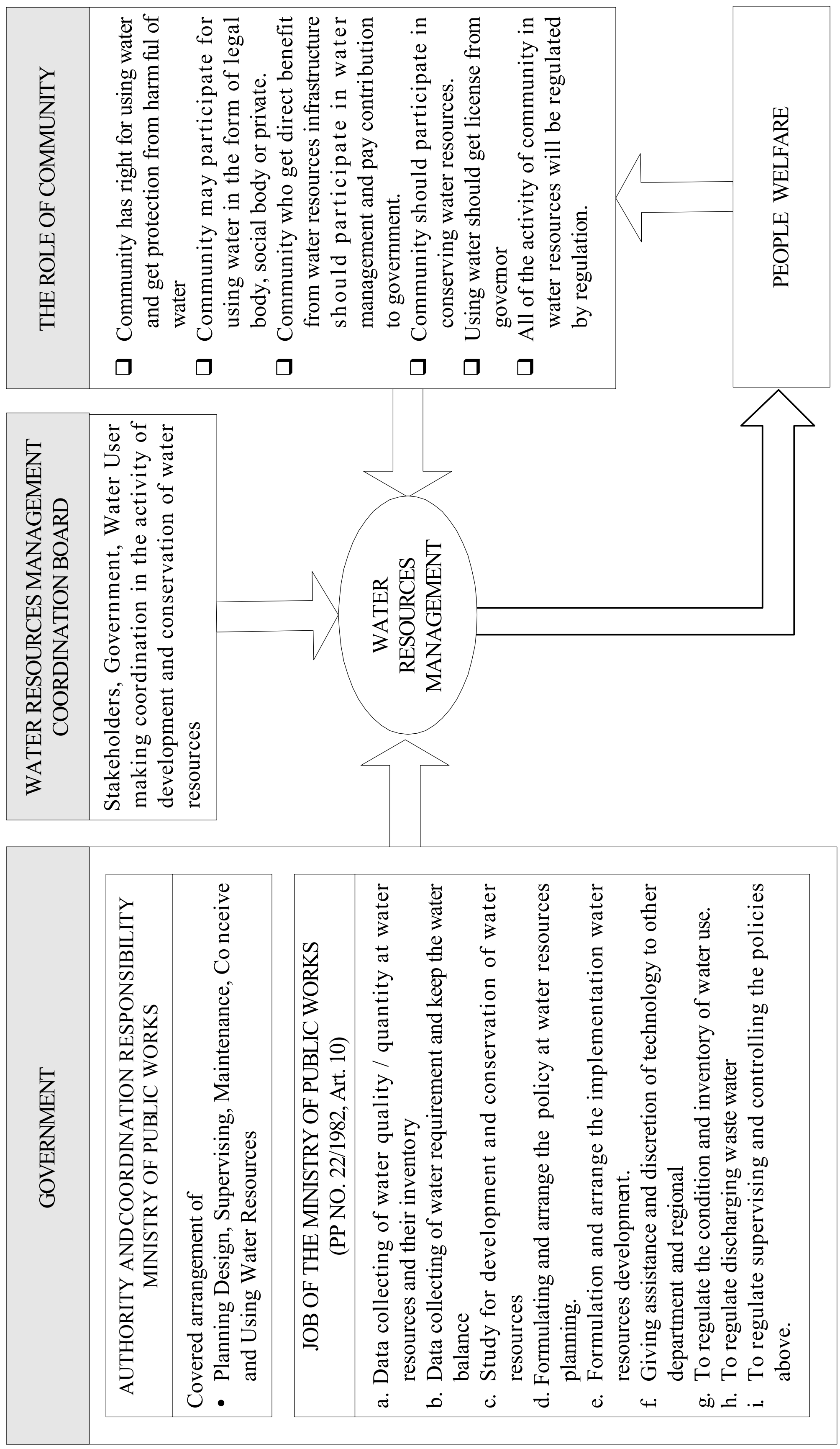
*Note: *) if Province is not capable **) if Kabupaten / Kota is not capable*



The Study on Flood Control and Water Management in Limboto-Bolango-Bone Basin in the Republic of Indonesia

Japan International Cooperation Agency

Figure C6.2.1
SUGGESTED TIU - LBB BASIN, GORONTALO PROVINCE



The Study on Flood Control and Water Management in Limboto-Bolango-Bone Basin in the Republic of Indonesia

Japan International Cooperation Agency

Figure C6.2.2
ROLE OF COMMUNITY PARTICIPATION IN WATER RESOURCES SECTOR

C7. NON-STRUCTURAL APPROACHES

C7.1 Watershed Management

C7.1.1 Current Issues

Sedimentation of Lake Limboto is a serious problem. The lake, which has storage capacity of 47.4 MCM below elevation +4.0 m,MSL, is estimated to receive annually 2 million to 5 million m^3 of sediment from the basin. Major source of the sediment is the Biyonga River followed by the Meluopo and Alo-Pohu rivers.

