③ Wash-out

The wash-out is sited at 7 locations, and it is a set of a sluice valve on drain pipe and a gate valve on distribution pipe. The direction and length of the drain pipe is subject to drainage channel/river. The set of valves are designed to be encased in concrete chamber as shown in the Figure 1.2.8.

③ Fire Hydrant

The fire hydrants are decided to be installed at 10 locations. As shown in Figure 1.2.9 the hydrants are supported by concrete blocks with K 250.

④ Standpipes

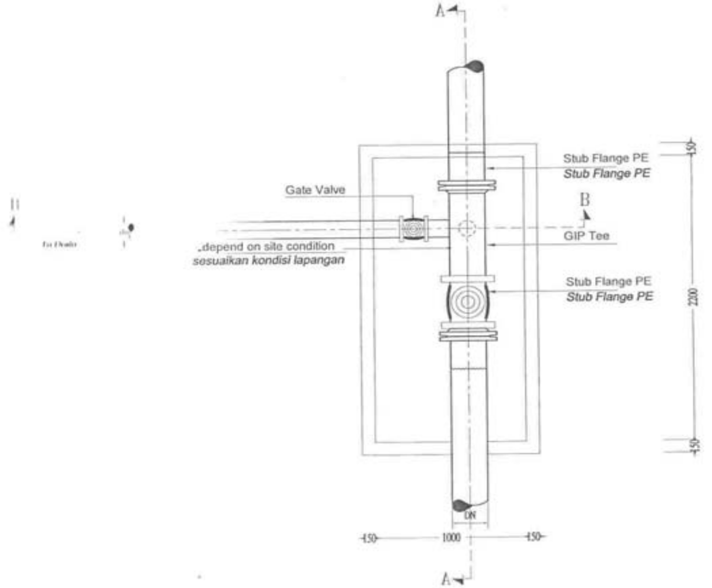
Typical drawing of stand pipe is as shown in Figure 1.2.10.

⑤ Pipe Bridges

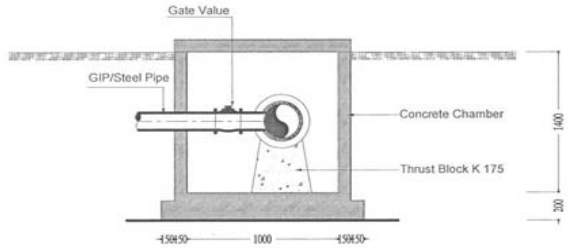
New secondary pipeline passing through Zones 1 and 4 crosses small river/drainage channel at four (4) locations as shown in Figure 1.2.3. For such crossing points, it is necessary to construct either pipe bridge or under-crossing structure. It is proposed that such structure be realized on a basis of design-built method by the contractor to be procured, and accordingly the bid documents sets forth such items in the bill of quantities.

1.3 DESIGN DRAWINGS

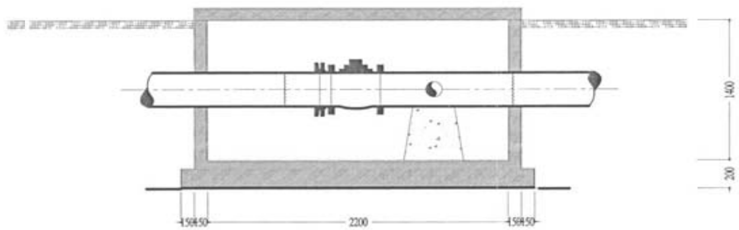
In total 55 drawings are prepared as Technical Documents as shown in Table 1.3.1.



PLAN
DENAH



PROFILE B-B
POTONGAN B-B



PROFILE A-A
POTONGAN A-A

TYPE	APPLICABLE DIAMETER	
	DISTRIBUTION DN	OUTLET DIMENSION
A	300, 200	100
B	200, 100	50

LIST OF FITTING AND ACCESSORIES

NO	FITTING/ACC	VOLUME
1	GIP/Steel Pipe	1 Unit
2	Flange (GIP)	2 Unit
3	Gate Valve	2 Unit
4	GIP Tee	1 Unit
5	Stub Flange PE	2 Unit

Note : The contractor shall determine appropriate location of the wash out in due consideration of site condition, the location of which shall be subject to approval of the engineer

Figure 1.2.8 Typical Washout Valve Chamber

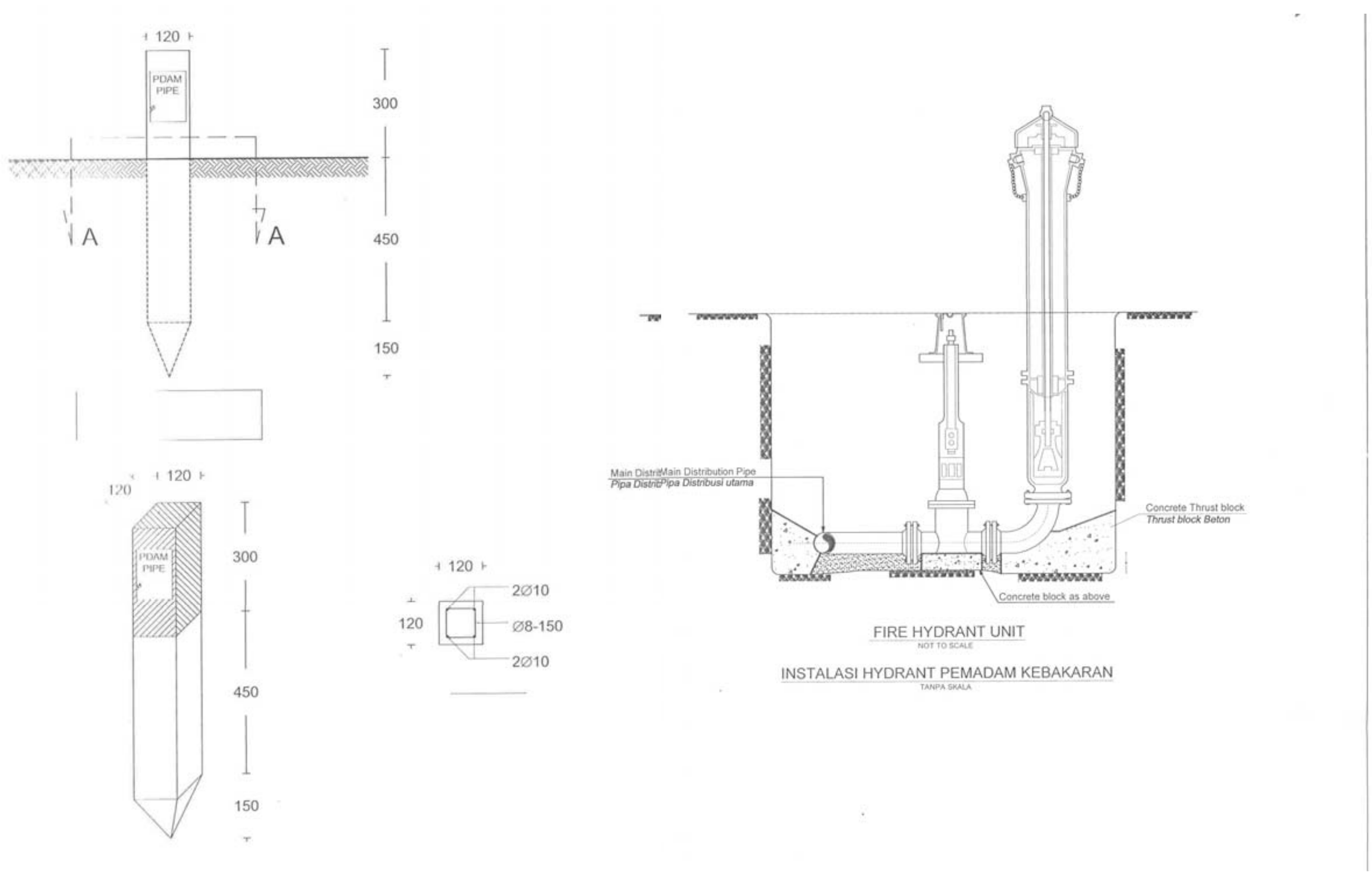


Figure 1.2.9 Fire Hydrant and Pipe Marking Post

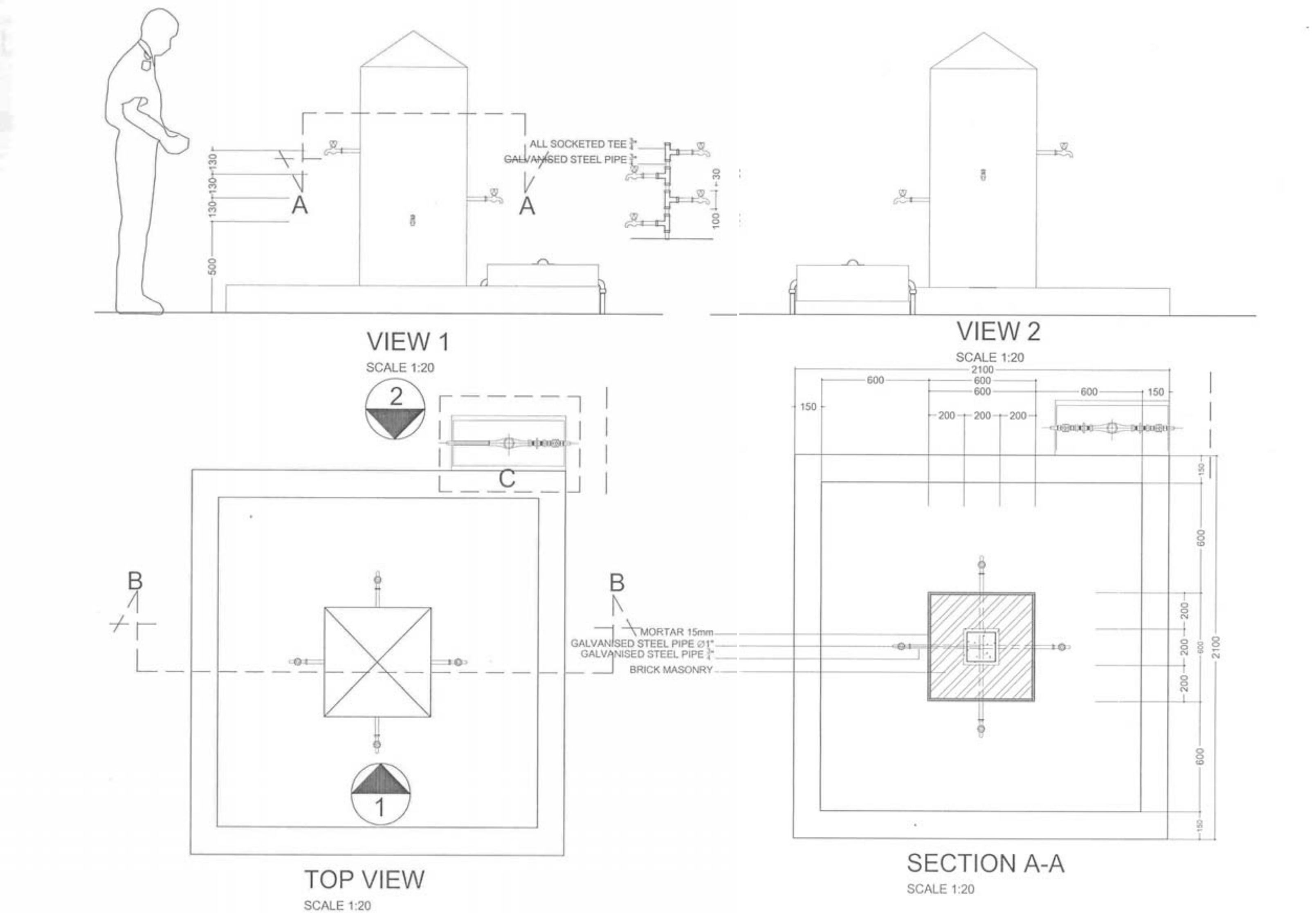


Figure 1.2.10 Public Stand Pipe

Table 1.3.1 List of Design Drawings

PLATE No.	DWG No.	DWG Title
A. GENERAL		
001	GN_010	PROJECT LOCATION MAP
002	GN_020	WATER SUPPLY DISTRIBUTION NETWORK PLAN
B. WATER SUPPLY DISTRIBUTION PIPELINE		
003	DP_010	KEY MAP
004	DP_020	PIPE ID TABLE
005	DP_030	DISTRIBUTION PIPELINE PLAN (01)
006	DP_040	DISTRIBUTION PIPELINE PLAN (02)
007	DP_050	DISTRIBUTION PIPELINE PLAN (03)
008	DP_060	DISTRIBUTION PIPELINE PLAN (04)
009	DP_070	DISTRIBUTION PIPELINE PLAN (05)
010	DP_080	DISTRIBUTION PIPELINE PLAN (06)
011	DP_090	DISTRIBUTION PIPELINE PLAN (07)
012	DP_100	DISTRIBUTION PIPELINE PLAN (08)
013	DP_110	DISTRIBUTION PIPELINE PLAN (09)
014	DP_120	DISTRIBUTION PIPELINE PLAN (10)
015	DP_130	DISTRIBUTION PIPELINE PLAN (11)
016	DP_140	DISTRIBUTION PIPELINE PLAN (12)
017	DP_150	DISTRIBUTION PIPELINE PLAN (13)
018	DP_160	DISTRIBUTION PIPELINE PLAN (14)
019	DP_170	DISTRIBUTION PIPELINE PLAN (15)
020	DP_180	DISTRIBUTION PIPELINE PLAN (16)
021	DP_190	DISTRIBUTION PIPELINE PLAN (17)
022	DP_200	DISTRIBUTION PIPELINE PLAN (18)
023	DP_210	DISTRIBUTION PIPELINE PLAN (19)
024	DP_220	DISTRIBUTION PIPELINE PLAN (20)
025	DP_230	DISTRIBUTION PIPELINE PLAN (21)
026	DP_240	DISTRIBUTION PIPELINE PLAN (22)
027	DP_250	DISTRIBUTION PIPELINE PLAN (23)
028	DP_260	DISTRIBUTION PIPELINE PLAN (24)
029	DP_270	DISTRIBUTION PIPELINE PLAN (25)
030	DP_280	DISTRIBUTION PIPELINE PLAN (26)
031	DP_290	DISTRIBUTION PIPELINE PLAN (27)
032	DP_300	DISTRIBUTION PIPELINE PLAN (28)
033	DP_310	DISTRIBUTION PIPELINE PLAN (29)
034	DP_320	DISTRIBUTION PIPELINE PLAN (30)
035	DP_330	DISTRIBUTION PIPELINE PLAN (31)
036	DP_340	DISTRIBUTION PIPELINE PLAN (32)
037	DP_350	DISTRIBUTION PIPELINE PLAN (33)
038	DP_360	DISTRIBUTION PIPELINE PLAN (34)
039	DP_370	DISTRIBUTION PIPELINE PLAN (35)
040	DP_380	DISTRIBUTION PIPELINE PLAN (36)
041	DP_390	DISTRIBUTION PIPELINE PLAN (37)
042	DP_400	DISTRIBUTION PIPELINE PLAN (38)
043	DP_410	DISTRIBUTION PIPELINE PLAN (39)
044	DP_420	DISTRIBUTION PIPELINE PLAN (40)
045	DP_430	DISTRIBUTION PIPELINE PLAN (41)
C. ASSOCIATED STRUCTURES		
046	AS_010	PIPE LAYING
047	AS_020	THRUST BLOCK FOR TEE, REDUCER AND END CUP
048	AS_030	THRUST BLOCK FOR BEND AND FUTURE CONNECTION
049	AS_040	TYPICAL BOX CULVERT CROSSING
050	AS_050	AIR VALVE CHAMBER
051	AS_060	WASHOUT VALVE CHAMBER
052	AS_070	GATE VALVE AND WATER METER CHAMBER
053	AS_080	FIRE HYDRANT AND PIPE MARKING POST
054	AS_090	HOUSE CONNECTION AND FUTURE CONNECTION
055	AS_100	PUBLIC STAND PIPE

1.4 COST ESTIMATE

Direct construction cost of the restoration works is estimated at the price level of July 2005 as given in Table 1.4.1. It should be noted that the cost does not include general expenses such as cost for performance and bid securities, insurance, mobilization and demobilization, etc.

Table 1.4.1 Estimated Construction Cost

Items	Description	Amount
A	**PREPARATORY WORKS**	**340,500,000**
A.1	Mobilization	25,000,000
A.2	Demobilization	25,000,000
A.3	Preparation and submission of monthly reports including photos	3,500,000
A.4	Preparation and submission of Video Record	10,000,000
A.5	Pipe factory inspection by PDAM staff (4 person)	36,000,000
A.6	Provision, operation and maintenance of the Engineers office,	24,000,000
	fully furnished as per specification	
A.7	Preparation and submission of working drawings and as-built drawings	15,000,000
A.8	Provision of temporary works	30,000,000
A.9	Provision and removal of safety equipment, light and first aid kit	12,000,000
A.10	Exploratory Boring	160,000,000
B	**CONSTRUCTION OF DISTRIBUTION PIPELINES FOR ZONE-1**	**13,207,633,400**
B.1	Supply of Pipe Materials	9,605,605,000
B.2	Installation of Pipelines	1,632,395,000
B.3	Supply and Installation of Valves, Water Meters and Fire Hydrants	525,940,600
B.4	Supply and Installation of Pipe Marks	7,692,800
B.5	Construction of Pipe Bridges	1,436,000,000
C	**CONSTRUCTION OF DISTRIBUTION PIPELINES FOR ZONE-2**	**10,864,160,900**
C.1	Supply of Pipe Materials	5,761,394,000
C.2	Installation of Pipelines	2,511,698,000
C.3	Supply and Installation of Valves, Water Meter, Fire Hydrants, Public Stand Pipes and House Connections	2,574,240,900
C.4	Supply and Installation of Pipe Marks	16,828,000
D	**CONSTRUCTION OF DISTRIBUTION PIPELINES FOR ZONE-3**	**12,125,834,500**
D.1	Supply of Pipe Materials	7,610,053,000
D.2	Installation of Pipelines	3,650,058,000
D.3	Supply and Installation of Valves, Water Meter, Fire Hydrants, Public Stand Pipes and House Connections	839,039,100
D.4	Supply and Installation of Pipe Marks	26,684,400
E	**CONSTRUCTION OF DISTRIBUTION PIPELINES FOR ZONE-4**	**8,012,109,800**
E.1	Supply of Pipe Materials	5,367,498,000
E.2	Installation of Pipelines	1,948,392,000
E.3	Supply and Installation of Valves, Water Meter, Fire Hydrants and House Connections	682,997,800
E.4	Supply and Installation of Pipe Marks	13,222,000
	TOTAL	**44,550,238,600**

CHAPTER 2 PREPARATION OF TECHNICAL REPORT

2.1 TENDER CONDITION

2.1.1 Source of Funds

The Government of Indonesia has received from the Government of Japan a Grant Aid amounting to Fourteen Billion Six Hundred Million Japanese Yen (Yen 14,600,000,000) as per Exchanged Note dated on January 17, 2005, for the purchase of products and services necessary for the execution of Program by the Government of Indonesia for Efforts to cope with the Damages caused by the Great Earthquake of the Coast of Sumatra, and by the Indian Ocean Tsunami Disaster which includes the Project.

