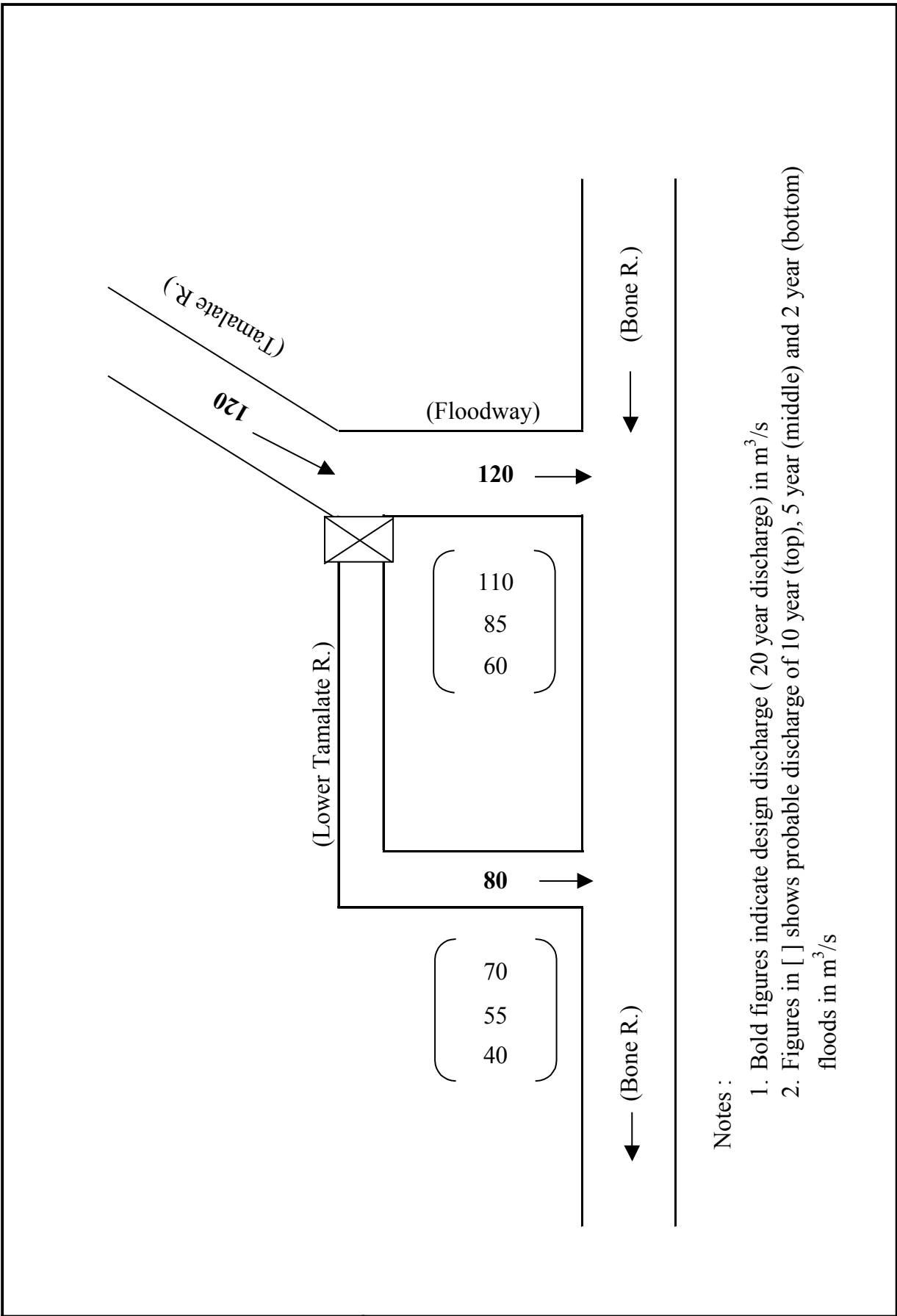


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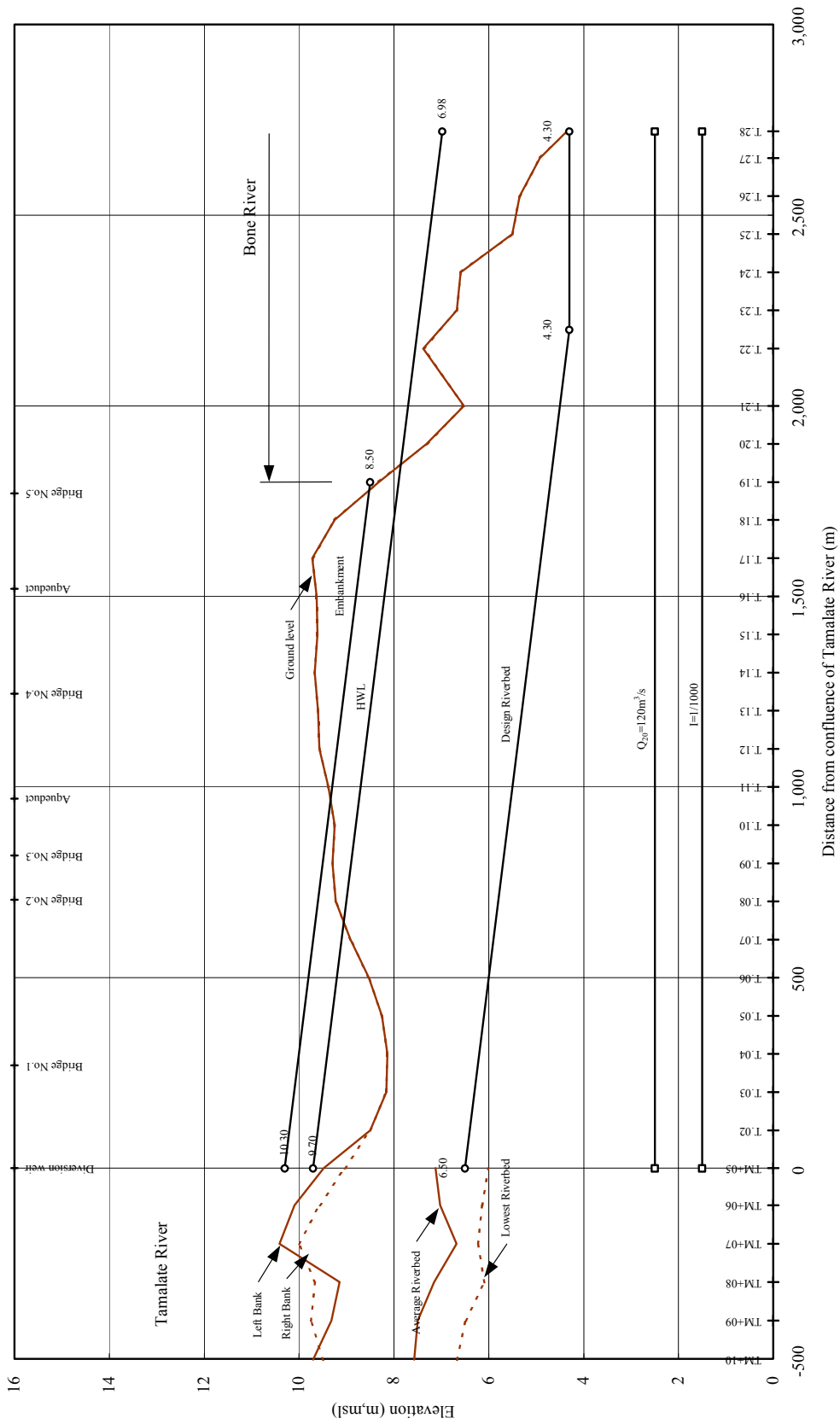