In the Bolango-Bone river system, the Bolango River transports more sediment than the Bone River although basin size of the Bolango River is only 37% of the Bone River. Vegetation of the Bone River is good. During past ten years, a total of 54 km^2 bush land and 21 km^2 forest lands were converted to farmland. Most of these took places in Lake Limboto basin and the Bolango River basin. Watershed management is duly required for these basins.

There are two sources of sediment, primary and secondary sources. The primary source is in the mountainous area. The sediments yielded in the mountainous area are transported by the river to the lower reaches, and first deposit on the plain area along the river. The secondary source is in the plain area. The deposits in the plain area are transported again toward downstream due to secondary side erosion. The Biyonga and the Bolango rivers are the typical rivers of the former type and the Alo-Pohu River of the latter type. In order to cope with the sedimentation problems of the lake, measures must be taken for the both sources.

C7.1.2 Possible Measures for Watershed Management

In order to promote watershed management activities in the Study Area, the agencies in responsible to flood mitigation should take all the possible actions to encourage:

1) Construction of erosion control facilities,
2) Afforestation and land use control, and
3) Dissemination activities.

For respective actions to be encouraged, possible measures and activities are presented

in the following paragraphs.

(1) Erosion Control Facilities

1) Construction of check dam
2) Bank protection works along rivers
3) Protection of hillside slope by terracing works and nursing vegetation
4) Protection of small-scale channel with gully plugging and surrounding slopes by planting shrubs and grasses.

(2) Afforestation and Land Use Control

1) Afforestation and reforestation artificially and fostering natural regeneration of trees.
2) Promoting farm tree and shrub planting by growing commercial crops such as fruit trees, medicinal herbs, aromatic plants and natural dyes. Well-managed commercial crops prevent land erosion in watersheds and promote sustainable watershed management activities through generation income.
3) Planting of fodder grasses on slopes, fodder trees on terraces, and restricting the number of livestock within permissible limits for sustaining the pasture and forest.
4) Conservation of wild medical herbs, by protecting from over-collect, thus allowing a sustained yield.
5) Reducing energy use.
6) Training the local leaders in land use and woodland management, and exchanging know-how among other communities.

(3) Dissemination Activities

In order to promote watershed management, the understanding and cooperation of local communities and individual are essential. Dissemination activities should be extended employing all the possible means as follows:

1) Establishing a specific date or dates for tree planting activities as a national and/or local level events and conducting tree planting campaign for afforestation, reforestation, form tree planting and forest conservation.
2) Commemorative tree planting for any ceremonies and memorial events by

residents, and local and national leaders.

3) Environmental education, tree misery and small arboretums in school.
4) Enactment of a system of commendation for excellent tree planting projects, including agro-forestry, riverside plantings and other community activities.
5) Combination of natural regeneration and/or afforestation project with tourism and local development project.
6) Campaign by mass media for planting trees.
7) Establishment of foundations and solicitation of funds to encourage tree planting.
8) Organizing tree-planting volunteer groups and facilitating volunteers from the overseas countries to participate as well.
9) Conducting of study tours to on-going projects to learn from past initiatives.

C7.1.3 Land Rehabilitation and Soil Conservation Project

Land Rehabilitation and Soil Conservation Center (Balai Rehabilitasi Lahan dan Konservasi Tanah: BRLKT) of Department of Forest and Plantation, North Sulawesi Province formulated a Project Plan for Land Rehabilitation and Soil Conservation (LRSC) in Limboto Sub-Basin in March 1999. The project plan stands on the same intention with watershed management proposed in the FM-MP. Implementation of the LRSC for Limboto is strongly recommended to alleviate sediment yield from the watershed and flood runoff as well. The outline of the LRSC in Limboto sub-basin are presented below.

Objectives: The objectives of the LRSC in Limboto sub-basin are:

1) To rehabilitate critical lands, and maintain and enhance soil fertility;
2) To control erosion and flood, and conserve natural resources;
3) To reduce sediment transport;
4) To build community awareness and attitude towards the conservation of natural resources; and
5) To enhance community income and welfare.

Necessary Actions: To accomplish the objectives, actions need to be implemented include:

1) Implementing the LRSC through re-greening and reforestation with tree crops

such as Sengon, Mahoni, Jati and Acasia; and MPTS species such as Kemiri, Jackfruit and jambu mete. In agricultural lands, such trees should combined with crop plants according to a recommended planting pattern;

2) Creating a good relationship between those who utilize the land and water resources (local people) and re-greening and reforestation program officers;

3) Building community awareness and developing self-supporting community to adopt information and technology about plant cultivation through some assistance from related institutions;

4) Developing agricultural production market system between community (farmer groups) and Village Cooperative (Koperasi Unit Desa); and

5) Enhancing community's income and welfare through forest and other lands productivity improvement in a sustainable manner.