Under this program, the Japan International Cooperation System (JICS) acts as an implementing agency for and on behalf of the Government of Indonesia in accordance with the Exchange of Notes.

2.1.2 Mode of Tender

The Contractor for construction will be procured through international competitive bidding which will be executed by JICS.

The contract is presumed to be unit price contract with bill of quantities.

2.2 TECHNICAL REPORT

The tender documents will comprise three (3) volumes as listed up hereunder:

(1) VOLUME I	Section 1	Invitation for Bids
	Section 2	Instructions to Bidders
	Section 3	Bid Data
	Section 4	Bill of Quantities
	Section 5	Forms, Annexes and Enclosures
	Section 6	Conditions of Contract
	Part I:	General Conditions of Contract
	Part II:	Conditions of Particular Application
	Part III:	Appendix to Bid
(2) VOLUME II	Section 7	Technical Specifications
(3) VOLUME III	Section 8	Drawings

JICA Study Team has produced Volumes II: Technical Specifications and III: Drawings as Technical Report.

APPENDIX 3

EMERGENCY REPAIR WORKS OF ACEH RIVER AND FLOODWAY UNDER JAPAN'S NON-PROJECT TYPE GRANT AID

APPENDIX-3: EMERGENCY REPAIR WORKS OF THE ACEH RIVER AND FLOODWAY UNDER JAPAN'S NON-PROJECT TYPE GRAND AID

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CHAPTER 1   DESIGN WORKS AND COST ESTIMATE

1.1 DESIGN CONDITIONS

1.1.1 Background

The earthquake and subsequent Tsunami caused various and serious damages on basic infrastructure. Dykes along the Aceh River and its tributaries are one of very important infrastructure and in fact protect the Banda Aceh City from flooding and inundation during high tide season. Parts of them were swept away or cracked or collapsed at many locations owing to the earthquake and Tsunami, and as subsequence the areas along such parts are submerged and/or subject to inundation frequently.

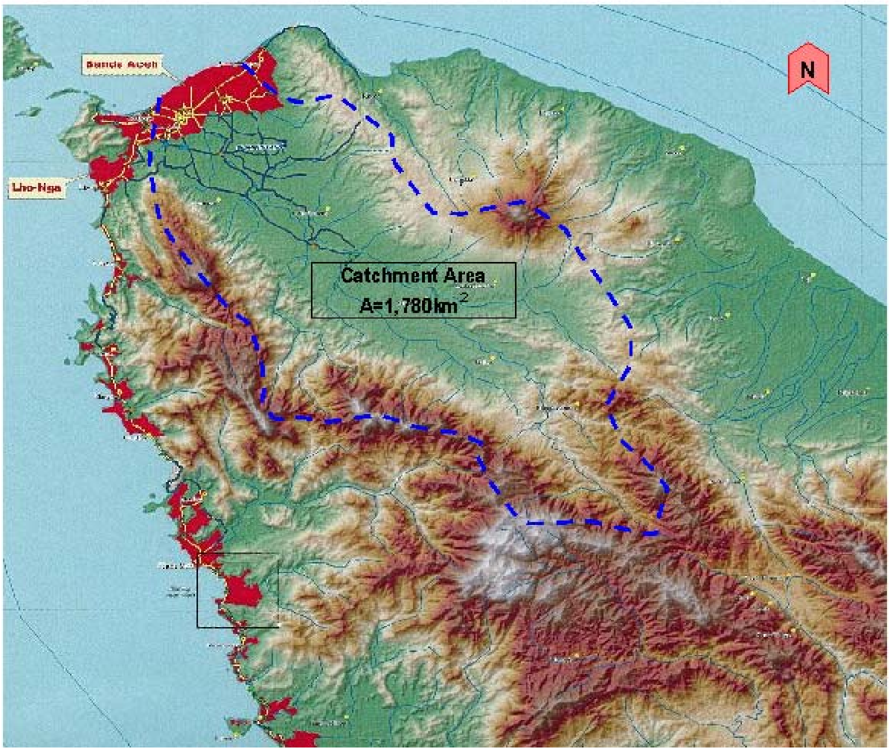


Figure 1.1.1   Aceh River River Basin

The Aceh River River has a catchments area of 1,780 km^2 with a length of 145 km. It takes its origin at Seulawah Mountains and runs to the north into the Strait of Malacca. Its drainage area includes Banda Aceh City and eleven (11) Kecamatan in the Kabupaten Aceh Besar, namely Masjid Raya Darul Imarah, Ingin Jaya, Kota Baro, Montasik, Sukamakmur, Indrapuri, Darussalam, Seulimum Kampung Jawa, and Kopelma Darussalam.

In 1993, the Aceh River Flood Control Project has been completed by the Government of Republic of Indonesia with financial assistance from Overseas Economic Cooperation Fund (OECF, now the Japan Bank for International Cooperation). The purpose of the Project was to secure the Banda Aceh City from habitual flooding.

Selected Emergency Repair Work of the Floodway Dyke in Aceh (the Project) is one of 13 Quick Impact Projects and to be implemented under Non-Project Type Grant Aid Program of GOJ. The Project aims at repairing the damaged dyke to the pre-disaster situation in principle. For its actual implementation, GOI appointed the Japan International Cooperation System (JICS).

1.1.2 Natural Condition of the Project Area

(1) Geological conditions

The Aceh River river basin is underlain by considerable thicknesses of quaternary and recent sediment. These consist mainly of sand and clay with occasional gravel which are intervener throughout with thin layers of volcanic tuffs and ashes. The river channel from the estuary to Indrapuri cuts through sedimental alluvium. The southeastern end of the river basin between Indrapuri and Seulimum is an area of the Pleistocene gravel terraces rising up to 20 m above the valley level. These are old river gravels and sands which have been preserved due to uplift and base level changes.

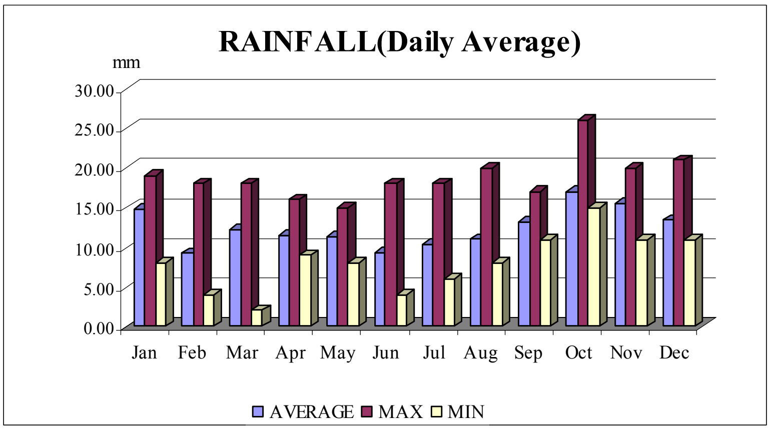
The present Aceh River river is for much of its length incised to a depth of 10 to 15 m below the flat valley floor indicating minor rejuvenation. Top soils and subsoil vary from gravels in the upper parts of the area to sand and clay in the lower parts of area.

(2) Climate

In the project area, there is no distinct dry and wet season. It rains throughout the year but has two periods with higher rainfall; the heaviest rainy period is from October to January and other period peaks in April or May.

(a) Rainfall

The mean annual rainfall in the Aceh River river basin is estimated at 1,648 mm. The average daily rainfall is as shown in Figure 1.1.2.

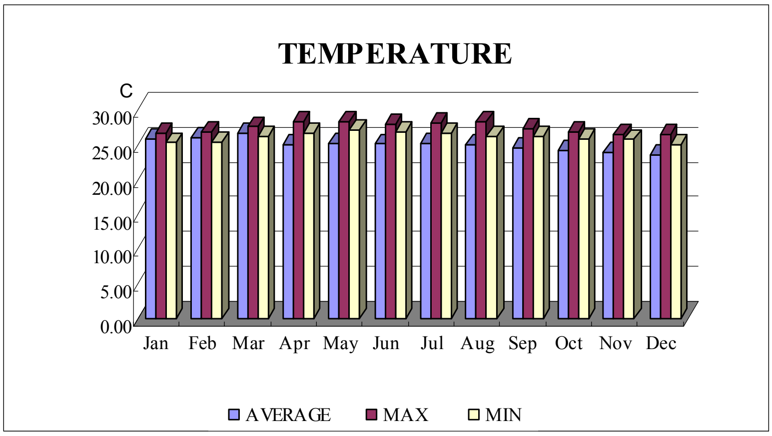


Source : Meteorological Station Blang bintang, Banda Acehh.

Figure 1.1.2 Rainfall (1994 – 2004)

(b) Air temperature

Mean monthly temperature remains relatively stable from 24 °C to 27 °C throughout the year as shown in Figure 1.1.3

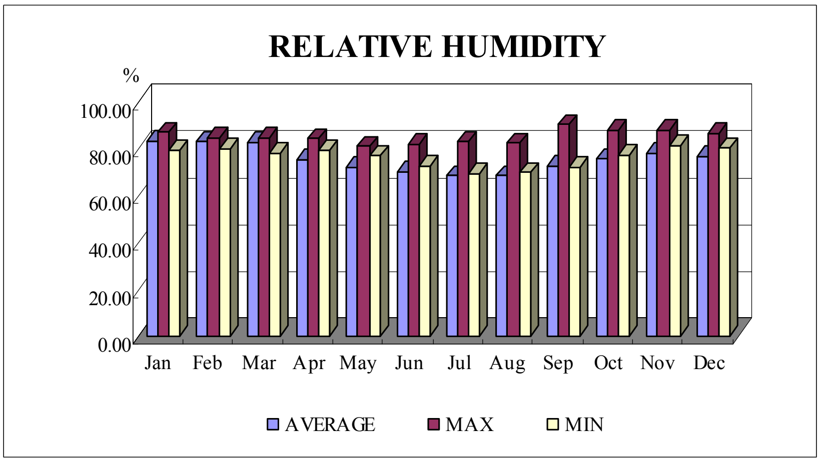


Source : Meteorological Station Blang Bintang, Banda Aceh.

Figure 1.1.3 Temperature (1994 – 2004)

(c) Relative humidity

Relative humidity normally fluctuates between 70 % and 80 % as shown in Figure 1.1.4.

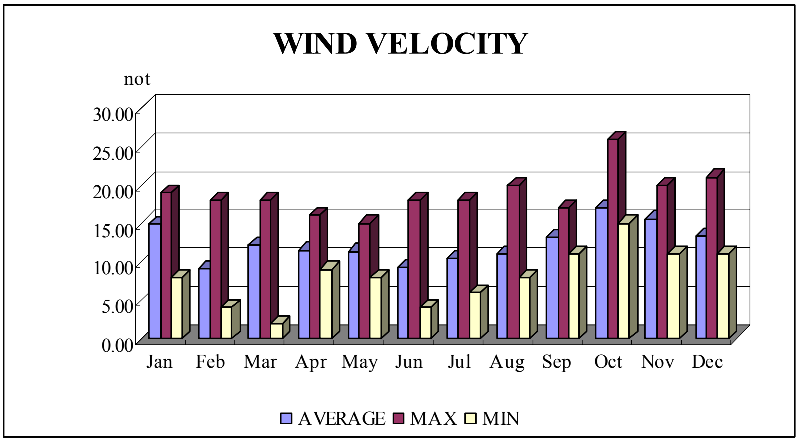


Source : Meteorological Station Blang bintang, Banda Acehh.

Figure 1.1.4 Relative Humidity (1994 – 2004)

(d) Wind velocity

Wind velocity is not very high. At the Sultan Iskandar Muda, the mean annual wind velocity is 2.8 m/s with a mean maximum wind velocity of 9.6 m/s as shown in Figure 1.1.5.



Source : Meteorological Station Blang bintang, Banda Acehh.

Figure 1.1.5 Wind Velocity (1994 – 2004)

(3) Hydrology

(a) River flow

The annual mean discharge of the Aceh River is 18.5 m^3/s at Seulimum which has a drainage area of 418 km^2.

(b) Riverbed materials

River bed materials vary from gravel in the upper reaches to clay and sands at the lower reaches.

1.1.3 Sources of Construction Materials

In general all construction materials such as earth material for embankment, fine and course aggregates for concrete, sand and gravels for road paving, cement, reinforcement bars, and fuel and oil products are available locally.

Concrete aggregates, materials for road paving and cobble or rubble stones for masonry, rip-rap and gabion works are available from Indrapuri, Lhong, Tanjung, Ujung Batee, and Blang Bintang.

1.1.4 Access to Site

Access to the Site is available by air, seaport, and road. The airport is located in Kab. Aceh Besar adjacent to the Banda Aceh city. The seaport is located at Malahayati, about 34 km from Banda Aceh city. An asphalt-paved road with a width of about 6 m (hereinafter referred to “the trunk road“) runs thought Banda Aceh city across the Project site. Many rural macadam-paved roads branching from the trunk road are also available as access to the Site.

1.2 DETAIL DESIGN

1.2.1 Basic Design Concept

The Project aims at repairing the damaged dykes to their original situation urgently in order to protect the city area from flooding and high tide. With implementation of the Project the present inundation areas will be secured and contribute to return of affected people and other development activities. Prior to commencement of the design works, the JICA Study Team made a number of discussions about repairing/rehabilitation concepts with the Indonesian counterpart agency concerned. As a result the following design policies were established:

① In view of urgent completion of the Project, the design should pay utmost attention to speedy and easy construction works. In view of creating job opportunity for Acehnese people, the construction works should be within capability of the local contractors

② In view of sustainability, the design should regard to easy maintenance and repair after completion of construction works.

③ In view of financial aspect, the design should consider the available budget and maximum use of construction materials locally.

1.2.2 Determination of Project Component

The Project components had been determined in due consideration of the requests of the Indonesian counterpart agency, urgency, condition prevailing at the Site and damaged structures, foreseen rehabilitation works and its volume, required construction period, etc. The Indonesian counterpart agency at first made very large scale rehabilitation works with 10 separate contract packages as depicted in Figure 1.2.1.

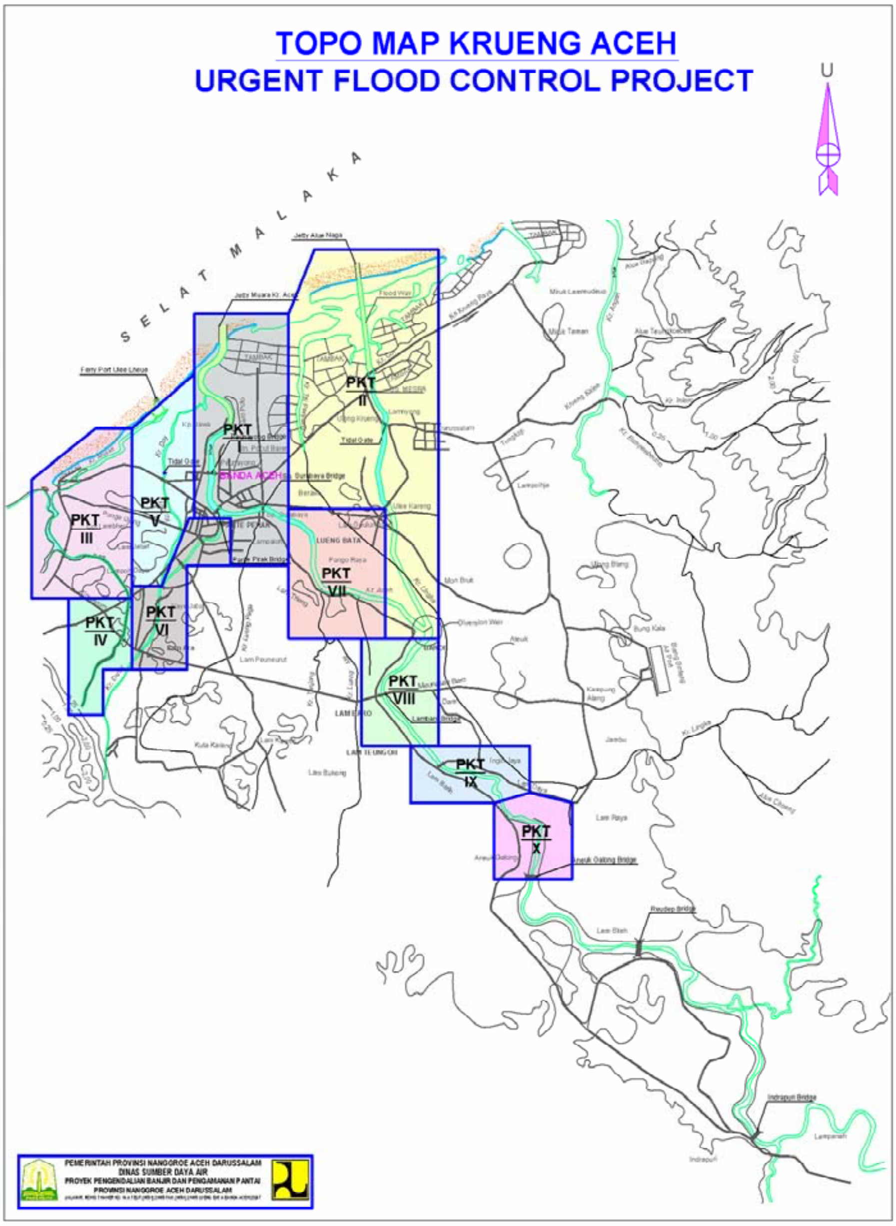


Figure 1.2.1 Initial Proposal for the Project Component

The above request is however considered to be beyond magnitude of non-project type grant aid program of GOJ in terms of cost to be incurred and includes dykes which are deemed not to be required urgent rehabilitation. The JICA Study Team then conducted detailed survey and study to determine scope of the Project.

(1) River Reach affected by Earthquake and Tsunami

On a basis of degree of damages, it is assessed that dykes along the following river reach are identified affected by earthquake and tsunami:

① Aceh River, from estuary up to border of the Banda Aceh City

② Aceh River Floodway, from estuary up to border of the Banda Aceh City (3rd Bridge)

③ Doy River, from the tide gate to confluence with the Daroy river

④ Neng River, from estuary to JL Soekarno Hatta

⑤ Daroy River, from connecting point of the Aceh River to JL Soekarno Hatta.