**Figure 5.3.12**  
**GENERAL LOCATION MAP OF TAMALATE FLOODWAY**



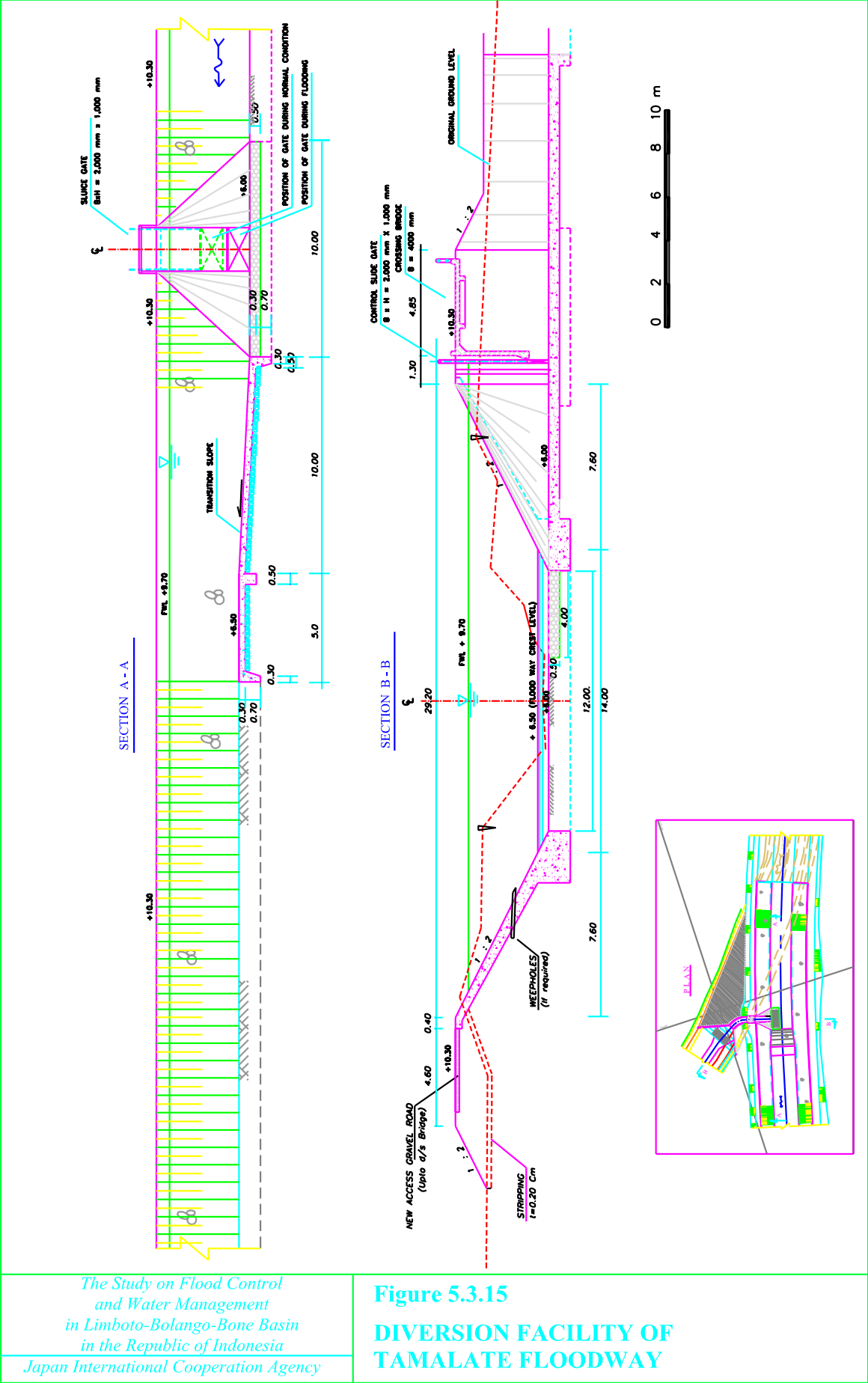
Notes :