Physical Targets: Total critical land areas in the forests is 12,573 ha and that of outside the forests is 13,524 ha. Total target area for the project during the first five years is 7,820 ha in the Limboto sub-basin, composed of 2,100 ha in the forest for social forest reforestation and 5,720 ha outside the forest for re-greening. Locations of these target areas are Kecamatan Limboto, Tibawa, Batudaa and Telaga, which are identified to have high and medium erosion rate.

Community Development Target: The first phase (5 year period) of the project targets on community's participation and income improvements as well as community's attitude and awareness level changes.

C7.2 Flood Plain Management

Flood damages sometimes occur or become serious because of the people's vulnerability, e.g., lack of awareness and motivation for preparedness, inadequate resources for risk reduction, lack of access to alternative sources of livelihoods. Flood plain management activities aim to reduce the vulnerability. The flood plain management scheme intends to promote following activities that will be done by relevant communities and individuals for flood damage mitigation:

1) Community Mobilization: By assisting to form community organizations, it

intends to build up organizational bases for the implementation of the Flood Mitigation Program.

2) Flood Proofing: This will assist the communities and individuals in flood-prone areas in taking preparedness to reduce damages by own efforts.

3) Flood Forecasting, Warning and Evacuation: Community people can be ready for reducing damages and evacuation, getting correct and timely information on coming flood.

4) Flood Fighting: In collaboration with the relevant agencies, the community organizations implement emergency flood mitigation activities fighting the attacking flood.

5) Community-based Flood Mitigation Measures: It will motivate the community organizations to contribute their shares in maintaining and sustaining the flood control structures, by deriving additional benefits for improving their livelihoods.

C7.2.1 Mobilization of Community

The flood plain management will start with the community mobilization to strengthen the organizational bases for local flood mitigation initiatives.

(1) Workshops for Local Community Leaders

Local community leaders will play crucial roles in the flood plain management. The leaders' main responsibilities will be to encourage and mobilize local resident to the activities. In order to enable the leaders to perform the tasks, a series of training/workshop will be undertaken for the local community leaders at the inception and during the implementation of the flood plain management.

(2) Creation of Organizational Bases at Community

The flood plain management will then mobilize the local community leaders to create organizational bases at the community level. This will be achieved with three sets of activities, i.e., (1) formation of community organizations, (2) promotion of public awareness, knowledge, and skills, and (3) generation of financial resources by the

community organizations.

Formation of Community Organizations: The community organizations would be formed with the following steps:

- Step 1: Organize settlement-wise meetings
- Step 2: Dialogues with communities
- Step 3: Establishment of community organizations for flood plain management
- Step 4: Strengthening of the organizations for other flood control works
- Step 5: Enter into agreement with community organization groups

Promotion of Public Awareness, Knowledge and Skills: Once the organizational bases are created with the above procedures, formal training of the organizations will be undertaken, concerning the following topics:

- Technicalities of flood control measures
- Skills in basic coping measures
- Community participation in flood mitigation

Generation of Financial Resources: The formation process of the community organization will be accompanied by the mobilization of financial resources by the organization members themselves. There are several possible sources of generating funds by the local communities themselves such as group savings and other community undertakings.

C7.2.2 Possible Measures for Flood Plain Management

Necessity of Local Coping Measures: It is important for people to be aware of the importance of taking community-based coping measures on their own, to complement the physical facilities. Moreover, they are instrumental in heightening the people's awareness of their vulnerabilities to floods.

Each local area has a particular set of needs for local coping measures. The program component for local coping measures will therefore be undertaken on a community-by-community basis. The following are a menu of support, which the Program will draw upon in assisting local communities to enhance their local coping

measures.

(1) Promotion of Flood Proofing

One common method is to reduce the risks of damage by adjusting agriculture, and by strengthening building. There are also other ways of promoting flood proofing.

1) Agricultural Adjustments:
   - Immediately after the summer crops are damaged, cultivate fast-growing crops (e.g., certain types of vegetables, Arun maize) which can even harvested in a few months' time - even in time for farmers to start winter crops;
   - Grow sweet potatoes if as a result of floods their farming lands are covered by thick sand, thus preventing them from cultivating other crops;
   - Where feasible, change from maize growing to rice cultivation which is less vulnerable to inundation, and in other words, more flood-resistant;
   - Double transplanting of paddy seedlings; and
   - Set aside rice seedlings, in order that they can re-plant paddies, even in case rice fields are destroyed due to flooding.

2) Housing Structures:
   - Construct houses on plinths, so that flood water flows underneath;
   - Build walls of mud which will let water pass through in times of flooding, to prevent houses from collapsing;
   - Raise grain stores on stilts, while building escape areas under roofs for family members and other valuables; and
   - Concentrate houses on higher grounds of the communities, to prevent residential shelters from being inundated during floods.