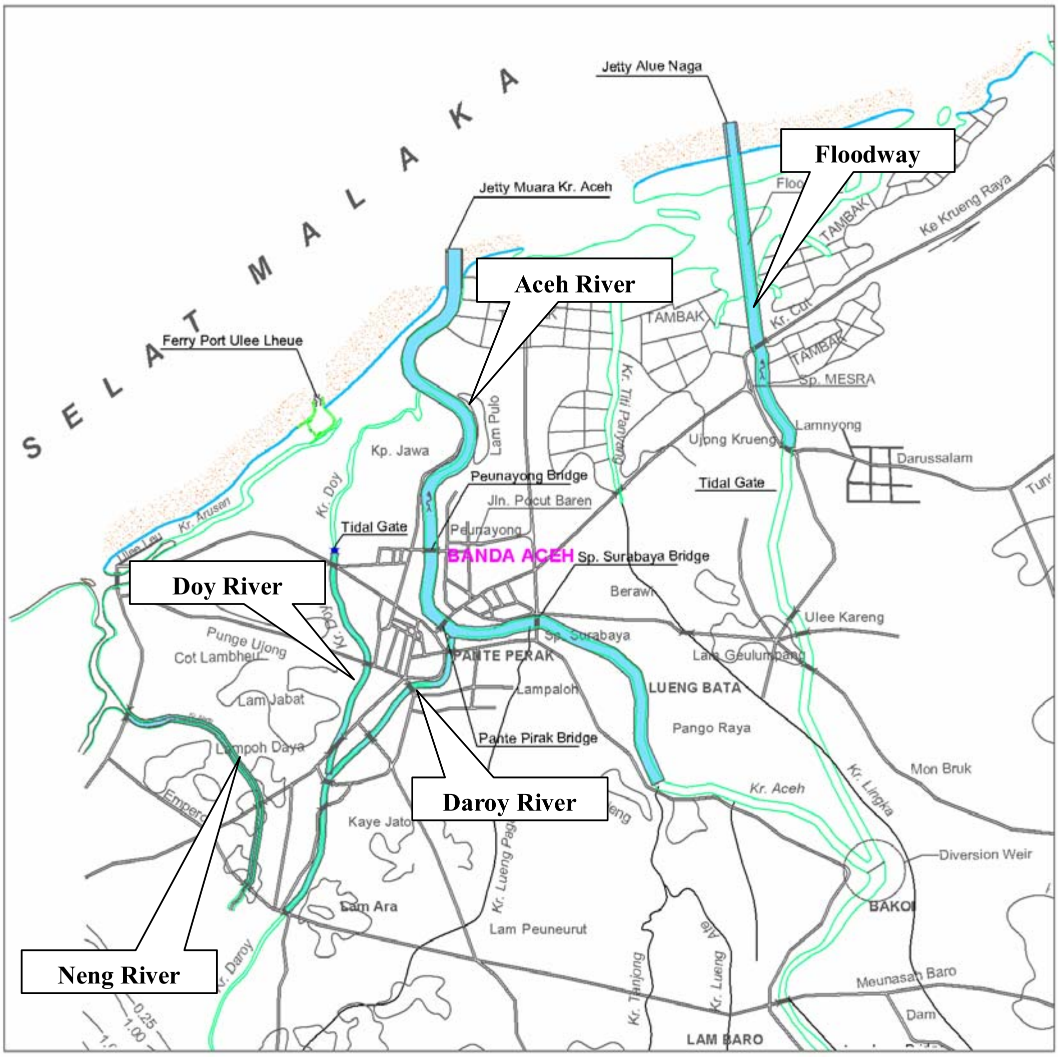


Figure 1.2.2 1st Selected River Reach for Rehabilitation under the Project

(2) Damage Assessments

The JICA Study Team had also conducted a damage survey of existing dykes along the above identified river reaches in order to assess degree of damages and thereby determine urgency and nature of rehabilitation works to be required. For this purpose topographic survey along the rivers were carried out not only covering the above ground surface but also under the water surfaces. Based on the results of the survey, conditions of existing dykes and river channel are found to be as follows:

(a) Aceh River

From estuary (No.0-50) to Peunayoung Bridge (No.17), some serious damages on revetment are found out and the area behind the section is fairly populated. Most serious damage section is around Lampulo where parapet walls and road pavement have been destroyed for a length more than 350m. In addition, some sunken ships are located in the river channel.

From Peunayoung Bridge (No.17) to Surabaya Bridge (No.27+50), there are also damages on the low water revetments. However degree of damage appears to be not serious compared to the downstream section. It is likely that the damaged structure sustains under the normal climatologic and hydrologic conditions..

For upstream section from Surabaya Bridge, minor damages are found out on dykes. It is likely that such damage is not due to the Tsumani but lasted for long before. Deposit of sedimentation is observed throughout the sections

(b) Floodway

From estuary (No.0-100) to Krueng Cut Bridge (No.11+100), dykes on both banks have been washed away from place to place and also damages on revetment are seen on both banks for a length more than 1,200m.

From Krueng Cut Bridge (No.11+100) to Lamnyong Bridge (No.19+50), damages on concrete revetment are seen from place to place. Deposit of small debris is observed in the channel of the river.

On the drainage canal located on LHS of the Floodway, there are erosions in toe of slopes which appears to be still developing.

(c) Doy River

There are two serious damaged sections; first section is from estuary (No.0-50) to the second bridge (No.7) and second section is after the JL.Teuku Umar (No13+50). In the first section, parapet walls have been washed away for a length of approximately 50m, while in the second section, joint of revetment blocks have developed a large gap in many areas. It is probable such blocks fall down in time, resulting in causing erosion of earth embankment.

Along the rest of sections, there are such minor damages as cracks on revetments and lack of flap gate. Such damages are judged to be not serious and require no urgent rehabilitation.

(d) Neng River

Around the Bridge on the JL.Teuku Umar, there are damages on revetment. A suspension bridge has been destroyed which was located on the mid point between estuary and JL.Teuku Umar.

(e) Daroy River

There is no serious damage for the entire reach excepting some minor damage such as missing of flap gates and cracks on the revetments. However according to Satellite images taken just after the disaster, a huge amount of debris are seen, indicating deposit or sedimentation in the channel

It is considered to be important that the urgency and importance of rehabilitation requirements be assessed not only from technical point of view but also from social aspects such as social effects and the number of population to be secured after rehabilitation works, etc.

(2) Selected Project Component

On the basis of the GOI's requests, first selection and damage survey, the components of the Project are finally determined as shown in Fig 1.2.3.

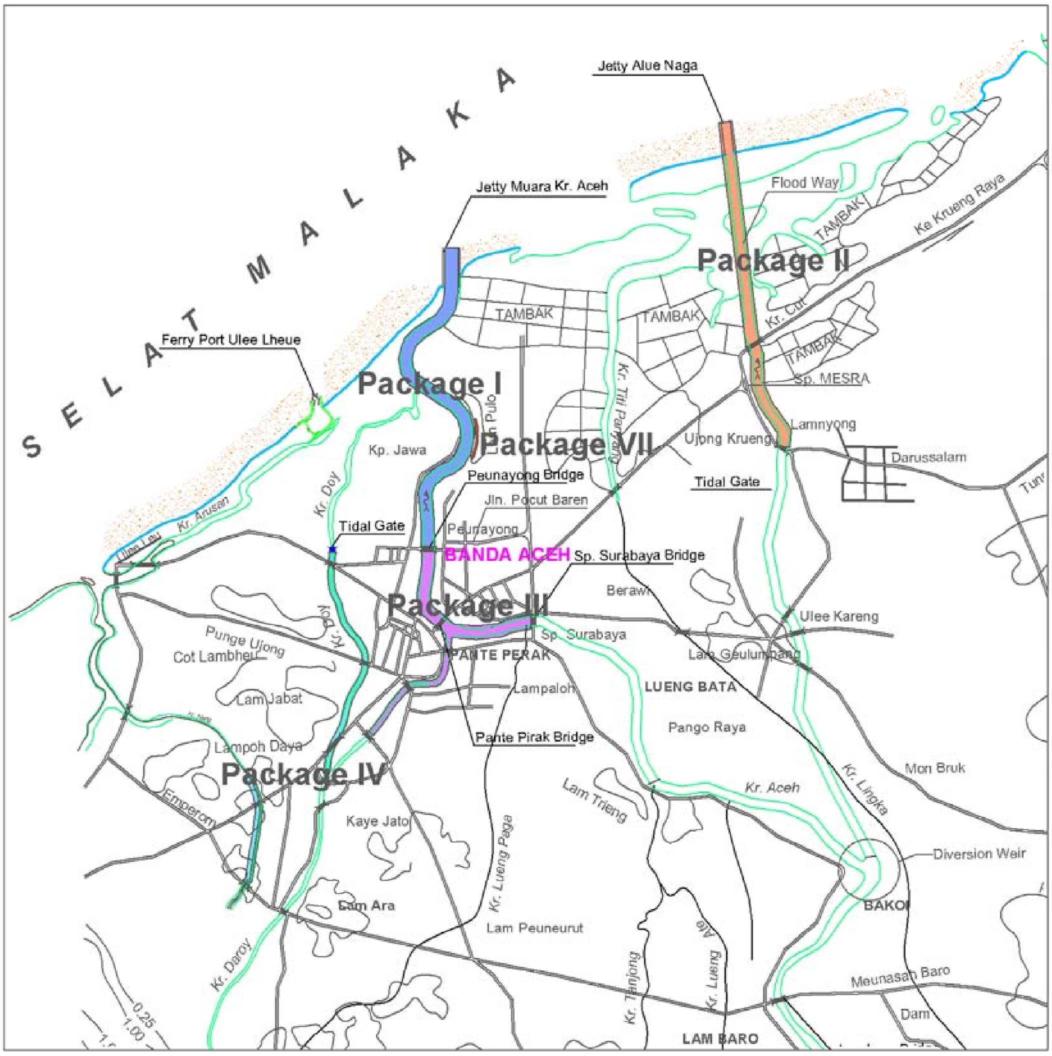


Figure 1.2.3 Summary of Project Components

As shown in the above figure the Project is proposed to be realized in five (5) separate contact packages in order to expedite and complete the construction works in a period shortest as possible in view of urgency.

Package I: Rehabilitation of Dykes and Revetments from Estuary to Peunayong Bridge (L=3,450m) and Dredging from Estuary to Lampulo (L=1,450m) on **Aceh River**

Package II: Rehabilitation of Dykes and Revetments from Estuary to Lamnyong Bridge (L=3,950m) and Normalization from Estuary to Krueng Cut Bridge (L=2,400m) on **Floodway**

Package III: Rehabilitation of Revetments and Normalization from Peunayong Bridge to Surabaya Bridge (L=2,050m) on **Aceh River**, and Normalization for **Daroy River** (L=1,516m)

Package IV: Rehabilitation of Revetments and Normalization for **Doy River** (L=3,050m) and **Neng River** (L=1,512m)

Package VII: Rehabilitation of Revetments around Lampulo on **Aceh River** (L=360m)

*Package V&VI were not used

The Project was divided into five packages; they were established by work areas with exception of the Package VII. The intention of introduction of the Package VII, originally the work at Package VII was included in Package I, however, as a result of discussion of GOI and GOJ of May 17th, 2005, was to start construction bt the middle of July 2005 was to activate the project smoothly and quickly because the project area was identified as most dangerous and important, when the existing situation would remain during next rainy season, another disaster might come for the area so quick response was necessary.

1.2.3 Engineering Design

(1) Design Discharge and Hydraulic Criteria

As noted in Section 1.1, the Aceh River Flood Control Project (KAFCP) was completed in 1993. The contemplated Project is determined in context of design criteria and data of the said project and basic design parameters are obtained as summarized below:

- Design drainage area: 1,780 km^2
- Design Flow : 1,300 m3/sec, having a return period of 5 years
- Distribution of flow: As per Figure 1.2.4
- Design water level at estuary: EL + 0.7 m i.e. mean high tide level
- Design freeboard: 1.0m from Estuary to Bakoi
- Slope of riverbed: 1/3,000

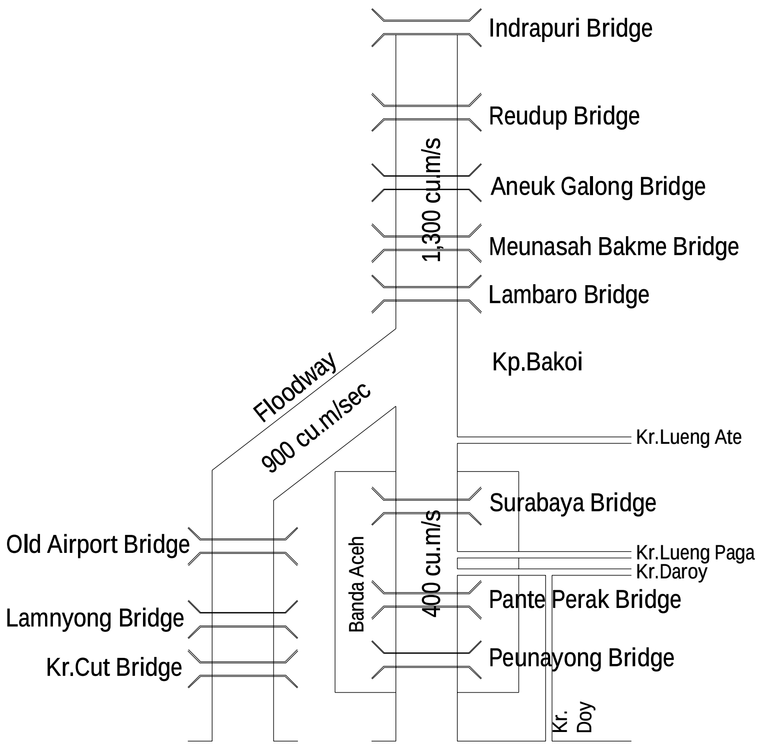
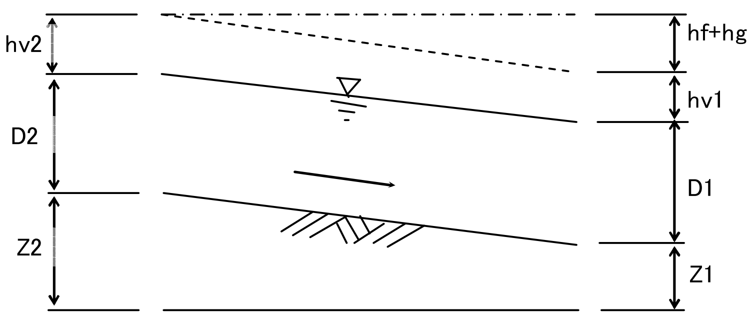


Figure 1.2.4 Discharge Distribution for Aceh River

(1) Hydraulic formula to be adopted

The hydraulic design of river channel is based on the following equation:



$$Z1+D1+hv1+hf+hg = Z2+D2+hv2$$

Where,

Z: depth from base line to bottom of canal (m)

D: water depth (m)

hv: velocity head (m)

hf: friction loss between two points(m)

hg: other head losses between two points (m)

$hv1= v1^2 / 2g \quad x\ \alpha \qquad V1=Q / A1$

$hv2= v2^2 / 2g \quad x\ \alpha \qquad V1=Q / A2$

Where:
A: flow area (sq.m)
Q: discharge (cu.m/sec)
P: wetted perimeter (m)
R: hydraulic mean depth (m)
n: roughness coefficient
α: correction coefficient of average velocity
L: section length (m)

hg= hgc + hge + hsc + hse + hgk
where,
hgc (gradual decrease of cross sectional area) : $0.2 \times (v1^2 / 2g - v2^2 / 2g)$
hge (gradual increase of cross sectional area) : $0.2 \times (v2^2 / 2g - v1^2 / 2g)$
hsc (rapid decrease of cross sectional area): $\{0.4857\text{-}0.4857x(A1/A2)\}/ v1^2 / 2g$
hse (raipd increase of cross sectional area): $(1\text{-}A1/A2)^2 \times v1^2 / 2g$
hgk (given coefficient;K2): $K2 \times v1^2 / 2g$

$F=\{Q^2 xT/g \times A^3\}^{1/2}$
where
F: Froude number
T: width of water surface (m)
g: gravity of acceleration 9.8

(2) Hydraulic design for River Improvement of Aceh River

Hydraulic design is conducted only for the Aceh River between the estuary and the Peunayong, since this river reach requires improvement of river channel. The other river reach involves only rehabilitation of revetments to the pre-disaster situation.

1) Analysis of channel capacity of Aceh River under existing condition

In order to determine quantity of channel improvement works of Aceh River between the estuary and Peunayong Bridge, discharge capacity of channel under existing condition was analyzed for the respective section. The results of the analysis are as presented in Figure.1.2.5 and Table 1.2.1

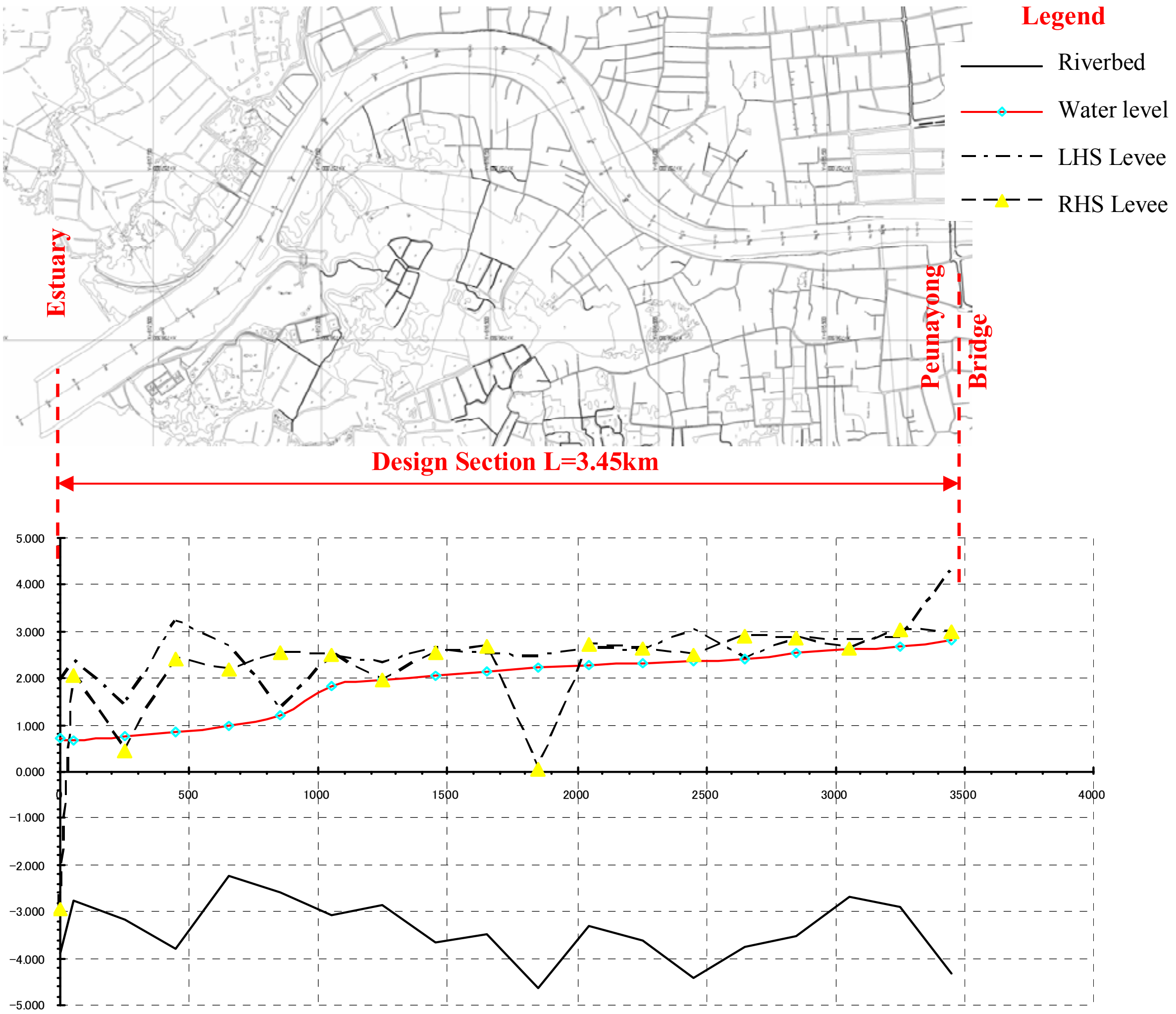


Figure 1.2.5 Profile of Aceh River under Present Condition

Table 1.2.1 Discharge Capacity of Aceh River under Present Condition

Chainage	Section Distance (m)	Accumulative Distance (m)	Riiverbed Level (m)	Water Level A (m)	LHS Levee Level (m)	RHS Levee Level (m)	Lower Levee Level B (m)	B-A (m)	Remarks
No.0-50	0.000	0	-3.898	0.700	1.925	-2.958	-2.958	-3.658	
No.0	50.000	50	-2.764	0.687	2.359	2.051	2.051	1.364	
No.1	200.000	250	-3.181	0.776	1.379	0.465	0.465	-0.311	
No.2	200.000	450	-3.809	0.853	3.196	2.425	2.425	1.572	
No.3	200.000	650	-2.222	1.002	2.679	2.197	2.197	1.195	
No.4	200.000	850	-2.604	1.193	1.358	2.541	1.358	0.165	
No.5	200.000	1050	-3.072	1.831	2.469	2.508	2.469	0.638	
No.6	200.000	1250	-2.836	1.958	2.326	1.983	1.983	0.025	
No.7	200.000	1450	-3.641	2.068	2.614	2.550	2.550	0.482	
No.8	200.000	1650	-3.470	2.153	2.511	2.667	2.511	0.358	
No.9	200.000	1850	-4.634	2.232	2.443	0.037	0.037	-2.195	
No.10	200.000	2050	-3.290	2.281	2.634	2.741	2.634	0.353	
No.11	200.000	2250	-3.614	2.328	2.575	2.656	2.575	0.247	
No.12	200.000	2450	-4.414	2.375	3.014	2.522	2.522	0.147	
No.13	200.000	2650	-3.767	2.432	2.411	2.896	2.411	-0.021	
No.14	200.000	2850	-3.520	2.525	2.863	2.863	2.863	0.338	
No.15	200.000	3050	-2.689	2.613	2.833	2.645	2.645	0.032	
No.16	200.000	3250	-2.889	2.693	2.856	3.026	2.856	0.163	
No.17	200.000	3450	-4.324	2.793	4.308	2.995	2.995	0.202	Peunayong Bridge