1. Bold figures indicate design discharge ( 20 year discharge) in m<sup>3</sup>/s
2. Figures in [ ] shows probable discharge of 10 year (top), 5 year (middle) and 2 year (bottom) floods in m<sup>3</sup>/s

**Figure 5.3.13  
DESIGN DISCHARGE DISTRIBUTION :  
TAMALATE RIVER**

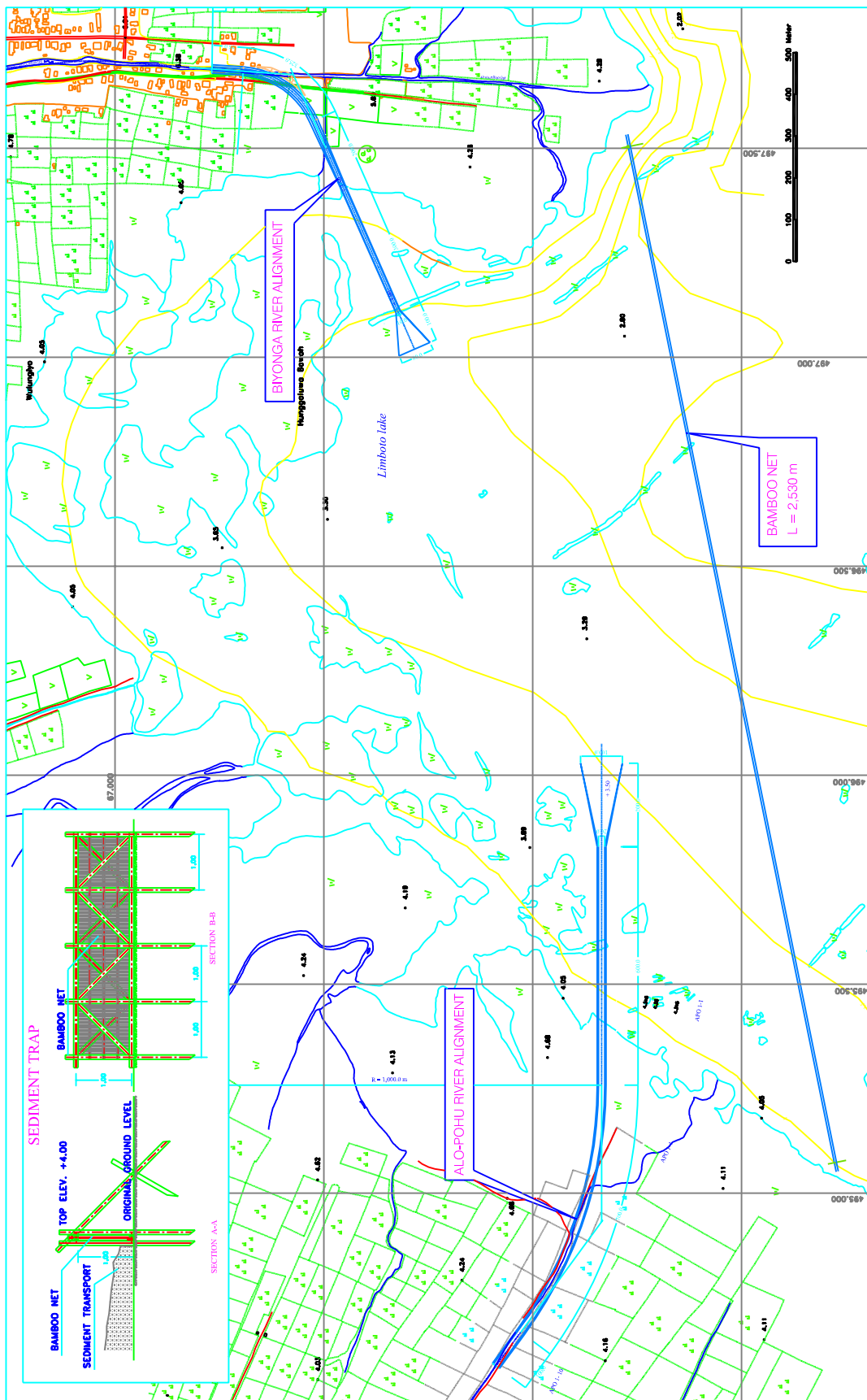


**Figure 5.3.14**  
**DESIGN LONGITUDINAL PROFILE OF TAMALATE FLOODWAY**



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**Figure 5.3.15**  
**DIVERSION FACILITY OF**  
**TAMALATE FLOODWAY**