3) Other Possible Flood Proofing Measures:
   - Aforestation/reforestation on the riverbanks will serve to curtail the speed of overflow water in case of emergencies;
   - In low-lying areas, drainage construction to reduce the level of inundation as well as to improve hygienic conditions during the monsoon; and,
   - Small-scale reservoirs development (e.g., creation/expansion of new/existing ponds) on community-owned barren land.

(2) Flood Forecasting, Warning and Evacuation

Many farmers in the flood plains have their own ways of forecasting and warning, in an attempt to give themselves enough lead time for evacuation. Usually, those who have experienced floods periodically have their own ways of evacuation in times of disasters.

Similarly, it is possible to incorporate more systematic approaches in local forecasting and warning simply by utilizing existing facilities and resources, which can be used to pass flood notices from the upstream areas. Where there is an irrigation barrage along the river, the irrigation office can possibly inform of the rising of the water level to other areas, in addition to the task of closing the water intake.

For evacuation purposes, people should find refuges in their own localities in advances, and if that is not possible, seek to safer areas in neighboring areas.

(3) Flood Fighting

Some local communities, when they notice the comings of flooding, install temporary flood fighting structures using local resources and materials. The structures serve either to contain the extent of bank erosion, or to deter the velocity of overflow.

However, those village-level measures, albeit commendable for their self-help approaches, often lack technical soundness. Such technical advise will be easily absorbed and to be put to practice, given the fact that those communities are already motivated and at least are aware of potentiality of collective efforts.

(4) Support to Community-based Flood Mitigation Measures

The program component for community-based sustainable measures is intended to derive additional benefits from the physical facilities, and to motivate the beneficiaries to help sustain the structures. Some examples of community-based flood mitigation measures are listed below.

1) **Community forest as dike works:** Community forests managed along the river and lakeshore and around the village will serve not only as flood mitigation, but also to serve various necessities of the local residents. Having met the local needs for forest products, the community organization can sell

surpluses in the market. Moreover, in case the local communities choose those species that require nurseries, the organizations can sell extra seeds and seedlings that are produced in their community nurseries.

2) **Access improvements using flood control structures:** When dikes are constructed for flood mitigation projects, they provide opportunities to simultaneously develop rural road networks. In some places, the dikes alone can be designed as access roads. In access improvement purposes, emphasis will be placed on labor-intensive methods which are locally suitable and affordable.

3) **Exploitation of bed material as channel excavation works:** Many rivers in the LBB basin are being mined for sand, gravel and boulder as construction materials. More importantly, exploitation of sand/gravel/boulder from a riverbed can be part of a river training scheme, which serves to increase the flood carrying capacity of a river if it is done orderly under control. It can also provide employment opportunities for rural people in the local community.

4) **Operation and maintenance of flood control structures:** Even for sophisticated engineering structures, a system of regular monitoring is necessary to ensure their continued stability. For this purpose, local communities will be given the responsibilities to constantly monitor the sites, and when necessary, seek external support for rehabilitation. These activities are for the direct benefit of the communities concerned.

5) **Land use management:** The purpose of land use management is to ensure flood risks are not worsened by ill-conceived land uses. It is crucial for the local communities to agree on local rules and practices that will stop these poor land use management for the profit of own communities.

C7.3 Arrangement for Implementation

(1) General

In order to promote the non-structural flood mitigation measures (watershed management and flood plain management) in the LBB basin, some arrangements to be considered for initiation of the activities are discussed here.

Participation of Local Community: The watershed management and the flood-plain management will be accomplished by mobilizing the relevant agencies, local communities and individuals in the flood plain areas. It is, therefore, essential to implement the program with participation of the local community organizations, even from the preparation stage of the program.

Collaboration with Community Based NGO: The program shall be implemented with close contact with the community people. It will be effective to promote the program in collaboration with community based NGO who know the peoples and real situation of the community.

Pilot Communities: It will be a practical approach to select a few communities as pilot communities for the implementation of watershed management or flood-plain management program. Accumulating the experience (both succeeded and failed) and know-how in the pilot communities, the program will be extended to other communities stage wise.

(2) Implementation of Watershed Management

Support for Promoting of LRSC Project: It is proposed these activities should be implemented by the office of Land Rehabilitation and Soil Conservation (Balai Rehabilitasi Lakan dan Konservasi Tanah: BRLKT) of Gorontalo Province within the frame of project plan for Land Rehabilitation and Soil Conservation (LRSC) formulated in 1999. Dinas PU/Kimpraswil of Gorontalo Province, Dinas PU-Praswil of Kabupaten Gorontalo, and Dinas PU of Kota Gorontalo should extend all the possible support to promote the LRSC project.

(3) Implementation of Flood-Plain Management

Community Mobilization: In order to mobilize community people for flood plain management activities, it is first necessary to organize the people for the activities. To establish community organization, it is practical to utilize existing governmental and community organizations adding new functions for flood-plain management to them. In the Study Area various community organizations exist or to be established as listed below.