As shown in the above, the computed water level exceeds the crown of the existing levees in a couple of sections, meaning overflow of design discharge, and freeboard are less than required almost for entire reach. It is therefore required to execute dredging of riverbed and/or heightening levees. The dredging is considered to be most appropriate as there have been accumulation of sediment and a couple of sunken fishing boats in the river bed.

2) Design of channel improvement work for Aceh River

The above result implies that, if the dredging is proposed to be carried out for a full length between the estuary and Puenayong, there would be a huge amount of river improvement volume which may not be completed within a single dry season. The river improvement work is therefore studied for two (2) cases for consideration of the GOI counterpart agency.

① Case 1 Full improvement

In this case study the river channel is considered to be improved over its entire length with cross-sectional area adopted in the KAFCP.

Plan and profile of the river and the result of hydraulic calculation are given in Figure 1.2.6 and Table 1.2.2 respectively.

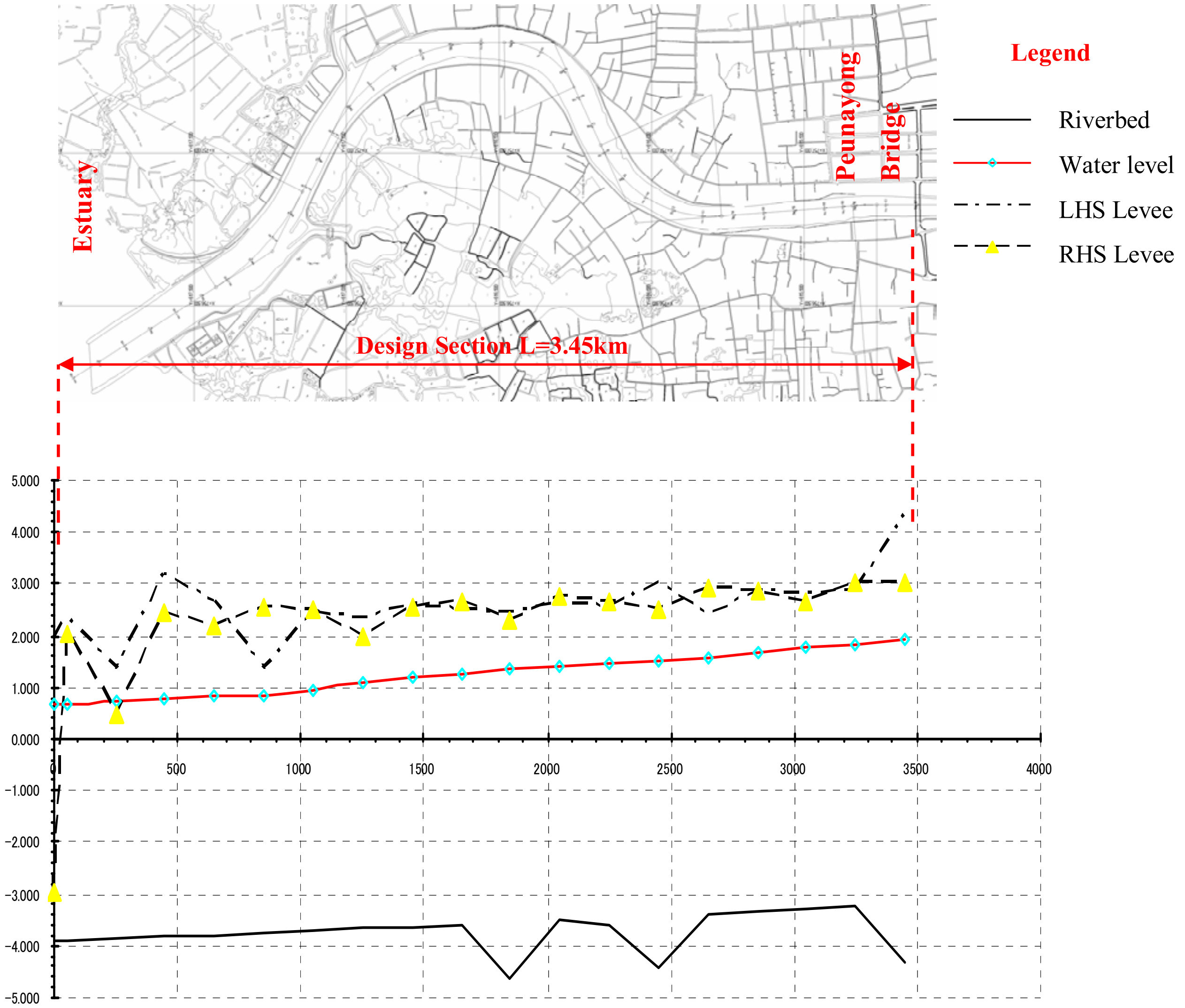


Figure 1.2.6 Plan and Profile of Aceh River: Hydraulic Design Case 1

Table 1.2.2 Hydraulic Calculation Results for Case 1

Chainage	Distance (m)	Accumulative Distance (m)	Riverbed Level (m)	Water Surface Level (m)	Design Levee Level A (m)	Existing Levee Level (LHS) (m)	Existing Levee Level (RHS) (m)	Lowest Existing Levee Level B (m)	B-A (m)
No.0-50	0	0	-3.898	0.700	2.000	1.925	-2.958	-2.958	-3.658
No.0	50	50	-3.900	0.700	2.000	2.359	2.051	2.051	1.351
No.1	200	250	-3.860	0.740	2.000	1.379	0.465	0.465	-0.275
No.2	200	450	-3.820	0.779	2.000	3.196	2.425	2.425	1.646
No.3	200	650	-3.780	0.820	2.000	2.679	2.197	2.197	1.377
No.4	200	850	-3.740	0.835	2.000	1.358	2.541	1.358	0.523
No.5	200	1050	-3.700	0.956	2.000	2.469	2.508	2.469	1.513
No.6	200	1250	-3.660	1.073	2.073	2.326	1.983	1.983	0.910
No.7	200	1450	-3.641	1.173	2.173	2.614	2.550	2.550	1.377
No.8	200	1650	-3.580	1.251	2.251	2.511	2.667	2.511	1.260
No.9	200	1850	-4.634	1.331	2.331	2.443	2.300	2.300	0.969
No.10	200	2050	-3.500	1.398	2.398	2.634	2.741	2.634	1.236
No.11	200	2250	-3.614	1.474	2.474	2.575	2.656	2.575	1.101
No.12	200	2450	-4.414	1.523	2.523	3.014	2.522	2.522	0.999
No.13	200	2650	-3.370	1.582	2.582	2.411	2.896	2.411	0.829
No.14	200	2850	-3.330	1.665	2.665	2.863	2.863	2.863	1.198
No.15	200	3050	-3.290	1.749	2.749	2.833	2.645	2.645	0.896
No.16	200	3250	-3.250	1.826	2.826	2.856	3.026	2.856	1.030
No.17	200	3450	-4.324	1.927	2.927	4.308	2.995	2.995	1.068

As shown in the table above, water surface almost remains within freeboard (one meter), excepting around estuary area.

It should however be noted that Case 1 would requires a huge amount of dredging works, approximately 400,000m3. Such large quantity of dredging work is deemed to be difficult to be completed within a single dry season and is very costly.

② Case 2 Limited Improvement

According to the field survey, this reach has been subjected to a huge amount of sediment in the river channel, compared to the reach upstream from Lampulo. In this case study therefore river improvement work is limited to a reach between the estuary and Lampulo, intending to identify more realistic plan to be completed within a single dry season while assuring safety against flooding.

Plan and profile and result of hydraulic design are as summarized in Figure 1.2.7 and Table 1.2.3 respectively.

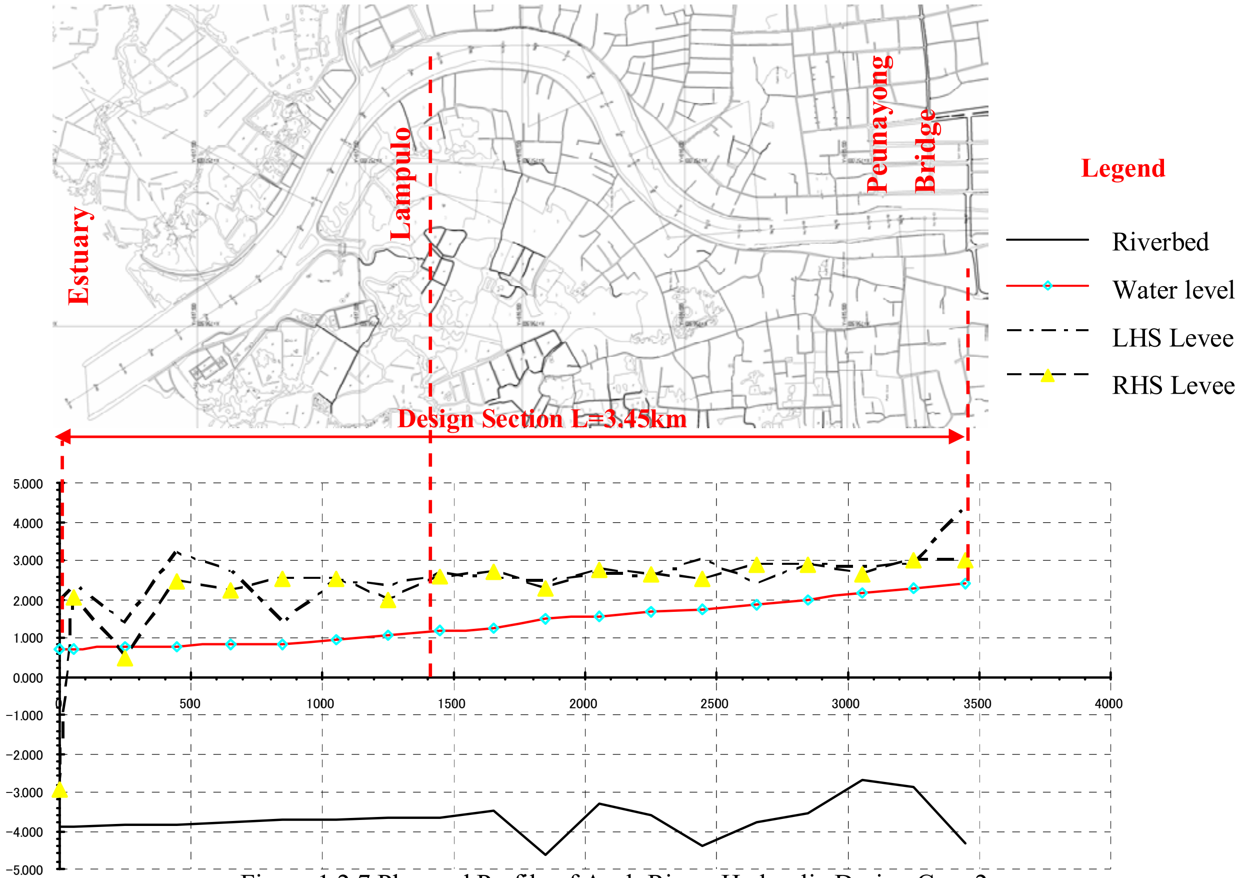


Figure 1.2.7 Plan and Profile of Aceh River: Hydraulic Design Case 2

Table 1.2.3 Hydraulic Calculation Result for Case 2

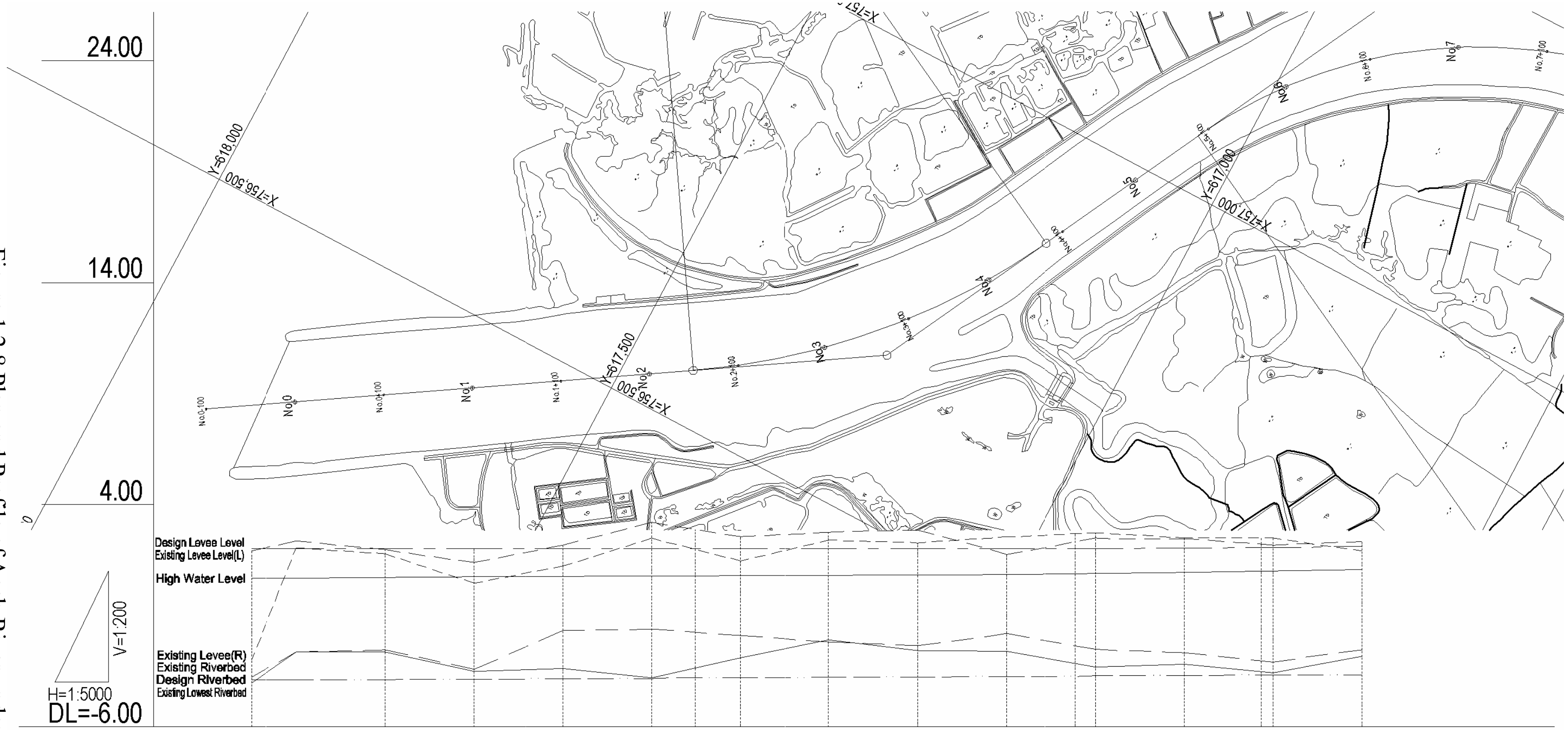
Chainage	Section Distance (m)	Accumulative Distance (m)	Riiverbed Level (m)	Examined Water Level A (m)	Re-designed Water Level B (m)	A-B (m)	LHS Levee Level (m)	RHS Levee Level (m)	Lower Levee Level C (m)	Designed Levee Level D (m)	C-A (m)	D-C (m)	Remarks
No.0-50	0.000	0	-3.898	0.700	0.700	0.000	1.925	-2.958	-2.958	2.000	-3.658	-4.958	
No.0	50.000	50	-3.900	0.700	0.700	0.000	2.359	2.051	2.051	2.000	1.351	0.051	
No.1	200.000	250	-3.860	0.740	0.740	0.000	1.379	0.465	0.465	2.000	-0.275	-1.535	
No.2	200.000	450	-3.820	0.779	0.779	0.000	3.196	2.425	2.425	2.000	1.646	0.425	
No.3	200.000	650	-3.780	0.820	0.820	0.000	2.679	2.197	2.197	2.000	1.377	0.197	
No.4	200.000	850	-3.740	0.835	0.835	0.000	1.358	2.541	1.358	2.000	0.523	-0.642	
No.5	200.000	1050	-3.700	0.956	0.956	0.000	2.469	2.508	2.469	2.000	1.513	0.469	
No.6	200.000	1250	-3.660	1.073	1.073	0.000	2.326	1.983	1.983	2.073	0.910	-0.090	
No.7	200.000	1450	-3.641	1.173	1.173	0.000	2.614	2.550	2.550	2.173	1.377	0.377	Lampulo
No.8	200.000	1650	-3.470	1.272	1.251	0.022	2.511	2.667	2.511	2.251	1.239	0.260	
No.9	200.000	1850	-4.634	1.455	1.331	0.123	2.443	2.300	2.300	2.331	0.845	-0.031	
No.10	200.000	2050	-3.290	1.551	1.398	0.153	2.634	2.741	2.634	2.398	1.083	0.236	
No.11	200.000	2250	-3.614	1.644	1.474	0.170	2.575	2.656	2.575	2.474	0.931	0.101	
No.12	200.000	2450	-4.414	1.735	1.523	0.212	3.014	2.522	2.522	2.523	0.787	-0.001	
No.13	200.000	2650	-3.767	1.839	1.582	0.257	2.411	2.896	2.411	2.582	0.572	-0.171	
No.14	200.000	2850	-3.520	1.987	1.665	0.322	2.863	2.863	2.863	2.665	0.876	0.198	
No.15	200.000	3050	-2.689	2.124	1.749	0.375	2.833	2.645	2.645	2.749	0.521	-0.104	
No.16	200.000	3250	-2.889	2.245	1.826	0.419	2.856	3.026	2.856	2.826	0.611	0.030	
No.17	200.000	3450	-4.324	2.390	1.927	0.464	4.308	2.995	2.995	2.927	0.605	0.068	Peunayong Bridge

Under this case study the channel bottom is graded up to Lampulo and that upstream from Lampulo is kept at the same level as existing. According to the result of hydraulic calculation, design discharge can be safely flown down within a reasonable freeboard. The estimated quantity of river improvement work is reduced to approximately 200,000 m3, being a half of that of Case 1.