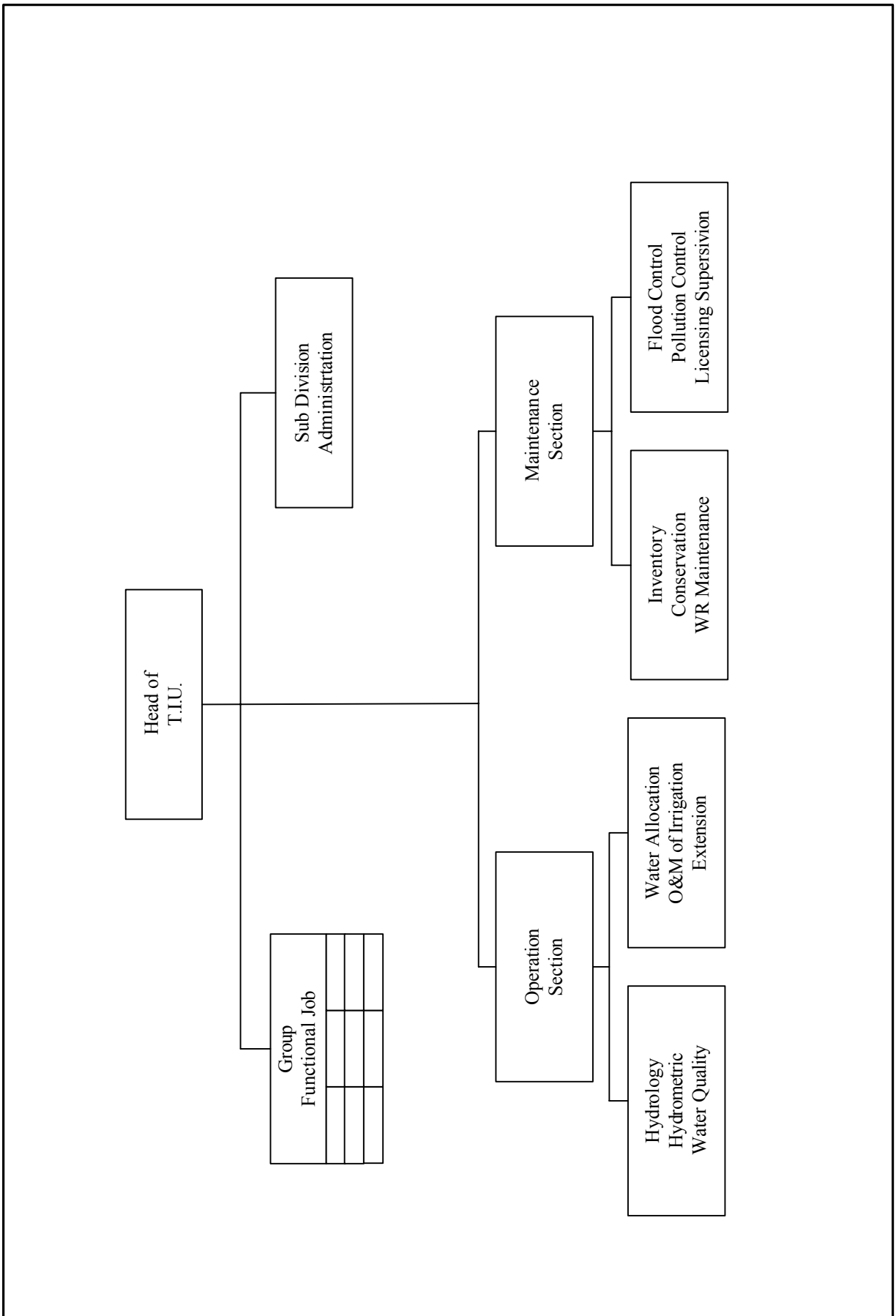


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in the Republic of Indonesia

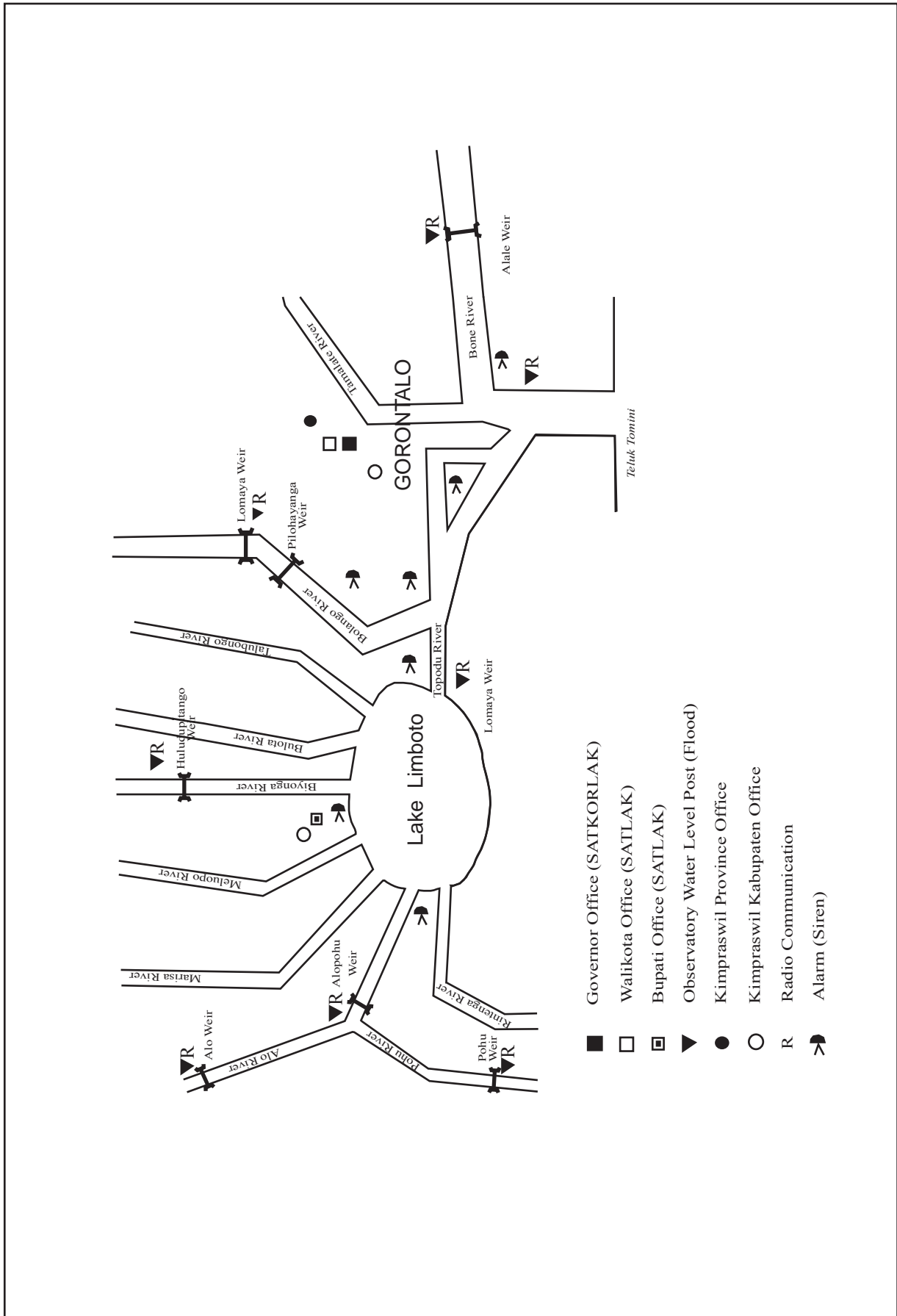
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Figure 5.3.16