Name of Organization		Level
1	PTPA/PPTPA (Province)	Province/River Basin *
2	PTPA/PPTPA (Kabupaten)	Kabupaten **
3	Irrigation Committee Province	Province
4	Irrigation Committee Kabupaten	Kabupaten
5	Water User Association (Irrigation)(P3A)	Farmer
6	Water User Association (Non Irrigation)	Industry, etc. ***
7	Land User Association (Arable)	Farmer ***

* Not yet established in Gorontalo Province

** Has been established in Kabupaten Gorontalo

*** Suggested to be established

Workshops/Trainings: In order to add new functions to the existing community organization, workshops and training are necessary for the community leaders and local government officers in charge as well. The workshops and training should be held by the relevant Dinas periodically every year before the flood seasons. The function of relevant organization in training activities is shown in Figure C7.3.1.

National Organization for Disaster Prevention: It is also important to link the flood-plain management activities with national organization for disaster prevention. The organization covers the whole country and respective administrative levels. It has subordinate organizations as follows:

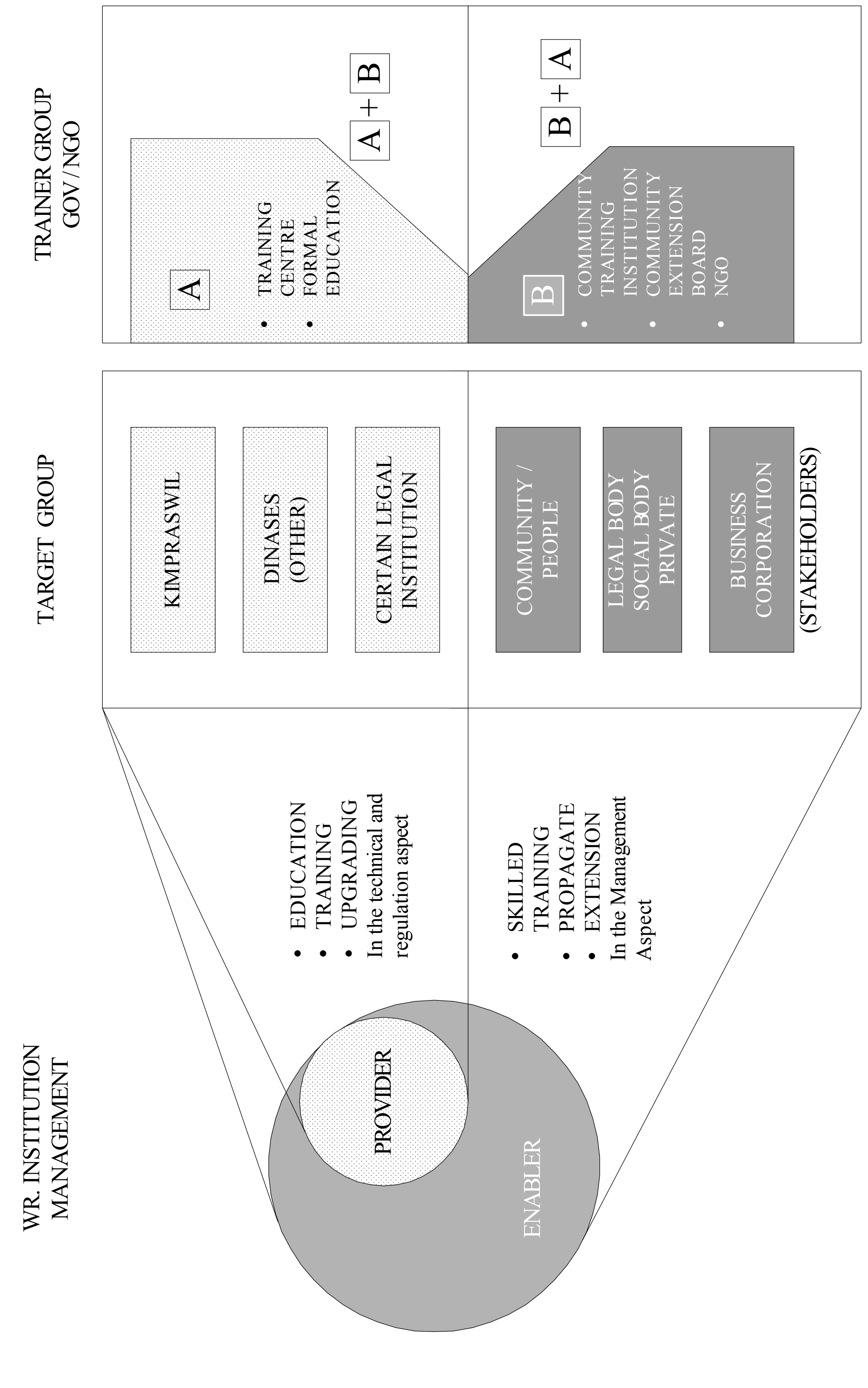
Name of Organization		Level	Chairman
i	BAKORNAS PBP (National Board for Coordination of Disaster Prevention)	National	Vice President
ii	SATKORLAK PBP (Implementation Coordination Unit for Disaster Mitigation and Evacuation)	Province	Governor
iii	SATLAK PBP (Implementation Unit for Disaster Mitigation)	Kabupaten/Kota	Bupati/Walikota
iv	Unit Operasi PBP (Operation Unit for Disaster Mitigation and Evacuation)	Kecamatan	Camat
v	SATGAS PBP (Task Force Unit for Disaster Mitigation and Evacuation)	Village	Head of Village