As a result of case study for river improvement work, it is concluded that Case 2 is technically and economically feasible and is adopted for the Project.

Plan and profile of proposed improvement work is as given in Figure 1.2.8.

Figure 1.2.8 Plan and Profile of Aceh River under Case 2 (1/3)



Design Levee Level	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.01	2.01	2.04	2.07 2.07	2.11
High Water Level	0.70	0.72	0.74	0.76	0.78	0.79	0.80	0.82	0.83	0.84	0.88	0.90	0.96	1.01 1.01	1.07
Design Riverbed Level	-3.92	-3.88	-3.86	-3.84	-3.82	-3.81	-3.80	-3.78	-3.76	-3.74	-3.73	-3.72	-3.70	-3.68 -3.68	-3.66
Existing Levee Level(R)	-2.96	1.78	0.45	1.23	2.48	1.98	1.47	2.39	2.28	2.54	2.68	2.73	2.50	2.49 2.48	1.91
Existing Levee Level(L)	1.93	1.96	1.38	2.17	3.20	2.87	2.54	2.76	2.85	1.76	2.31	2.48	2.47	2.22 2.18	2.33
Existing Lowest Riverbed Level	-4.02	-2.64	-3.50	-3.39	-3.81	-3.35	-2.89	-2.09	-2.56	-2.61	-3.15	-3.32	-3.19	-3.52 -3.57	-2.84
Existing Riverbed Level	-3.78	-2.55	-3.42	-1.68	-1.61	-1.76	-1.91	-2.18	-2.34	-1.82	-2.36	-2.53	-2.67	-3.03 -3.08	-2.55
Accumulative Length	-50	100	200	300	400	450	500	600	700	800	877	900	1,000	1,086 1,100	1,200
Chainage	-50.0	+100.0	NO.1	+100.0	NO.2	+49.6	+100.0	NO.3	+100.0	NO.4	+77.2	+100.0	NO.5	+86.4 +100.0	NO.6
Curve	R=00 L=499.625					R=800 L=427.525					R=00 L=209.261			R=550 L=602.956	

Design Levee Level	2.11	2.14	2.17	2.20	2.23	2.26	2.27	2.29	2.30	2.33	2.36	2.38	2.40	2.43	2.45	2.46	2.49
High Water Level	1.07	1.12	1.17	1.21	1.25	1.29	1.29	1.32	1.33	1.37	1.40	1.42	1.44	1.47	1.49	1.50	1.52
Design Riverbed Level	-3.66	-3.64	-3.62	-3.60	-3.58	-3.56	-3.56	-3.54	-3.54	-3.52	-3.50	-3.49	-3.48	-3.46	-3.44	-3.44	-3.42
Existing Levee Level(R)	1.91	1.60	2.55	2.56	2.67	1.95	1.86	1.71	1.64	1.75	2.74	2.65	2.58	2.70	2.70	2.70	2.52
Existing Levee Level(L)	2.33	2.51	2.61	2.60	2.63	2.62	2.62	2.56	2.54	2.48	2.83	2.78	2.74	2.58	2.53	2.50	3.01
Existing Lowest Riverbed Level	-2.84	-3.11	-3.64	-3.80	-3.54	-3.58	-3.59	-4.31	-4.63	-3.71	-3.29	-3.22	-3.16	-3.61	-4.15	-4.43	-4.41
Existing Riverbed Level	-2.55	-2.24	-2.03	-2.66	-2.54	-1.74	-1.65	-2.70	-3.17	-2.31	-2.94	-2.65	-2.42	-2.36	-3.05	-3.41	-3.44
Accumulative Length	1,200	1,300	1,400	1,500	1,600	1,689	1,700	1,769	1,800	1,900	2,000	2,056	2,100	2,200	2,266	2,300	2,400
Chainage	NO.6	+100.0	NO.7	+100.0	NO.8	+89.4	+100.0	+168.9	NO.9	+100.0	NO.10	+55.9	+100.0	NO.11	+65.6	+100.0	NO.12
Curve	R=550 L=602.956					R=00 L=79.499			R=250 L=287.021				R=00 L=209.754		R=400 L=488.591		

Figure 1.2.8 Plan and Profile of Aceh River under Case 2 (2/3)

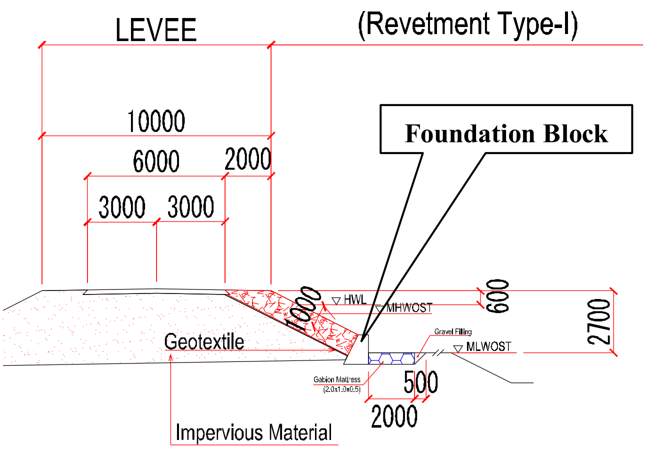
Design Levee Level	2.49	2.53	2.56	2.59	2.61	2.62	2.66	2.69	2.72	2.75	2.75	2.76	2.77	2.93
High Water Level	1.52	1.55	1.58	1.62	1.65	1.67	1.71	1.75	1.79	1.82	1.83	1.86	1.88	1.93
Design Riverbed Level	-3.42	-3.40	-3.37	-3.35	-3.34	-3.33	-3.31	-3.29	-3.27	-3.25	-3.25	-3.23	-3.21	-3.18
Existing Levee Level(R)	2.52	2.55	2.90	2.67	2.78	2.86	1.38	2.65	1.85	2.85	3.02	3.02	3.03	3.00
Existing Levee Level(L)	3.01	3.02	2.41	2.86	2.88	2.89	2.95	2.84	2.79	2.85	2.86	2.88	2.89	4.34
Existing Lowest Riverbed Level	-4.41	-3.80	-3.78	-3.41	-3.52	-3.61	-3.76	-2.86	-3.14	-2.93	-2.89	-3.44	-3.74	-4.32
Existing Riverbed Level	-3.44	-3.56	-3.49	-3.07	-3.36	-3.61	-3.74	-2.82	-2.49	-2.76	-2.81	-3.41	-3.74	-4.12
Accumulative Length	2,400	2,500	2,600	2,700	2,754	2,800	2,900	3,000	3,100	3,186	3,200	3,285	3,300	3,400
Chainage	NO.12	+100.0	NO.13	+100.0	+54.2	NO.14	+100.0	NO.15	+100.0	+85.9	NO.16	+84.5	+100.0	NO.17
Curve	R=400 L=488.591					R=00 L=431.671				R=1000 L=78.559			R=00 L=207.679	

Figure 1.2.8 Plan and Profile of Aceh River under Case 2 (3/3)

(4) Design of Revetment Works

The following structures have been designed, which were not placed before the Tsunami;

1) Foundation block at toe of levee



The foundation block supports materials to be placed on slopes such as rip rap and wet cobble stone masonry on it. The block was designed as precast concrete structure. The size is 1.5m in length, being selected in due consideration of easiness of transportation and minimizing of construction time.

2) Wet cobble masonry

The wet cobble stone masonry is placed instead of fabric sheet with concrete filling which was initial structure. It is selected as it is easy in construction, allows use of local material and reduces construction cost.

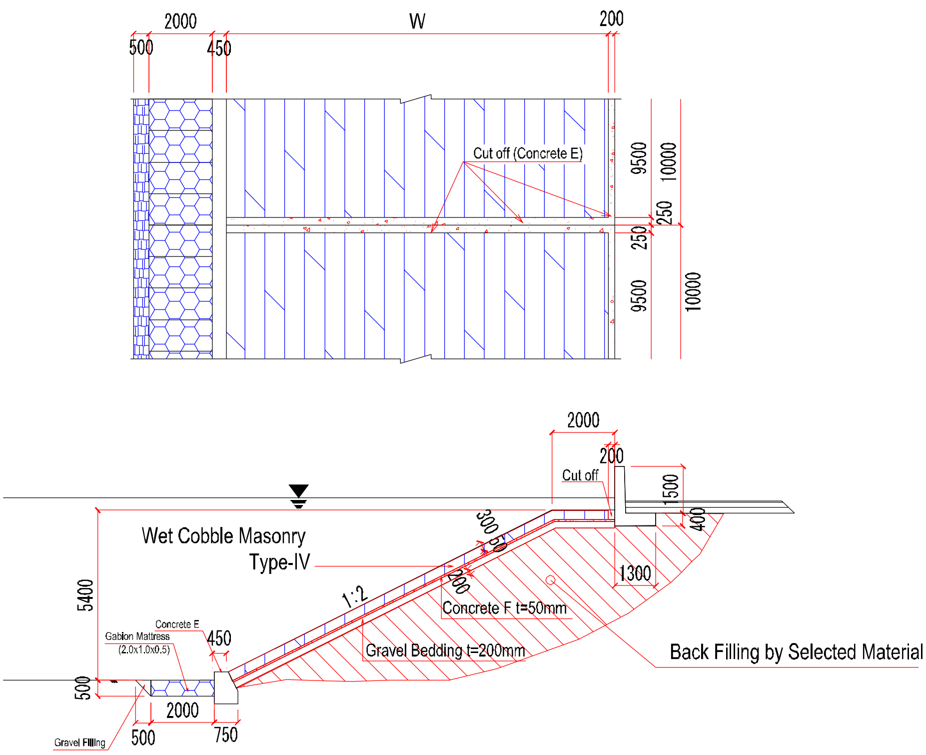


Figure 1.2.9 Cross Section of Wet Cobble Masonry

(5) Construction Planning for Dredging Works

① Method of dredging

The proposed river improvement work in Aceh River includes dredging of approximately 200,000 m3 from river channel. The JICA Study Team has conducted a construction capability survey of the local contractors, especially with the view to available constructional equipment for dredging works. The survey area covers not only Banda Aceh but also Medan. Though there are various types of dredging works, the following construction equipment are identified to be made available locally according to the survey.

Clamshell and Backhoe Dredging: Clamshell and Backhoe are available locally but not

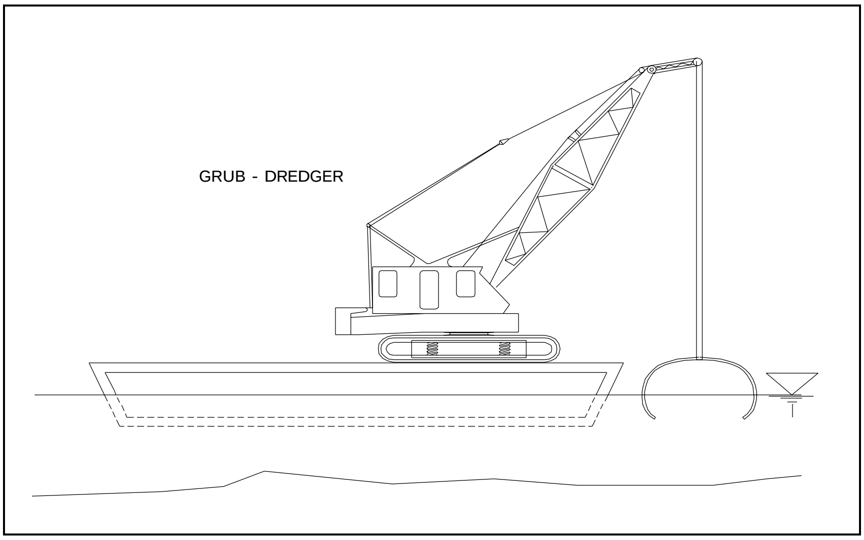


Figure 1.2.10 Clamshell Dredging

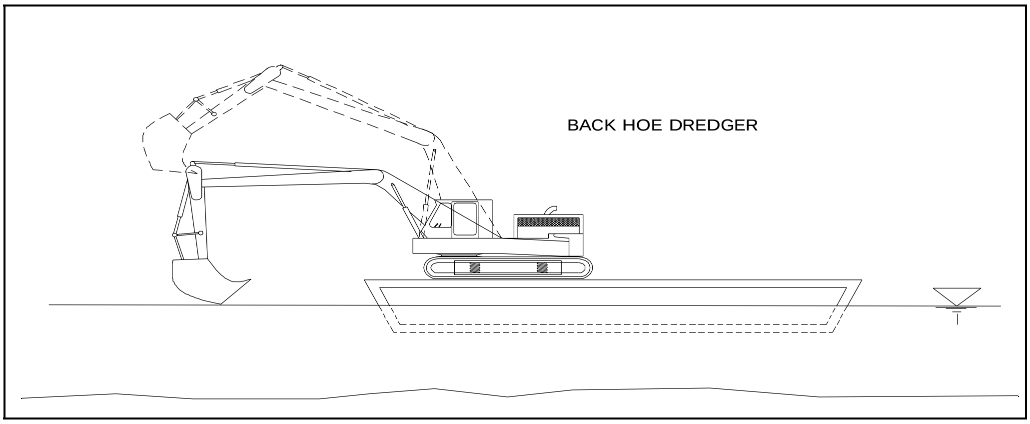


Figure 1.2.11 Backhoe Dredging

Flat Pontoon: This is essentially required to execute dredging works by using clamshell and backhoe, and is owned by local contractor. The specification of the available pontoon is as follows:

Size	Length	Width	Height	Loading Capacity
Max	60 m	20 m	2.5 m	use as dredger
	40 m	15 m	1.8 m	500 cum loaded
	25 m	9 m	1.5 m	200 cum loaded

The pontoon can also be used as barge for hauling of dredged materials with tug boat.

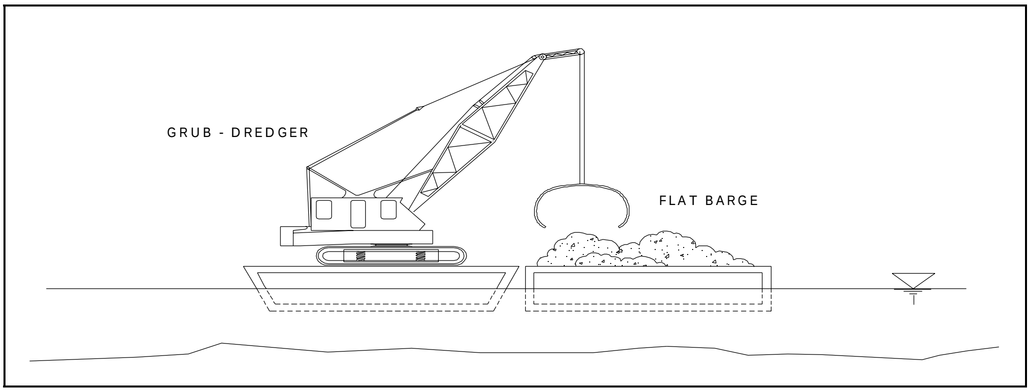


Figure 1.2.12 Flat Pontoon as Barge

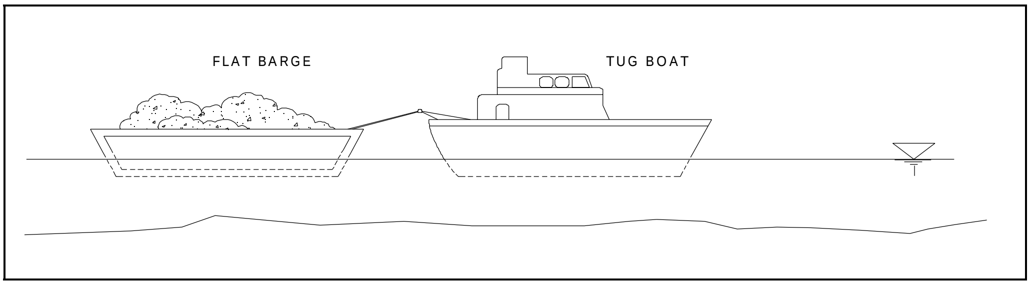


Figure 1.2.13 Hauling of Dredged Materials by Pontoon and Tag Boat

Cutter Suction Pump Dredger: One of the local contractors has a cutter suction pump dredger with the following specifications:

Draft at working	1.0 m
Maximum dredged depth	6.1 m
Power of main engine	725 PS (Diesel)
Diameter of discharged pipe	400 mm
Economical discharged distance	330 m (capacity 500 cum/hr)
Maximum discharged distance	500 m (capacity 300 cum/hr)
Overall length	24 m

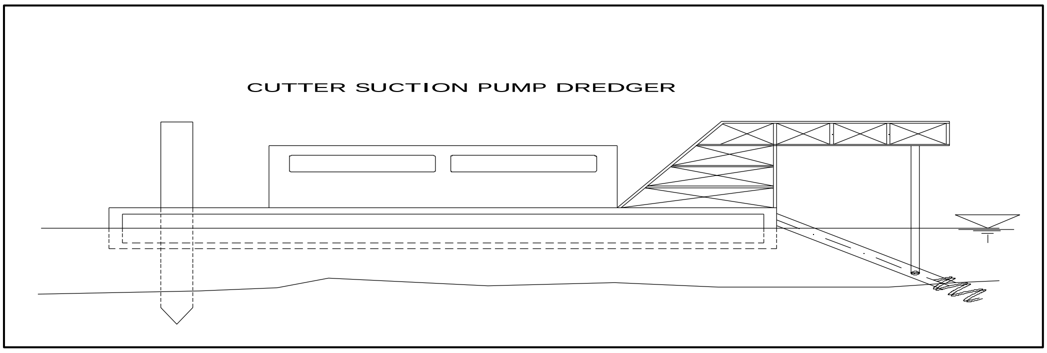
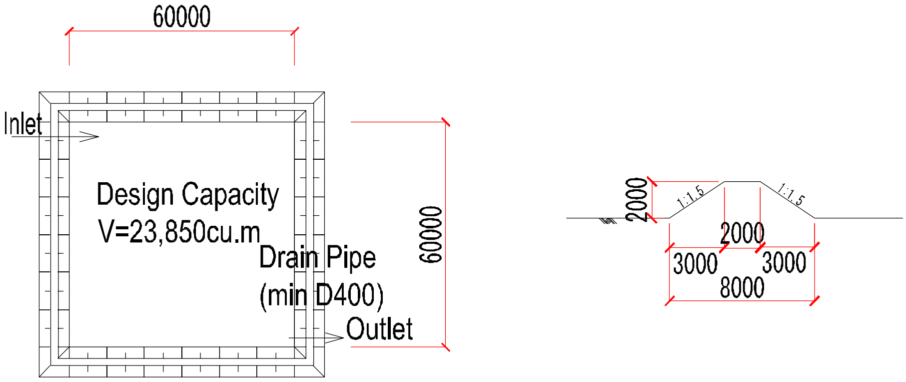


Figure 1.2.14 Cutter Suction Pump Dredger

The dredging works by this equipment requires provision of a temporary pond to separate liquid and mud. Minimum size of the pond would be 60 meter square as shown below:



Plan　　　　　　　　Cross Section

Figure 1.2.15 Temporary Pond

② Execution of dredging works

Dredging shall generally be carried out from downstream reaches to upstream reaches to avoid flooding due to the occurrence of unexpected high water.