DESIGN PLAN OF SEDIMENT TRAP



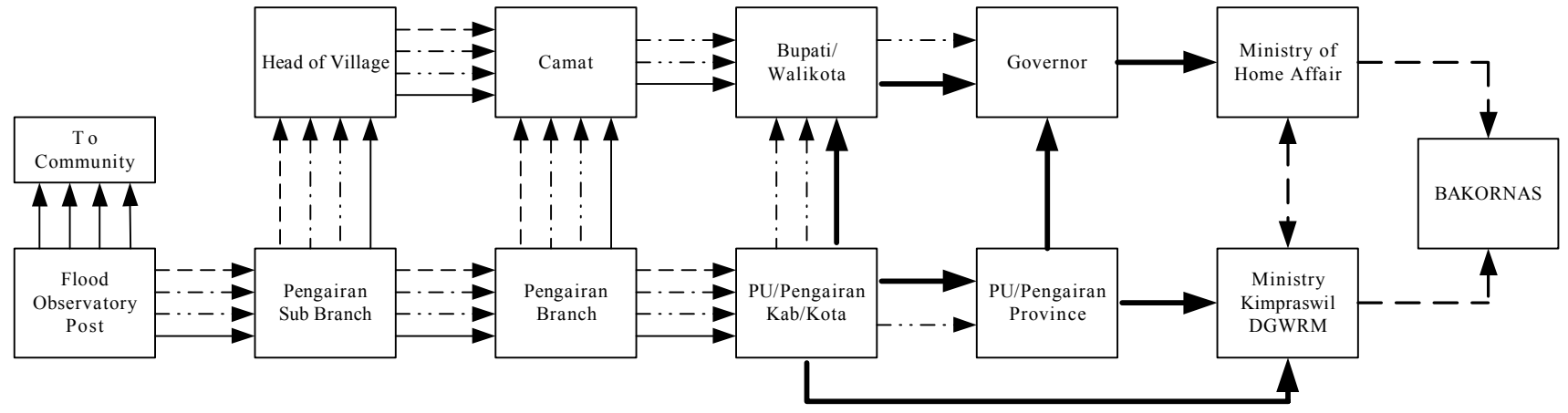
**Figure 5.6.1**  
**SUGGESTED TIU - LBB BASIN, GORONTALO PROVINCE**



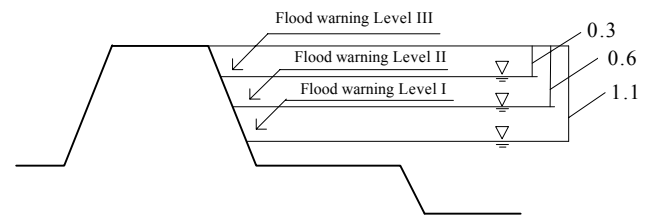
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**Figure 5.7.1**  
**CONCEPTUAL SYSTEM FOR FORECASTING, WARNING & EVACUATION**