Flood Proofing: Various types of flood proofing measures are conceivable and each of them may have different agency in charge. Development, promotion and evaluation of the flood proofing activities should be done in coordination/collaboration with these agencies in charge.

Flood Forecasting, Warning and Evacuation: There exist water intake weirs at the head of plain areas of the most major rivers. At these weirs, flow conditions are observed continuously. The information from these weirs is invaluable for flood forecasting, warning, and evacuation purposes. Even the information is not in time for evacuation, it will surely contribute to reduce damages in the flood plain areas in the downstream reaches. A conceptual flood forecasting system for the basin and a flow chart for flood warning procedure are shown in Figures C7.3.2 and C7.3.3.

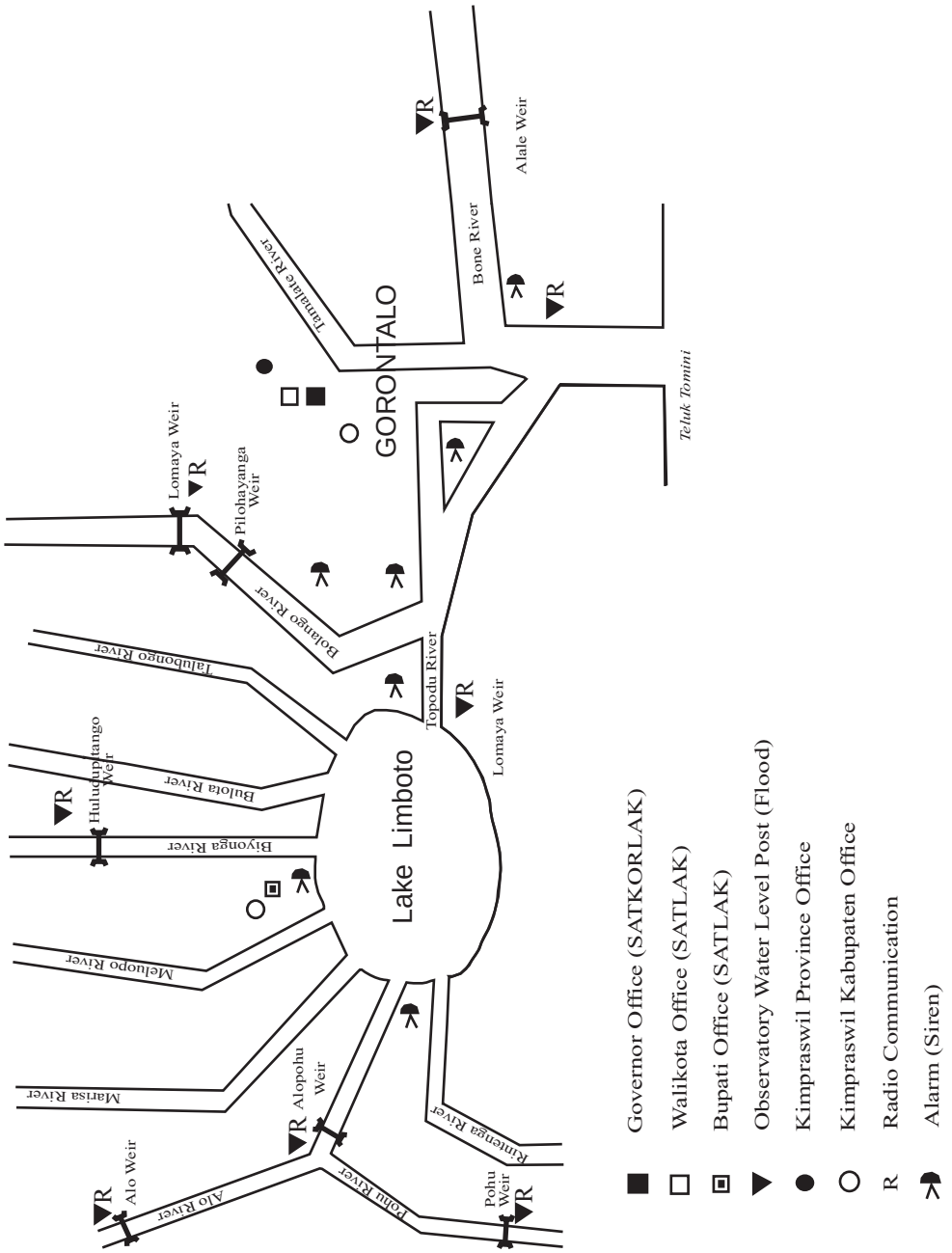
Flood Fighting: Flood fighting activities can be implemented in combination with activities of SATLAK PBP Kabupaten Gorontalo. The organization of the SATLAK PBP is shown in Figure C7.3.4.