(6) Construction Planning for Removal of Debris

① Floodway

As of July 2005, there are found no debris and/or other things which hamper smooth hydraulic behavior of the river.

② Aceh River

As of July 2005, there are three (3) sunken boats between the estuary and the Peunayong Bridge, and also another three (3) sunken boats in the upstream from Surabaya Bridge. Four out of 6 sunken boats are seen in photographs below:

The biggest sunken ship: overall length, 20 meters

Sunken ship appeared bow and cabin at Lampulo

Sunken Ship near Peunayong Bridge

Sunken small boat under Surabaya Bridge

Those boats are estimated to be 10 to 20 meters in length and necessary to be salvaged in order to secure flow area sufficient to discharge design flood flow and to ensure safe passage of water transport. The salvage work is considered to be executed by either crab dredger or derrick crane.

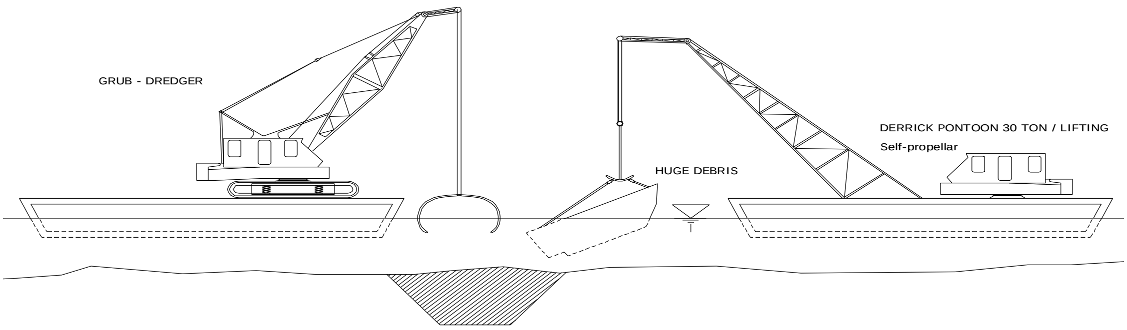


Figure 1.2.16 Salvage of Debris

1.2.4 Recommendation

The rehabilitation design has been completed under conditions in July 2005. It might be possible that before and during the construction, additional work would be required which are unforeseen at the time of design. Such additional works are recommended to be executed.

A complete river improvement plan is desired to be re-established on a basis of new city development and land use plan and talking into account of changes in geographic conditions after the earthquake and Tsunami.

1.3 DESIGN DRAWINGS

In total 228 design drawings are prepared to facilitate tender for construction contract. Table 1.3.1 shows a list of the drawings.

Table 1.3.1 List of Design Drawing

Package	Title	Page
Package I	Location Map	1
	Aceh River Plan	2-5
	Aceh River Profile	6-8
	Typical Cross Section	9-10
	Cross Section	11-46
	Detail of Structures	47-50
	Sub Total	**50**
Package II	Location Map	1
	Floodway plan	2-6
	Floodway Profile	7-10
	Typical Cross Section	11
	Cross Section	12-55
	Levee Cross Section	56
	Detail of Revetment Type-II	57
	Detail of Drainage Canal	58
	Detail of Foundation Block	59
	Detail of Drainage Canal Facilities	60
	Inspection Road	61
	Sub Total	**61**
Package III	Location Map	1
	Aceh River Plan	2-4
	Aceh River Profile	5-6
	Typical Cross Section	7-8
	Cross Section	9-31
	Structure	32-33
	Daroy River Plan	34-35
	Daroy River Cross Section	36-52
	Sub Total	**52**
Package IV	Location Map	1
	Doy River Plan	2-6
	Doy River Profile	7-11
	Doy River Typical Cross Section	12
	Doy River Cross Section	13-44
	Neng River Plan	45-46
	Neng River Profile	47-49
	Neng River Typical Cross Section	50

	Neng River Cross Section	51-69
	Detail of Structure	70-71
	Repair of Structure	72
	Sub Total	**72**
Package VII	Location Map	1
	Plan (Lampulo, Aceh River)	2
	Profile	3
	Typical Cross Section	4
	Cross Section	5-9
	Detail of Structure	10-12
	Inspection Road	13
	Sub Total	**13**
	Grand Total	**228**

1.4 COST ESTIMATE

Construction cost of the proposed restoration works is estimated at price level of July 2005, with the total figure JPY 435,537,917. Cost estimates for each package are shown on the following table, from Table 1.4.1 to Table 1.4.5. It should be noted that the cost shown in the table does not include general expenditures such cost for bid security and performance security, mobilization and demobilization of the contractor, etc.

Table 1.4.1 Bill Quantity of Package I

No.	Description	Unit	Quantity	Unit Price	Amount (Yen)
1.	**Rehabilitation of River Condition and Structures of Krueng Aceh River**				
1.1	**Temporary work**				
/01	Coffering and Care of Water including Dewatering, River slope protection works	LS	1.0	12,428,200	12,428,200
/02	Temporary Pond for Dredging (150 m x 150 m, h=2 m)	LS	1.0	3,482,100	3,482,100
/03	Removal of Sunken Ship (Large size more than 10 m, 3 nos.)	LS	1.0	630,000	630,000
/04	Removal of Sunken Ship (Small size less than 10 m, 20 nos)	LS	1.0	990,000	990,000
	Sub Total of Item 1.1				**17,530,300**
1.2	**Restoration to Normal River Condition**				
/01	Dredging (Estuary to Lampulo approx. L= 1,450 m)	Cu.m	203,300	444	90,265,200
/02	Disposal for Dredged Material (hauling distance 1,000 ~ 2,000 m)	Cu.m	156,500	164	25,666,000
	Sub Total of Item 1.2				**115,931,200**
1.3	**Rehabilitation of Dyke Embankment**				
/01	Earthfill for Dyke Embankment with Selected Material (hauling	Cu.m	530	527	279,310
	distance within 30,000 m)				
	Sub Total of Item 1.3				**279,310**
1.4	**Rehabilitation of Low and High Water Revetment and Parapet Wall**				
/01	Excavation for River Channel (hauling distance 2,000 ~ 3,000 m)	Cu.m	1,815	212	384,780
/02	Excavation for Structure (hauling distance 2,000 ~ 3,000 m)	Cu.m	1,045	218	227,810
/03	Earthfill with Selected Material (hauling distance within 30,000 m)	Cu.m	335	527	176,545
/04	Gravel Filling	Cu.m	165	1,343	221,595
/05	Demolishing of Existing Structures, t= 500 mm	Cu.m	3,800	1,045	3,971,000
/06	Concrete Class C for Parapet Wall	Cu.m	170	4,845	823,650
/07	Concrete Class E for Partition Wall, Revetment and Precast Foot Bloc	Cu.m	1,820	4,737	8,621,340
/08	Concrete Class F in Leveling Concrete	Cu.m	80	4,369	349,520
/09	Form for Items 2.4/06 and 2.4/07	Sq.m	4,655	1,033	4,808,615
/10	Reinforcement Bars for Item 2.4/06	Ton	8	108,263	866,104
/11	Installing of Gabion Mattress with Geotextile Sheet, 2,000 mm x 1,000 mm x 500 mm	Cu.m	1,320	2,353	3,105,960
/12	Wet Cobble Masonry, Type IV	Cu.m	4,980	3,241	16,140,180
/13	Reformation of Existing Rip-Rap, 20 ± 5 kg	Cu.m	3,275	2,054	6,726,850
/14	Providing and Installing of Precast Concrete Block, 500 mm x 500 mm x 100 mm	Sq.m	310	1,369	424,390
/15	Furnish and Installation of Dowel bar, ϕ=19 mm, L= 1,200 mm	Nos.	51	409	20,859
/16	Furnishing and Installing Rubber Joint Filler, t= 10 mm	Sq.m	1,725	3,007	5,187,075
/17	Furnishing and Installing Water Stop, W= 240 mm	Lin.m	55	1,511	83,105
	Sub Total of Item 1.4				**52,139,378**
2	**Total of Item No.1 (1.1 to 1.4)**				**17,530,300**

Table 1.4.2 Bill Quantity of Package II

No.	Description	Unit	Quantity	Unit Price	Amount (Yen)
1.	**Rehabilitation of Dyke and Revetment for the Floodway of Krueng Aceh River**				
1.1	**Temporary work**				
/01	Coffering and Care of Water including Dewatering, River Slope protection	LS	1.0	5,573,200	5,573,200
/02	Temporary Pond for Dredging (140 m x 140 m, h= 1.5 m)	LS	1.0	2,550,000	2,550,000
/03	Removal of existing PC beam and pier structures from the river (Approx. 10 beams and 3 piers)	LS	1.0	1,925,700	1,925,700
	Sub Total of Item 1.1				**10,048,900**
1.2	**Restoration to Normal River Condition**				
/01	Dredging (Estuary Area and surrounding, Approx. L= 1,100 m)	Cu.m	28,420	622	17,677,240
	Sub Total of Item 1.2				**17,677,240**
1.3	**Rehabilitation of Levee and Revetment**				
/01	Excavation for Structure (hauling distance 2,000 ~ 3,000 m)	Cu.m	3,620	218	789,160
/02	Earthfill with Selected Material (hauling distance within 30,000 m)	Cu.m	66,560	527	35,077,120
/03	Backfill with Random Materials (hauling distance 200 - 500 m)	Cu.m	645	162	104,490
/04	Gravel Filling	Cu.m	280	1,343	376,040
/05	Demolishing of Existing Structures, t= 300 mm	Cu.m	2,750	1,045	2,873,750
/06	Concrete Class E for Partition Wall and Precast Foot Block	Cu.m	3,980	4,737	18,853,260
/07	Form for Items 2.2/06	Sq.m	17,090	1,033	17,653,970
/08	Installing of Gabion Mattress with Geotextile Sheet, 2,000 x 1,000 x 500 mm	Cu.m	3,860	2,353	9,082,580
/09	Wet Cobble Masonry, Type IV	Cu.m	350	3,241	1,134,350
/10	Rip-rap, 20 ± 5 kg	Cu.m	11,850	2,054	24,339,900
/11	Furnish and Installation of Sand bag for foundation	Nos.	15,350	78	1,197,300
/12	Furnish and Installation of Steel Mesh, ϕ= 9 mm	Kg	540	134	72,360
/13	Furnishing and Installing Rubber Joint Filler, t= 10 mm	Sq.m	200	3,007	601,400
/14	Subbase Course, t = 200 mm (Compacted)	Cu.m	2,875	4,512	12,972,000
/15	Base Course, t = 150 mm (Compacted)	Cu.m	125	4,602	575,250
/16	Surface Course, t= 50 mm (Compacted)	Sq.m	750	698	523,500
/17	Providing and Placing of Sod Facing	Sq.m	8,600	74	636,400
	Sub Total of Item 1.3				**126,862,830**
1.4	**Rehabilitation of Drainage Canal**				
/01	Excavation for Structure (hauling distance 2,000 ~ 3,000 m)	Cu.m	1,220	218	265,960
/02	Bench Cut Excavation for Existing Dyke (hauling distance 2,000 ~ 3,000 m)	Cu.m	4,720	240	1,132,800
/03	Earthfill with Selected Material (hauling distance within 30,000 m)	Cu.m	4,230	527	2,229,210
/04	Backfill with Random Materials (hauling distance 200 - 500 m)	Cu.m	220	162	35,640
/05	Demolishing of Existing Structures, t= 300 mm	Cu.m	680	1,045	710,600
/06	Concrete Class E for Foundation of Revetment	Cu.m	1,080	4,737	5,115,960
/07	Form for Items 2.4/06	Sq.m	5,190	1,033	5,361,270
/08	Rip-rap, 20 ± 5 kg	Cu.m	490	2,054	1,006,460
/09	Providing and Placing of Sod Facing	Sq.m	3,100	74	229,400
	Sub Total of Item 1.4				**16,087,300**
1.5	**Rehabilitation of Drain Pipe Culvert**				
/01	Excavation for Structure (hauling distance 2,000 ~ 3,000 m)	Cu.m	10	218	2,180
/02	Backfill with Random Materials (hauling distance 200 - 500 m)	Cu.m	70	162	11,340
/03	Concrete Class C for Outlet	Cu.m	8	4,845	38,760
/04	Concrete Class E for Foundation of Drain Pipe	Cu.m	5	4,737	23,685
/05	Concrete Class F in Leveling Concrete	Cu.m	3	4,369	13,107
/06	Form for Items 2.3/03 and 2.3/04	Sq.m	67	1,033	69,211
/07	Reinforcement Bars for Item 2.4/04	Ton	0.7	108,263	75,784
/08	Furnish and Installation of Drain Concrete Pipe ϕ= 600 mm	Lin.m	30	4,950	148,500
/09	Furnishing and Installing Water Stop, W= 240 mm	Lin.m	3	1,511	4,533
/10	Providing and Installation of Flap Gate (650 mm x 650 mm)	Nos	2	450,000	900,000
	Sub Total of Item 1.5				**1,287,100**
2	**Total of Item No.1 (1.1 to 1.5)**				**171,963,370**

Table 1.4.3 Bill of Quantity of Package III

No.	Description	Unit	Quantity	Unit Price	Amount (Yen)
1.	**Rehabilitation of Dyke and Parapet wall of Krueng Aceh River (between Peunayong Bridge and Surabaya Bridge)**				
1.1	**Temporary work**				
/01	Coffering and Care of Water including Dewatering, River slope protection & Parapet wall	LS	1.0	5,429,642	5,429,642
/02	Removal of Sunken Ship (Small size less than 10 m, 10 nos.)	LS	1.0	495,000	495,000
	Sub Total of Item 1.1				**5,924,642**
1.2	**Normalization of Krueng Aceh River**				
/01	Excavation for River Channel (hauling distance 3,000 ~ 5,000 m)	Cu.m	10,350	272	2,815,200
	Sub Total of Item 1.2				**2,815,200**
1.3	**Rehabilitation of Dyke and Revetment**				
/01	Excavation for River Channel (hauling distance 3,000 ~ 5,000 m)	Cu.m	190	272	51,680
/02	Excavation for Structure (hauling distance 3,000 ~ 5,000 m)	Cu.m	140	270	37,800
/03	Earthfill with Selected Material (hauling distance within 30,000 m)	Cu.m	60	527	31,620
/04	Gravel Filling	Cu.m	25	1,343	33,575
/05	Demolishing of Existing Structures, t= 300 mm	Cu.m	620	1,045	647,900
/06	Concrete Class E for Partition Wall and Precast Foot Block	Cu.m	240	4,737	1,136,880
/07	Concrete Class F in Leveling Concrete	Cu.m	5	4,369	21,845
/08	Form for Items 2.2/06	Sq.m	1,075	1,033	1,110,475
/09	Reinforcement Bars for Item 2.2/06	Ton	1	108,263	108,263
/10	Installing of Gabion Mattress with Geotextile Sheet, 2,000 x 1,000 x 500 mm	Cu.m	200	2,353	470,600
/11	Wet Cobble Masonry, Type IV	Cu.m	740	3,241	2,398,340
/12	Providing and Installing Precast Concrete Block, 500 mm x 500 mm x 100 mm with Geotextile Sheet	Sq.m	325	1,369	444,925
/13	Furnishing and Installing Rubber Joint Filler, t= 10 mm	Sq.m	255	3,007	766,785
	Sub Total of Item 1.3				**7,260,688**
1.4	**Normalization of Krueng Daroy River**				
/01	Excavation for River Channel (hauling distance 3,000 ~ 5,000 m)	Cu.m	300	272	81,600
/02	Demolishing of Existing Structures, t= 300 mm	Cu.m	5	1,045	5,225
/03	Wet Cobble Masonry, Type IV	Cu.m	5	3,241	16,205
/04	Furnishing and Installing Rubber Joint Filler, t= 10 mm	Sq.m	1	3,007	3,007
/05	Providing and Installating Flap Gate (600mm x 600mm) including Gate Frame and Structral repair works	Set	4	450,000	1,800,000
	Sub Total of Item 1.4				**1,906,037**
2	**Total of Item No.1 (1.1 to 1.4)**				**17,906,567**