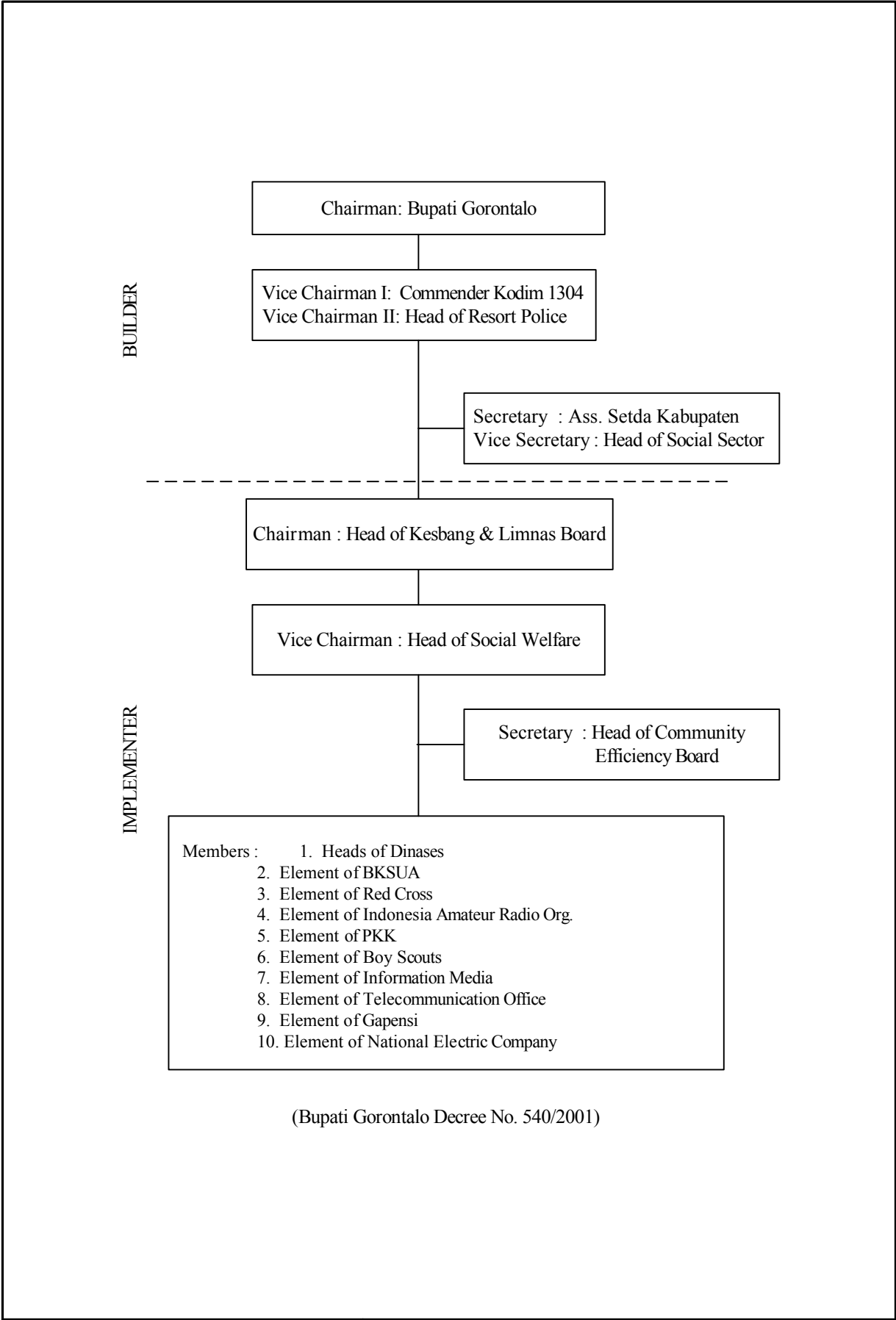
**Figure 5.7.2**  
**FLOW CHART FOR FLOOD WARNING PROCEDURES**

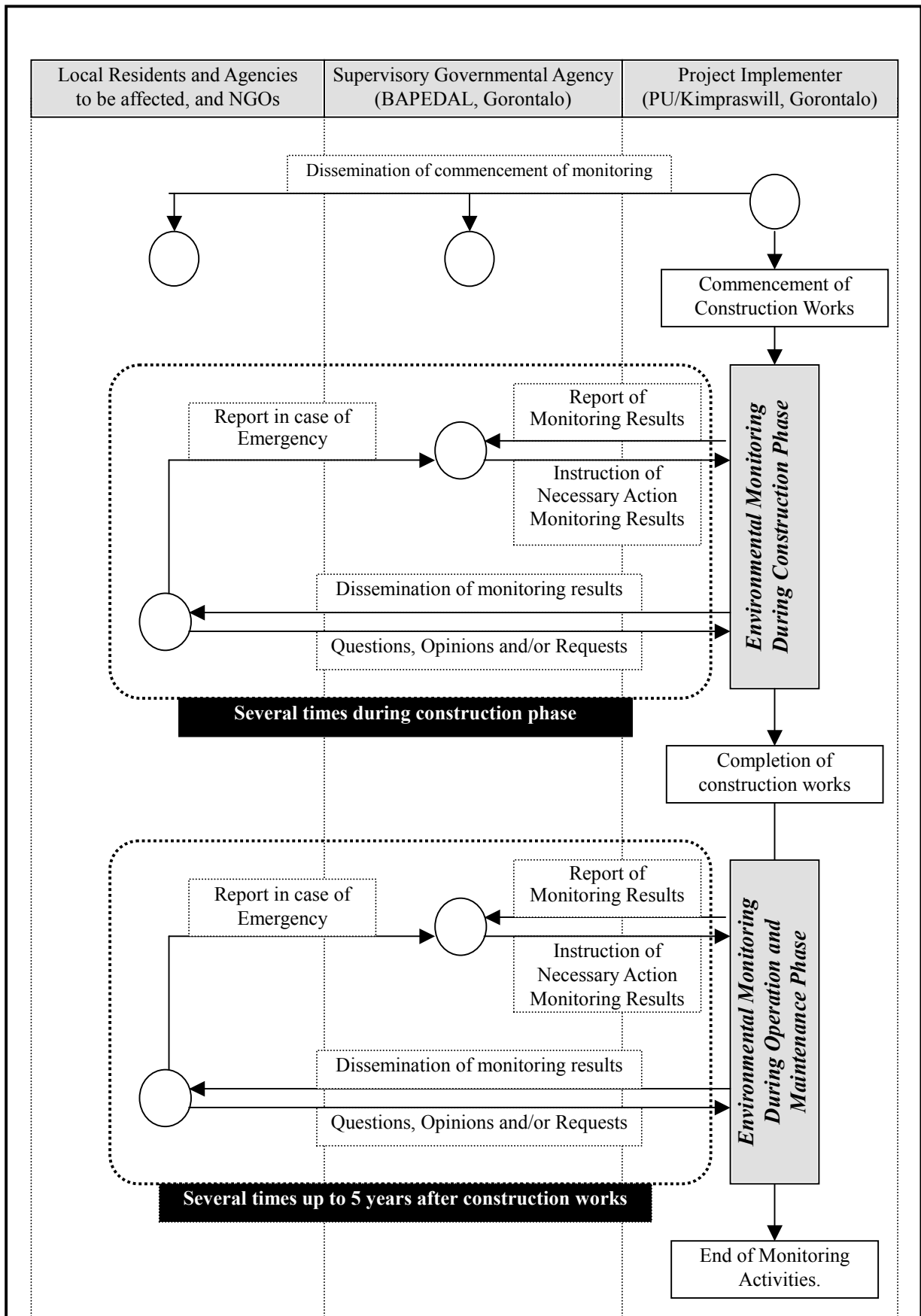


- > Flood Warning Level I
- - -> Flood Warning Level II
- . . .> Flood Warning Level III
- > Dike Breach
- > Disaster Report
- - -> Coordination in Central Level
- > Warning to community use sirine