Community Based Flood Mitigation Measures: Local community should take the initiative in proposing and implementing the projects of this type getting technical and financial subsidy. Workshops and training are effective tool to disseminate the activities. They are also necessary to enhance the capability of community leader and local government officers in charge and to develop and promote practical community-based sustainable flood mitigation measures by themselves. The incorporation of community-development NGOs and volunteers is also advisable to make the activities sustainable.

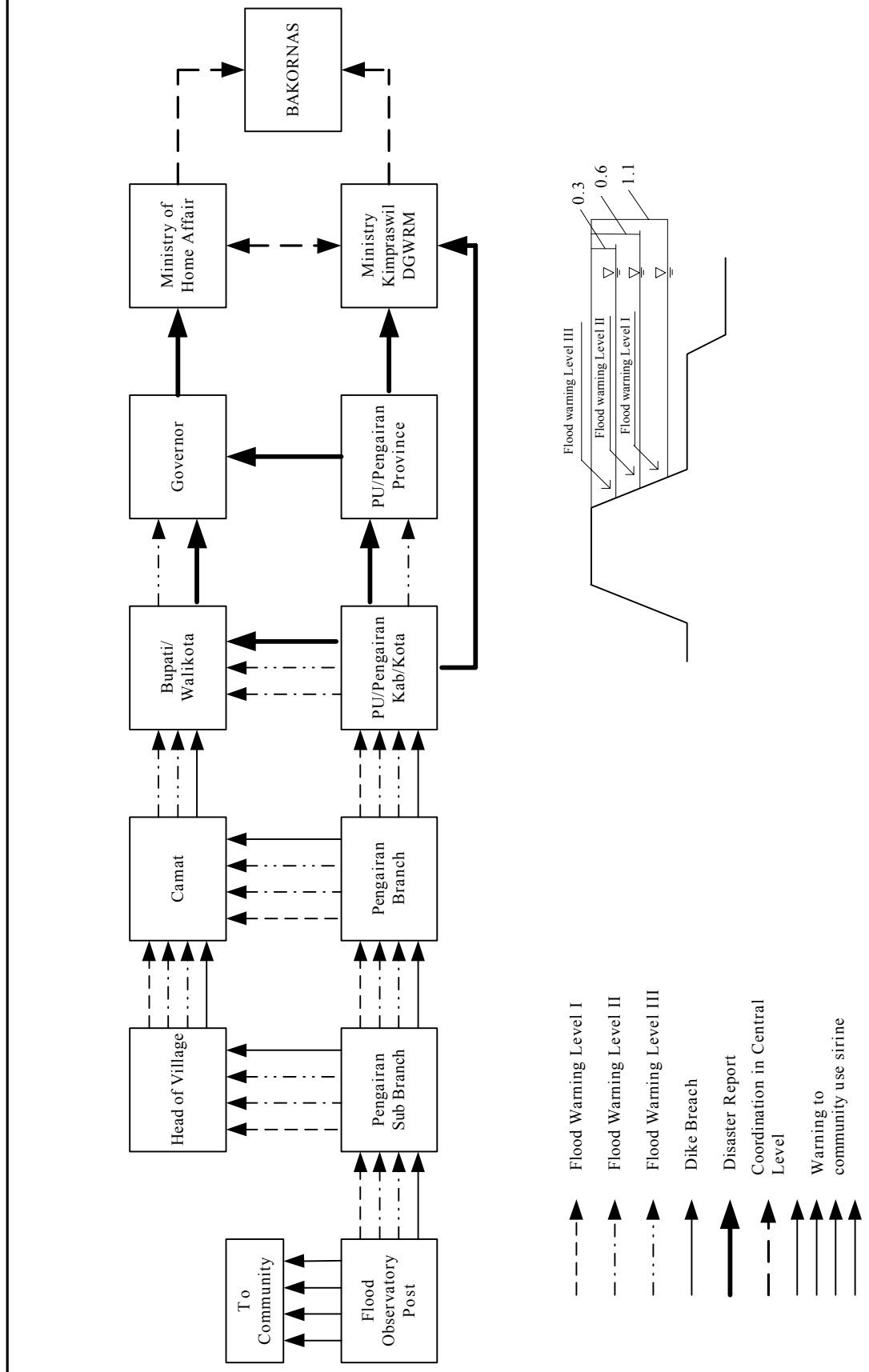


Source : PT ADHI EKA

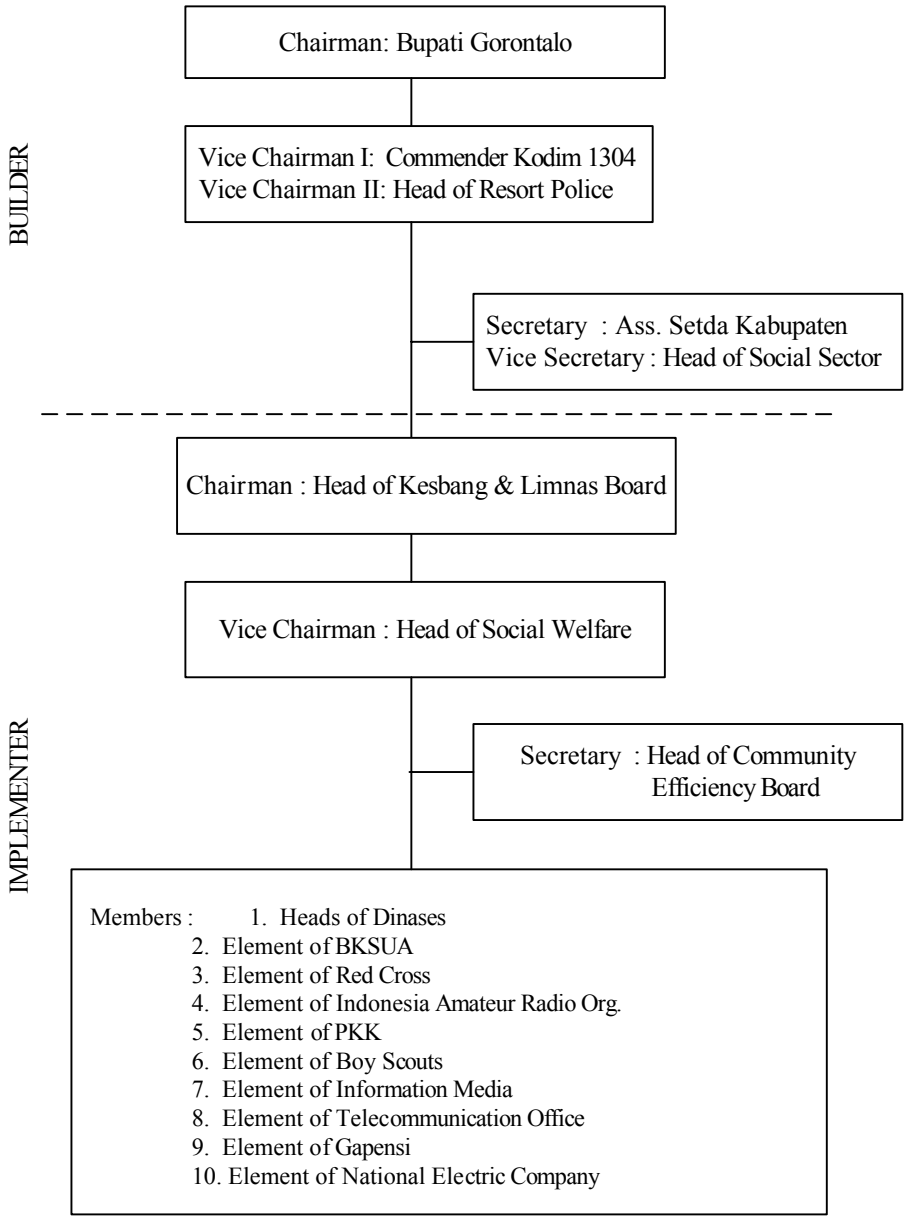
The Study on Flood Control and Water Management in Limboto-Bolango-Bone Basin in the Republic of Indonesia	**Figure C7.3.1** **FUNCTION OF RELEVANT ORGANIZATIONS IN TRAINING ACTIVITIES**
Japan International Cooperation Agency	



The Study on Flood Control and Water Management in Limboto-Bolango-Bone Basin in the Republic of Indonesia	**Figure C7.3.2 CONCEPTUAL SYSTEM FOR FORECASTING, WARNING & EVACUATION**
Japan International Cooperation Agency	



The Study on Flood Control and Water Management in Limboto-Bolango-Bone Basin in the Republic of Indonesia	**Figure C7.3.3** **FLOW CHART FOR FLOOD WARNING PROCEDURES**
Japan International Cooperation Agency	



(Bupati Gorontalo Decree No. 540/2001)

The Study on Flood Control and Water Management in Limboto-Bolango-Bone Basin in the Republic of Indonesia *Japan International Cooperation Agency*	**Figure C7.3.4** **ORGANIZATION OF SATLAK PBP KABUPATEN GORONTALO**