Table 1.4.4 Bill of Quantity of Package IV

No.	Description	Unit	Quantity	Unit Price	Amount (Yen)
1.	**Rehabilitation of Dyke and Revetment for the Floodway of Krueng Aceh River**				
1.1	**Temporary work**				
/01	Coffering and Care of Water including Dewatering, River slope protection	LS	1.0	4,903,300	4,903,300
/02	Staging by scaffolding (370 Sq.m), River bank protection Type D	LS	1.0	300,000	300,000
	Sub Total of Item 1.1				**5,203,300**
1.2	**Restoration to Normal River Condition of Kr. Doy river**				
/01	Excavation for River Channel (hauling distance 2,000 ~ 3,000 m)	Cu.m	14,100	212	2,989,200
/02	Excavation for Structure (hauling distance 2,000 ~ 3,000 m)	Cu.m	1,270	218	276,860
/03	Earthfill with Selected Material (hauling distance within 30,000 m)	Cu.m	470	527	247,690
/04	Backfill with Random Materials (hauling distance 200 - 500 m)	Cu.m	290	136	39,440
/05	Gravel Filling	Cu.m	10	1,343	13,430
/06	Demolishing of Existing Structures, t= 300 mm	Cu.m	300	1,045	313,632
/07	Concrete Class C for Parapet Wall	Cu.m	190	4,845	920,550
/08	Concrete Class E for Partition Wall and Precast Foot Block	Cu.m	330	4,737	1,563,210
/09	Concrete Class F in Leveling Concrete	Cu.m	60	4,369	262,140
/10	Form for Items 2.2/06	Sq.m	1,980	1,033	2,045,340
/11	Reinforcement Bars for Item 2.2/07	Ton	9	108,263	974,367
/12	Providing and Installing of Precast Concrete Block, 500 mm x 500 mm x 100 mm	Sq.m	500	1,369	684,500
/13	Wet Cobble Masonry, Type IV	Cu.m	10	3,241	32,410
/14	Furnish and Installation of Steel Mesh, ϕ= 9 mm	Kg	1,330	134	178,220
/15	Furnishing and Installing Rubber Joint Filler, t= 10 mm	Sq.m	50	3,007	150,350
/16	Furnishing and Installing Water Stop, W= 240 mm	Lin.m	50	1,511	75,550
/17	Furnishing and Installing of Dowel bar, ϕ= 19 mm, L= 1,200 mm	Nos.	120	409	49,083
/18	Sub-base Course, t= 200 mm (Compacted)	Cu.m	180	4,512	812,160
/19	Base Course, t = 150 mm (Compacted)	Cu.m	135	4,602	621,270
/20	Surface Course, t= 50 mm (Compacted)	Sq.m	900	698	628,200
	Sub Total of Item 1.2				**12,877,602**
1.3	**Restoration to Normal River Condition of Kr. Neng river**				
/01	Excavation for River Channel (hauling distance 3,000 ~ 5,000 m)	Cu.m	4,100	272	1,115,200
/02	Excavation for Structure (hauling distance 3,000 ~ 5,000 m)	Cu.m	590	270	159,300
/03	Backfill with Random Materials (hauling distance 200 - 500 m)	Cu.m	290	136	39,440
/04	Demolishing of Existing Structures, t= 300 mm	Cu.m	270	1,045	282,269
/05	Concrete Class E for Concrete Gravity Wall	Cu.m	270	4,737	1,278,990
/06	Concrete Class F in Leveling Concrete	Cu.m	30	4,369	131,070
/07	Form for Items 2.3/04	Sq.m	770	1,033	795,410
/08	Gravel Filling	Cu.m	30	1,343	40,290
/09	Furnishing and Installing of Dowel bar, ϕ= 19 mm, L= 1,200 mm	Nos.	60	409	24,541
/10	Furnishing and Installing Rubber Joint Filler, t= 10 mm	Sq.m	30	3,007	90,210
/11	Furnishing and Installing Water Stop, W= 240 mm	Lin.m	40	1,511	60,440
	Sub Total of Item 1.3				**4,017,160**
1.4	**Rehabilitation of Flap Gate in Kr. Doy and Kr. Neng**				
/01	Providing and Installing of Flap Gate (600mmx600mm) including Gate Frame and Structural Repair work	Places	4	450,000	1,800,000
/02	Providing and Installing of Flap Gate (900mmx900mm) including Gate Frame and Structural Repair work	Places	4	650,000	2,600,000
/03	Providing and Installing of Flap Gate (1,200mmx1,200mm) including Gate Frame and Structural Repair work	Places	3	900,000	2,700,000
	Sub Total of Item 1.4				**7,100,000**
2	**Total of Item No.1 (1.1 to 1.4)**				**29,198,062**

Table 1.4.5 Bill of Quantity of Package VI

No.	Description	Unit	Quantity	Unit Price	Amount (Yen)
1.	**Rehabilitation of Revetment and Parapet wall of Krueng Aceh River**				
1.1	**Temporary work**				
/01	Coffering and Care of Water, River bank protection & Parapet wall	LS	1.0	6,866,400	6,866,400
	Sub Total of Item 1.1				**6,866,400**
1.2	**Rehabilitation of Revetment and Parapet wall**				
/01	Excavation for River Channel (hauling distance 1,000 ~ 2,000 m)	Cu.m	450	179	80,643
/02	Excavation for Structure (hauling distance 1,000 ~ 2,000 m)	Cu.m	1,000	177	177,000
/03	Earthfill with Selected Material (hauling distance within 30,000 m)	Cu.m	8,500	527	4,476,694
/04	Gravel Filling	Cu.m	56	1,343	75,208
/05	Demolishing of Existing Structures, t= 300 mm	Cu.m	20	1,045	20,909
/06	Concrete Class C for Parapet Wall	Cu.m	360	4,845	1,744,200
/07	Concrete Class E for Partition Wall & Foot Block	Cu.m	412	4,737	1,951,644
/08	Concrete Class F in Leveling Concrete	Cu.m	54	4,369	235,926
/09	Form for Items 2.2/06 and 2.2/07	Sq.m	3,240	1,033	3,348,409
/10	Reinforcement Bars for Item 2.2/06	Ton	17	108,263	1,840,471
/11	Installing of Gabion Mattress with Geotextile Sheet, 2,000 x 1,000 x 500 mm *1	Cu.m	800	2,353	1,882,400
/12	Wet Cobble Masonry, Type IV	Cu.m	1,360	3,241	4,407,760
/13	Furnish and Installation of Dowel bar, ϕ=19 mm, L= 1,200 mm	Nos.	111	409	45,399
/14	Furnishing and Installing Rubber Joint Filler, t= 10 mm	Sq.m	180	3,007	541,260
/15	Furnishing and Installing Water Stop, W= 240 mm	Lin.m	97	1,511	146,567
/16	Subbase Course, t = 200 mm (Compacted)	Cu.m	240	4,512	1,082,880
/17	Base Course, t = 150 mm (Compacted)	Cu.m	180	4,602	828,360
/18	Surface Course, t= 50 mm (Compacted)	Sq.m	1,200	698	837,600
	Sub Total of Item 1.2				**23,723,330**
	Total of Item No.1 (1.1 to 1.2)				**30,589,730**

CHAPTER 2 PREPARATION OF TECHNICAL REPORT

2.1 TENDER CONDITIONS

2.1.1 Outline of the Project

The Project aims at restoring function of the Aceh River and its tributaries which had seriously damaged by the 2004 disaster. It is necessary to complete urgently in order to secure the people, property and assets, ensure continuous public and economic activities without interruption, avoid outbreak of diseases which may occur if flooded, etc.

The restoration requirements have been identified through the filed survey and investigation which were conducted in June and July 2005, and design has also completed as reported in Chapter 1 of this report.

The works under the Project will include, but not be limited to the following:

Package I: Rehabilitation of Dykes and Revetments from Estuary to Peunayong Bridge (L=3,450m) and Dredging from Estuary to Lampulo (L=1,450m) on **Aceh River**

Package II: Rehabilitation of Dykes and Revetments from Estuary to Lamnyong Bridge (L=3,950m) and Normalization from Estuary to Krueng Cut Bridge (L=2,400m) on **Floodway**

Package III: Rehabilitation of Revetments and Normalization from Peunayong Bridge to Surabaya Bridge (L=2,050m) on **Aceh River**, and Normalization for **Daroy River** (L=1,516m)

Package IV: Rehabilitation of Revetments and Normalization for **Doy River** (L=3,050m) and **Neng River** (L=1,512m)

Package VII: Rehabilitation of Revetments around Lampulo on **Aceh River** (L=360m)

2.1.2 Source of Funds

The Government of Indonesia has received from the Government of Japan Grant Aid amounting to Fourteen Billion Six Hundred Million Japanese Yen (¥ 14,600,000,000) as per the Exchange of Notes dated on January 17th, 2005, for the purchase of products and services necessary for the execution of the Program by the Government of Indonesia for Efforts to cope with the Damages caused by the Great Earthquake of the Coast of Sumatra and by the Indian Ocean Tsunami Disaster which includes the Project.

Under this Program, Japan International Cooperation System (JICS) acts as an implementing agent for and on behalf of the Government of Indonesia in accordance with the Exchange of Notes.

2.1.3 Mode of Tender

The Contractor for each package of construction works will be procured through international competitive bidding which will be executed by JICS.

The contract is presumed to be a unit price contract with bill of quantities.

2.2 TECHNICAL REPORT

The tender documents will comprise three (3) volumes as listed up here below:

(1)	VOLUME I	Section 1 Invitation for Bids
	Section 2	Instructions to Bidders
	Section 3	Bid Data
	Section 4	Bill of Quantities
	Section 5	Forms, Annexes and Enclosures
	Section 6	Conditions of Contract
	Part I:	General Conditions of Contract
	Part II:	Conditions of Particular Application
	Part III:	Appendix to Bid
(2) VOLUME II	Section 7	Technical Specifications
(3) VOLUME III	Section 8	Drawings

Technical report was prepared. Composition of the report is same as that of the Project: RECOVERY OF WATER SUPPLY SYSTEM IN BANDA ACEH CITY. JICA Study Team has produced Volumes II: Technical Specifications and III: Drawings as Technical Report.

APPENDIX 4

REHABILITATION OF LAMPULO MARKET UNDER JAPAN’S NON-PROJECT TYPE GRANT AID

APPENDIX 4 REHABILITATION OF LAMPULO MARKET UNDER JAPAN'S NON-PROJECT TYPE GRANT AID

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CHAPTER 1 DESIGN AND ESTIMATED CONSTRUCTION COSTS

1.1 DESIGN CONDITIONS

1.1.1 Purpose and Overview of the Project

The Lampulo Fish Market, which is located close to the mouth of the Aceh River (approximately 1 km), which in turn is approximately 2 km to the north of the center of Banda Aceh City on Sumatra Island, Indonesia, suffered major damage in the earthquake that occurred off the shore of Sumatra. As shown in Figure 1.1.1, in addition to the Fish Market, a number of other buildings also existed at the site, among them lodging facilities, a mosque, a management building, and a classroom building. Most of these were destroyed and are in a dangerous state. Moreover, the fishing equipment in the facility was damaged to the point where it no longer functions at all. In view of these circumstances, the Lampulo Fish Market should be repaired and rebuilt, with the aim of restoring the functions of the fishing facility, which plays an important role in society as a facility that supplies food to the Aceh region, so that the market will be able to provide a hygienic and stable supply of food. Additionally, ice-making machines, freezers and generators are being procured separately for the facility so that it can safely provide seafood, which is a stable source of food. In formulating the planning for rebuilding the Fish Market, careful attention is being paid to space that will allow equipment and materials to be set up efficiently, to maintenance and inspections, and to upkeep management.

Figure 1.1.1 Condition of Lampulo

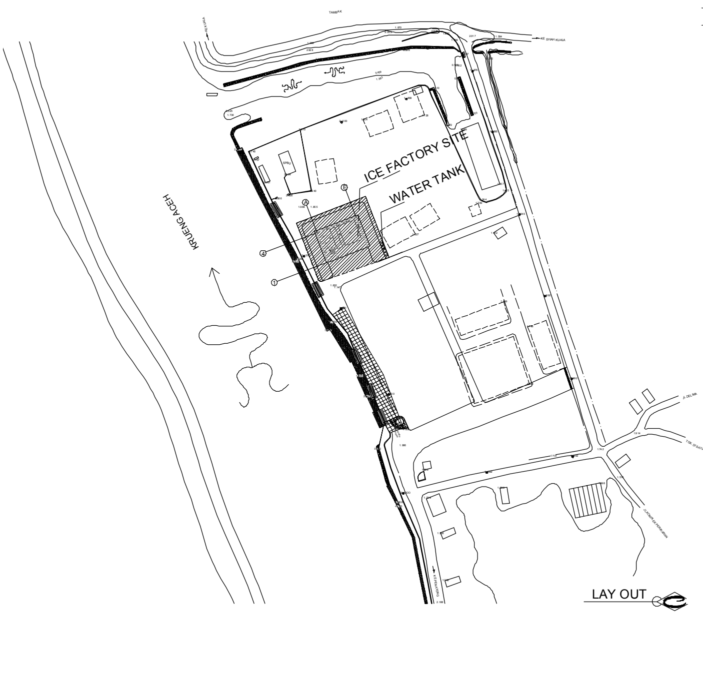

Figure 1.1.2 Site plan of the Lampulo Fish Market

1.1.2 Location of the Fish Market

The facility is located at a point approximately 1 km from the mouth of the Aceh River, which in turn is approximately 2 km to the north from the center of Banda Aceh City, and, being located along the river, suffered enormous damage from the tsunami.

Figure 1.1.3 shows the location of the Lampulo Fish Market.

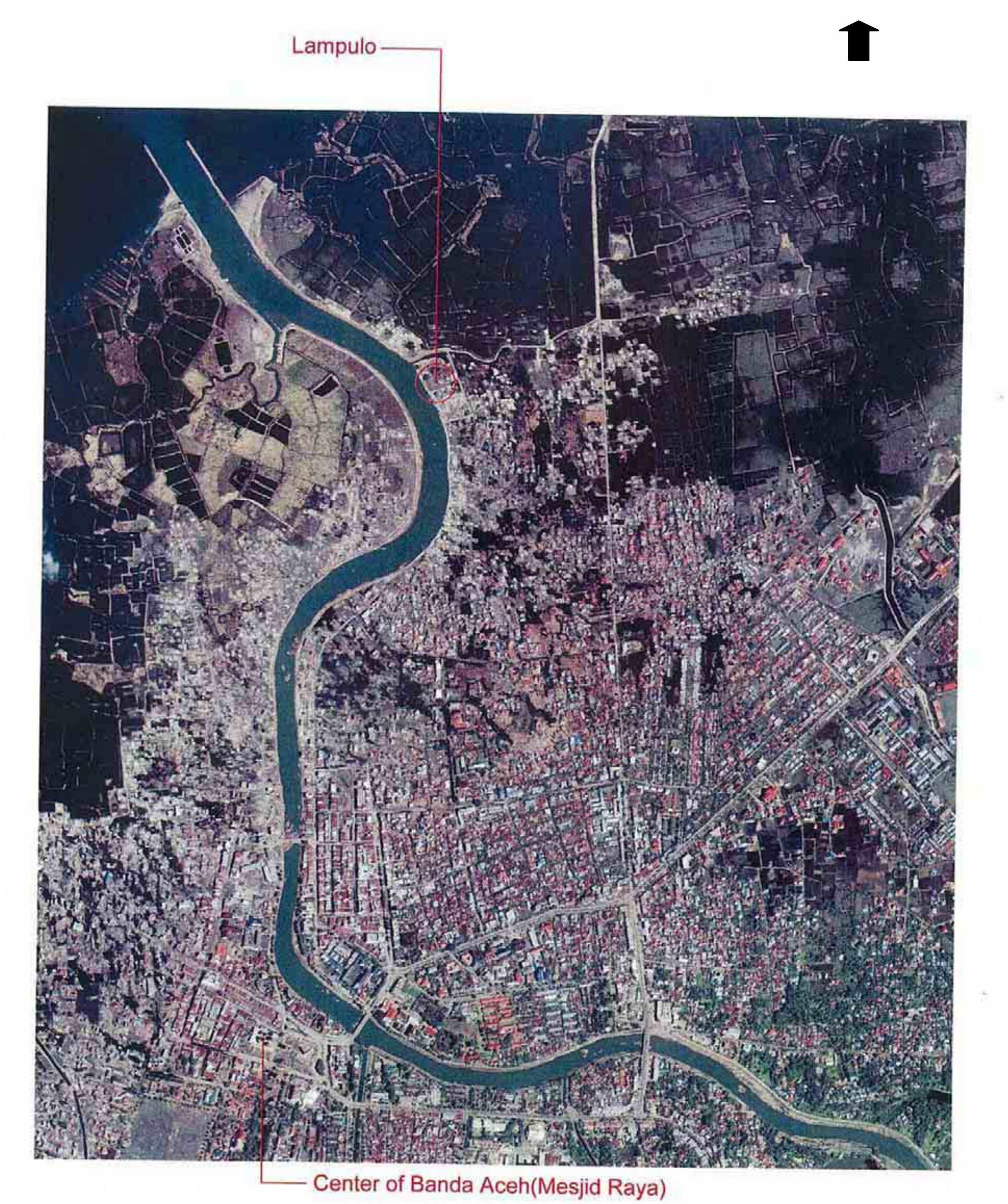

Figure 1.1.3 Location of the Lampulo Fish Market

1.1.3 Site Conditions

The site measures approximately 1,600 m^2. The overall site is divided by the property of Aceh Province, Aceh City and the private sector, with the Fish Market located within the Aceh Province area. The site is nearly square in shape, with the Fish Market being located on the west side of the center, and is flat overall. However, the average ground level is very low, being close to the highest water level. The area frequently suffers damage from high tides and floods. Currently, in addition to a gas station (for fishing boats) that has been newly built, the site is home to a fish selling area and auction market, as well as a cafeteria and other buildings that have been very simply constructed.

1.1.4 Conditions in the Surrounding Area

Because the project site is near the sea, a broad range of the surrounding area was completely destroyed by the tsunami. The only remnants left are the foundations and walls of some of the buildings. Also, the site is surrounded by roads to the south and east, and hence good access is available.

1.1.5 Environment

Because of the nature of the Fish Market, it faces onto the Aceh River and is surrounded by facilities involved in the fishing industry. Because those facilities were also destroyed by the tsunami, it is thought that they, similarly, will be restored, and thus there are no items involving the surrounding environment that will have to be taken into consideration when rebuilding the Fish Market.

1.1.6 Basic Policy for the Construction Project

The construction project to rebuild the Fish Market destroyed by the tsunami was decided after discussions had been carried out on an as-needed basis with related authorities in the Government of Indonesia. As the procedure for the project, opinions were exchanged with the Fish Market Operation and Management Corporation, which was directly involved in the facility, a study of hopes and demands and a facility usage study was implemented, and a project proposal was formulated. Along with these, the implementation design was promoted based on the approval of the Ministry of Maritime Affairs and Fishery, which is the overseeing organization.

(1) Overall layout planning

The facility previously included the Fish Market, a laboratory, lodging facilities, a mosque, a management building and a classroom building, along with other facilities, but those facilities were also destroyed. For centralizing those facilities or for constructing new buildings that have new functions when the overall fishing facilities are rebuilt. At the same time, however, from the standpoint that maintaining the convenience of the unloading wharf for fishing boats and the market is an important element in the layout of the project facility, the position for construction was planned based on demolition of any existing facilities that have been destroyed, and building the new facility on that site.

(2) Points considered in the floor planning and setting the facility scale

When the facility basic planning were carried out, consideration was given to the specifications (sizes, weights, quantities, etc.) of new equipment and supplies for which procurement and installation are being planned separately, such as ice-making machines, freezers and generators, and was also given to factors such as making the work efficient, making upkeep management easy, and providing space for maintenance and inspections. At the same time, when the floor planning was implemented, elements such as assuring space for selling, reception and shipping, and storing the fish were also considered. In terms of the structure, as well, the placement of pillars was considered and the planning was done in such a way as to assure a wide space. As a result, the planning is different from the plan type used prior to the disaster.

(3) Points considered in section planning

Taking into consideration the fact that appropreate space will also be needed for equipment such as the ice-making machines and freezers in terms of maintenance and inspections, as well as work efficiency, the story height was set at 4.7 m. Additionally, the floor of the first story of the market was planned at a height of approximately 1 m above ground level, with the aim of keeping the facility sanitary and protecting equipment and materials from high tides and floods.

(4) Countermeasures against salt damage

Because the planned site for the facility is near the sea and is constantly affected by the tides, the main structure will be reinforced concrete. For the roof, a steel frame that has been rustproofed will be used, and the roofing material will be galvanized sheet iron roofing.