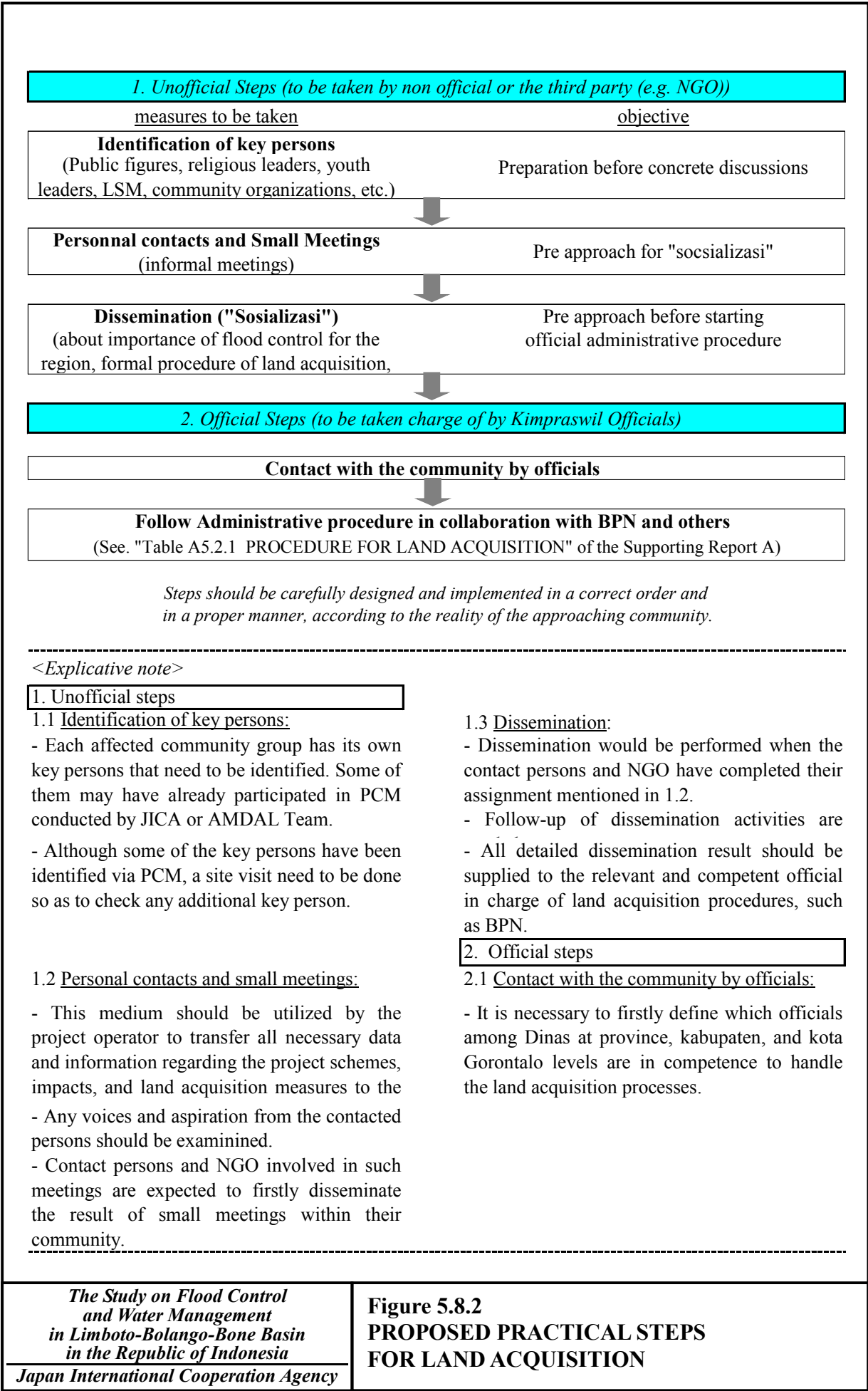








**Figure 5.8.1**  
**PROCEDURAL FLOW OF ENVIRONMENTAL  
MANAGEMENT ASSESSMENT**



Sub-Project/Activities	Year (2003 - 2019)																
	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
National Five-Year Plan																	
<b>1 Preparatory Stage</b>																	
1.1 Feasibility Study																	
1.2 Fund Arrangement																	
1.3 Definite Plan/Detail Design																	
1.4 Preservation of Lands																	
1.5 Research and Investigation																	
1.6 Coordination																	
<b>2 Intensive Implementation Stage</b>																	
Lower Bone River Improvement																	
Lower Bolango River Improvement																	
Topodu River Improvement with Topodu Gate																	
Sediment Trap Works																	
Tamalate Floodway																	
<b>3 Sustainable Implementation Stage</b>																	
Middle Bone River Improvement																	
Lower Tamalate River Improvement																	
Middle Bolango River Improvement																	
Biyonga River Improvement																	
Meluopo River Improvement																	
Marisa River Improvement																	
Alo-Pohu River Improvement																	
Rintenga River Improvement																	
East and West Dikes of Lake Limboto																	
<b>4 Watershed Management</b>																	
<b>5 Flood Plain Management</b>																	

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**Figure 5.9.1**

**IMPLEMENTATION SCHEDULE OF FM-MP**

## CHAPTER 6. CONCLUSION AND RECOMMENDATIONS

### 6.1 Conclusion

**1. Output of Study:** As a result of the Study on Flood Control and Water Management in Limboto-Bolango-Bone (LBB) Basin, flood mitigation master plan (FM-MP) was formulated based on 20-year flood and a feasibility study was conducted for the selected priority projects.

**2. FM-MP:** The FM-MP requires the total project cost of Rp.555.0 billion (US\$57.81 million or ¥7,169 million equivalent) at the fixed price as of November 2001, including direct cost, land acquisition and compensation cost, and other indirect costs. The direct cost covers those for the improvement of the Bone, Bolango and lower Tamalate, Biyonga, Meluopo, Marisa, Alo-Pohu and Rintenga rivers; construction of Tamalate floodway; and Lake Limboto management. Besides the above, the FM-MP includes the watershed and flood-plain management as non-structural components.

**3. Overall Evaluation of FM-MP:** The FM-MP was evaluated economically viable. The negative impacts to natural and social environment was evaluated to be mitigated with due considerations during project implementation. On the contrary, the FM-MP was evaluated to be valid from the viewpoints of natural and social environment.

**4. Implementation of FM-MP:** In order to activate the flood mitigation activities in the basin, implementation of the FM-MP is proposed stage-wise as follows:

- 1) Preparatory stage: Until end of 2004
- 2) Intensive implementation stage: From beginning of 2005 to end of 2009
- 3) Sustainable implementation stage: From beginning of 2010 to end of 2019

**5. Priority Projects Selected:** The following sub-projects were selected out of the FM-MP for intensive implementation:

- 1) Bone-Bolango-Tapodu (BBT) River Improvement with Tapodu Gate
- 2) Construction of Tamalate Floodway
- 3) Sediment Trap Works in Lake Limboto
- 4) Watershed Management and Flood-Plain Management

**6. BBT River Improvement Project:** The project will secure the areas along the Lower Bone, Lower Bolango and Tapodu rivers including the city of Gorontalo against

20-year flood, and alleviate flooding in the lakeside areas of Limboto by reducing peak flood levels and their durations. The project requires the total project cost of Rp.120.2 billion at fixed price basis, and the fund required for the project implementation was estimated at Rp.146.3 billion (US\$15.24 million or ¥1,891 million equivalent) including price contingency during the construction period.

**7. Tamalate Floodway Project:** The project will secure the the urban areas of Gorontalo City, diverting the flood runoff of the upper Tamalate River to the Bone River with new floodway. The project requires the total project cost of Rp.20.8 billion at fixed price basis, and the fund required for the project implementation was estimated at Rp.29.8 billion (US\$3.10 million or ¥385 million equivalent).

**8. Sediment Trap Works in Lake Limboto:** The sediment trap work aims to trap the sediment in the northern part of Lake Limboto, confining by bamboo-net fence with crest elevation of +4.0 m,MSL. These works are implemented as research works of the lake sedimentation and test-works to develop the usage of trapped sediment. The work requires the project cost of Rp.2.67 billion in total at fixed price basis, and the fund required for the project implementation was estimated at Rp.3.31 billion (US\$345,000 or ¥42.8 million equivalent).

**9. Watershed Management and Flood-Plain Management:** Besides the structural measures mentioned above, it was also proposed to start activities for the watershed management and flood-plain management as early as possible, from dissemination activities and establishment of local community organization in the pilot villages selected.

**10. Overall Evaluation of Priority Projects:** The priority projects were subjected to economic evaluation except for the sediment trap works and the watershed and flood-plain management. The BBT river improvement project and Tamalate floodway project were confirmed to yield high economic return under the future basin conditions. Sensitivity analysis endorsed the EIRR higher than 12 % even for 10 % cost over-run and 10 % benefit-shortage due to an unforeseen economic trend. The priority project was evaluated economically viable. Study for the environmental impact assessment (EIA) was conducted for the priority project, and environmental management and monitoring plans were prepared. The EIA Evaluation Committee (AMDAL Commission) of Gorontalo Province has already issued written approval on the EIA.

## 6.2 Recommendations

1. The proposed project (the Project) aims to mitigate flood damages in the most important areas of the new-born Gorontalo Province including its capital city. The Project contributes directly to enhance peoples' livelihood in the flood-prone areas. The Project is a core infrastructure to support economic development of the province. In addition, the implementation of the Project is significant to the capacity building of the relevant staff and to the arrangement of the administrative setup as well. Implementation of the Project at an early stage is recommended.
2. Considering the required fund and the budget available currently, assistance and support in and out of the province would be inevitable for the implementation of the Project. It is desirable that Gorontalo Province makes haste the administrative decision toward the implementation the Project in association with Kabupaten Gorontalo and Kota Gorontalo, so as to initiate preparatory actions for funding and coordination among the agencies concerned.
3. The Bolango River Improvement heavily depends on the storage function of the Lake Limboto, while the lake is now troubled with serious sedimentation primarily caused by deforestation in the watershed area. It is recommended to take actions as early as possible for the watershed management to conduct afforestation and regulation of deforestation, giving considerations on the enhancement of livelihood of resident peoples in watershed area.
4. The Project was evaluated to be valid from natural and social environment aspects. The evaluation is yes, provided that (1) the watershed management would be carried out strictly, and (2) management and monitoring regarding the water environment of Lake Limboto would be conducted appropriately in sustainable manner.