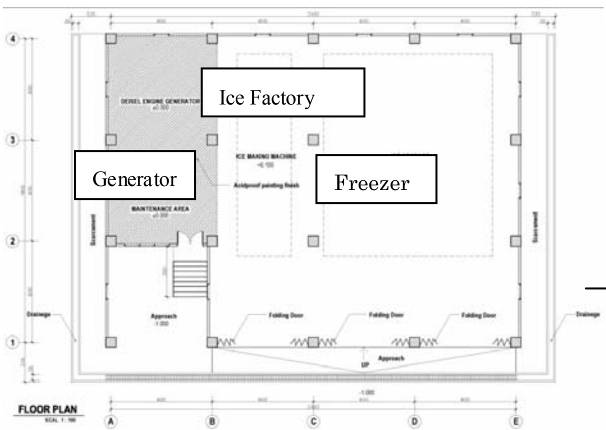

Figure 1.1.4 Ice Factory Floor Plan 28.7 m (W) x 20.35 m (D)

Figure 1.1.5 Ice Factory Elevation Height of Eaves =5 Height of Building =9.2 m

1.1.7 Electrical Planning and Water Supply Planning for Construction

(1) Electrical planning for construction

The power supply-related equipment of the facility was also destroyed by the tsunami. Currently, PLN is doing the wiring construction for the telegraph poles around the project site, so as in the past, power will be supplied through the poles. As a rule, however, when applications are submitted to PLN (Indonesia's state-run power company), PLN makes the decisions regarding the locations where power is to be supplied.

Figure 1.1.6 Telegraph Poles Near the Project Site

1.1.8 Structure Planning

(1) An overview of the structures is shown below.

Table 1.1.1 An Overview of the Structures

Name of building			Lampulo Ice Factoryt
Application			Fisheries facility
Type of construction			New
Building scale	Construction floor space (m^2)		432.0 (m^2)
	Total floor space (m^2)		432.0 (m^2)
	No. of stories		Single story
	Eaves height (m)		6.70 (m)
	Building height (m)		9.20 (m)
	Height of 1st floor		5.70 (m)
Structure overview	Type of construction		Reinforced concrete + steel truss roof
	Structure shape	X direction	Rigid-frame structure
		Y direction	Rigid-frame structure
	Type of foundation		Pile foundation
Plans for expansion			None

(2) Basic policy for structural design

1) Drawing up the structure type and structure shape

One aspect of the basic policy concerning this emergency restoration project and reconstruction assistance project is restoring the facility to its pre-disaster state and implementing a structural design that is capable of withstanding earthquakes. Various types of structures are feasible, among them (1) steel frame construction, (2) reinforced concrete construction, (3) steel frame reinforced concrete construction, and (4) block construction. Among these, (4) block construction does not have good resistance to earthquakes, while (3) steel frame reinforced concrete construction is not economical on the scale of two- or three-story buildings. (1) Steel frame construction has toughness, and is flexible enough to be able to follow an intricate design that involves curves. Another benefit is that processes can be shortened, but in general, this construction is not economical, and it requires special technology in the plant, such as machining technology, welding technology and bolt joining technology, making quality monitoring difficult. Upkeep control expenses also tend to mount up, as the building has to be repainted once every few years. Additionally, in a building such as the present one, that involves numerous openings such as windows and doors, diagonal beams and braces cannot be shared in many cases, and although this does not detract from the ability to withstand earthquakes, it results in significant deformation of the building in relation to the horizontal force when an earthquake occurs. With (2) reinforced concrete construction, on the other hand, there is a problem in that a longer construction period is required than with steel frame construction. In terms of the building situation in Indonesia, however, construction materials can be acquired easily and economically, and this type of construction is widely used in the region. Moreover, this type of construction is the most appropriate to the scale of the new building to be built at the facility, and also offers adequate resistance to earthquakes, so it was decided to use a rigid-frame structure with a reinforced concrete construction for this project. With respect to the roof, because the building, being a fish market, is a special one and will require a wide space with few pillars, we decided to use steel frame trussed girders.

2) Basic policy of the structural design relating to load in the event of an earthquake

The project area is close to the sea, and most of the buildings in the surrounding area, including this facility itself, were destroyed by the earthquake and the tsunami, but it is impossible to design buildings capable of withstanding a tsunami that is so large that can completely demolish building structures. Basically, the structural design policy relating to load in the event of an earthquake was formulated as described below, in view of the fact that this emergency restoration aid is aimed at restoring the current state, and that new earthquake standards based on the survey of damages being promoted by the local Earthquake Committee and on earthquake engineering have not yet been put in place.

① Coefficient for calculating horizontal load in the event of an earthquake

The design standards of Indonesia were used to calculate the horizontal load acting on a building in the event of an earthquake, and the calculation was made using the following equation.

- ♦ Horizontal load (H) = building weight (W) x earthquake coefficient (Cd)
  - Earthquake coefficient (Cd) = C x I x K
  - Basic coefficient (C) = 0.09 (Zone 2)

    (Because Banda Aceh City is in Zone 2 of the Indonesian earthquake zones, the basic coefficient is 0.09. The earthquakes zones range from 1 to 6, and values ranging from 0.13 to 0.00 are used for the basic coefficient, based on the firmness of the ground and the period of a particular building. This value is approximately half that of the earthquake standards used in Japan, but Aceh City is classified in the large-earthquake zone in Indonesia.)

- Importance coefficient (I) = 1.0
- Structure coefficient (K) = 1.0 or 2.5

  If the structure is a rigid-frame structure, 1.0 is used, and if it is a diagonal-bracing structure, 2.5 is used. Consequently, the earthquake coefficient (Cd) will be 0.09 x 1.0 x 1.0 = 0.09. The product of this value and the building weight is the horizontal load that acts on the building if an earthquake occurs.

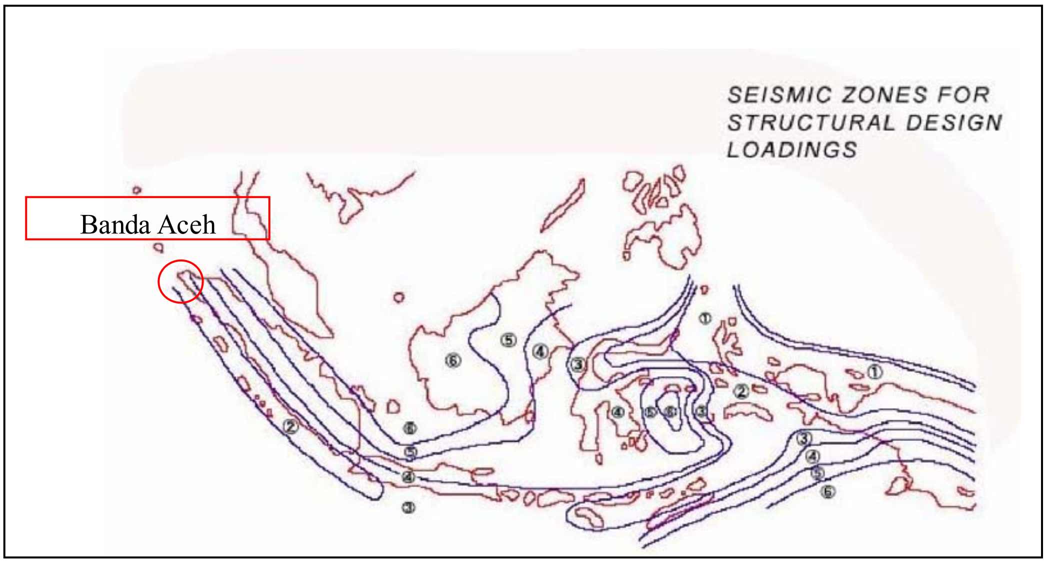

Figure 1.1.7 Earthquake Zones in Indonesia

②Additional margin of horizontal load if an earthquake occurs

When designing a new building to be built in an area where disaster has struck in the form of an earthquake and tsunami, in view of the fact that buildings designed based on the existing standards were destroyed, the point at issue is what degree of standards for earthquake resistance are necessary. In terms of this issue, at the current stage, given that no new earthquake resistance design standards have yet been provided, it is difficult to set this degree because there is no theoretical proof of how much additional horizontal load would provide a safe margin. Additionally, the destruction may have been caused by a number of factors, such as the ground sinking, buildings not having enough structural resistance, buildings being old and having deteriorated, and construction being defective, and thus it cannot be stated conclusively that the existing design standards are inadequate. Moreover, one characteristic of design standards is that they cannot be set by any one individual designer, but rather are not applied until provided by official authorities. Against that background, with respect to the earthquake-resistant design of the new buildings to be built in this project, the values calculated for the existing Indonesian design standards were used to calculate the horizontal load generated when an earthquake occurs, and measures such as including an addition margin of horizontal load beyond the necessary amount, for safety purposes, were not used.

3) Specifying the foundation type

The foundation form can be done in two ways: one is to use a direct foundation, in which the vertical load is supported by the surface area of the foundation, and the other is to use a pile foundation in which concrete piles and steel pipe piles, or PC piles, are driven into the ground and the load is supported by the hard ground at the base of the piles and the frictional force underground. Taking safety into consideration, the pile foundation method will be used, based on the results of a ground survey involving a study of the natural conditions that will be described later.

4) Design load

Design loads are categorized as follows: (1) fixed loads, (2) live loads, and (3) short-term horizontal force (earthquake load / wind load). The first type, the fixed load, is imposed by the actual weight of the building skeleton and the finishing materials. The second type, the live load, is determined based on the applications of the building. The project facility is a fisheries facility, but it will be subject to the live load imposed by equipment and materials such as ice-making devices and freezers, so the types of load noted below were used, with reference to the standards of the Architectural Institute of Japan.

Table 1.1.2 Live loads

Application	Sections targeted for design	
	Load for the beam and floor design	Load for the structure skeleton and foun design
Market	300 (kg/m^2)	270 (kg/m^2)
Roof	0 (kg/m^2)	0 (kg/m^2)

According to the standards of the Architectural Institute of Japan, the load is reduced, considering that the live load for the design of the structure skeleton (pillars and girders) and the foundation will be more widely dispersed than the load for the design of the beams and floor. Moreover, for this project, the roof is galvanized sheet iron roofing, and the facility will not be used as an open square, so the live load was not taken into consideration. For the third type of load, the short-term horizontal force (earthquake load / wind load), there are two types of load; one induced by earthquakes and one by wind, but that induced by earthquakes is clearly larger, so the horizontal force when an earthquake occurs was used. As an earthquake and wind acting simultaneously would result in a redundant design, this was not used.

5) Wind load

According to meteorological data for the local area, the wind load is relatively small. Since the basic velocity is around 35 m/sec, we compared the load guidelines with those of the Architectural Institute of Japan and converted the basic velocity into the wind pressure, arriving at a basic wind force of 78.5 kg/m2. This is about half the wind load of Japan (basic velocity = 60 m/sec), so it can be judged that this load does not govern the structural design.

6) Stress analysis

The calculation of the stress used to design principal structural components such as the pillars and girders, and the vertical load used to design the foundation, was done using either SAP2000 or STAAD PRO 2000, both of which are 3D structural analysis programs commonly used in Indonesia.

7) Cross-section design and load combinations

The cross-section was calculated using not the allowable stress method, but rather an ultimate stress method similar to the design standards of France. With this method, an extra margin is added to the actual load ahead of time using a coefficient, and then the design stress of the structure is calculated, and the cross-section is decided based on the ultimate proof stress of the concrete and reinforcements. The load combinations used to calculate the design stress of the structure are as noted below.

①Mu= 1.2 fixed load + 1.6 live load

②Mu= 1.05 fixed load + 1.05 x (0.9 x live load) + 1.05 earthquake load

8) Materials used

Materials were selected that are marketable in the area near Aceh City in Indonesia, and that are easily accessible. In light of the fact that we would be using an appropriate design strength balanced with the building scale, we did not use high-strength or other special concrete or reinforcements.

Table 1.1.3 Materials list

Strength of concrete used	For structure skeleton design	For concrete slab on grade and le concrete
	K250 (250 kg/cm^2)	K200 (200 kg/cm^2)

Reinforcements used	Deformed bars	Round bars
	BJD 32 Yield point strength (3200 kg/cm^2)	BJTP24 (2400 kg/cm^2) Yield point strength (2400 kg/cm^2)

Steel frame used Conforms to JIS SS400	Yield point strength = 2400 kg/cm^2 Tensile strength = 4100 kg/cm^2

1.2 NATURAL CONDITIONS

1.2.1 Geology

(1) Soil survey positions and survey method

A soil survey is necessary when implementing the foundation design for a new building to be constructed. However, the only documents still in existence concerning the site for the Fish Market were a diagram showing the strata, that was noted on a sectional diagram of wells, and because the ground strength was not adequately identified, soil surveys (Dutch dual-cone penetration tests) were carried out at four locations on the site planned for construction. An overview of the survey results is presented below.

The location of the survey points are shown in Figure 1.2.1 and the photograph of the survey is shown in Figure 1.2.2.

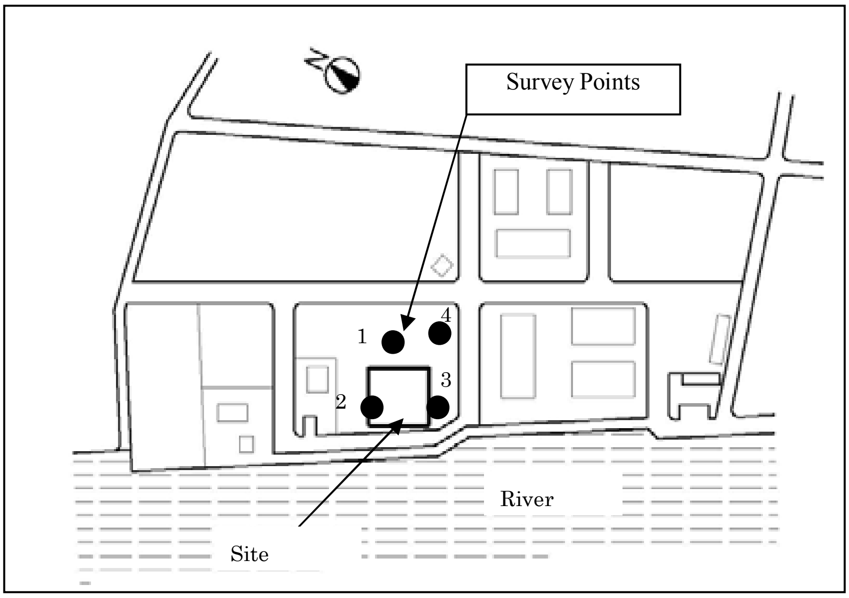

Figure 1.2.1 Location of the Survey Points

Figure 1.2.2 Soil Survey
(No. 1 Point)

Table 1.2.1 shows soil survey method.

Table 1.2.1 Soil Survey Method and Fitness of Survey Items

Survey method	Survey item						Target soil		
	Stratum Configuration	Physical characteristic	Consolidation characteristic	Strength characteristic	Bearing capacity characteristic	Deformation characteristic	Cohesive soil	Sandy soil	Baserock
Standard penetration test	◎	○		○	◎	△	○	○	
Dutch dual-cone penetration test	○			◎	○		○	○	
Flat-plate loading test					◎	○	○	○	

◎: Fits best and is used frequently ○ : Fits well and is used relatively often △ : Rarely used

(2) Survey results

1) Graph of cone penetration resistance values

The results of cone penetration resistance values are shown in Figure 1.2.3 and 1.2.4.

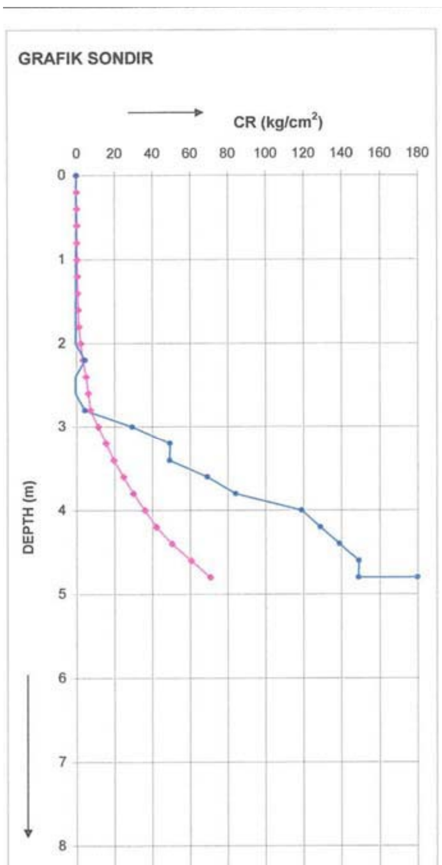

Figure 1.2.3 Graph of Penetration Resistance Values, No. 2 Position

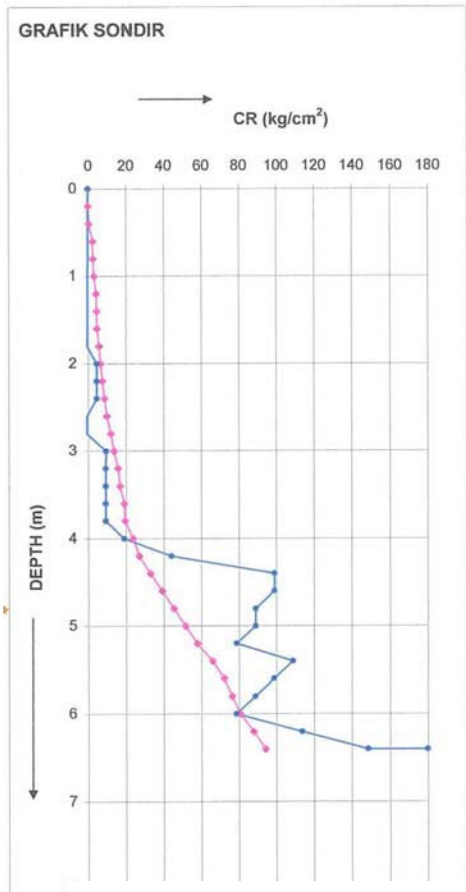

Figure 1.2.4 Graph of Penetration Resistance Values, No. 3 Position

2) An overview of the survey results

The Stratum configuration and bearing ground is shown in Table 1.2.2.

Table 1.2.2 Stratum Configuration and Bearing Ground

Survey method	Dutch dual-cone penetration test
Survey positions	4 locations within the site
Survey depth	—5.0～6.0 m from the ground surface
Groundwater level	—1.0 m from the ground surface
Strata	To a depth of around —1.0 m from the ground surface, there is a layer of surface soil sediment, and to around —4.0 m from the ground surface, there is a layer of fine sand peculiar to rivers that is extremely loose soil. At depths greater than —4.0 from the ground surface, there are alternating layers of coarse sand, gravel, and clay mixed with sand, all of which are thin strata. At around —5.0 from the ground surface, there is a layer of gravel at which the cone penetration resistance (qc) increases sharply.
Bearing ground	To a depth of around —4.0 m from the ground surface, the ground is extremely soft, but deeper than that, the ground is judged to be bearing ground. The bearing ground needs to be at around —4.0 m from the ground surface for a direct foundation, and around —6.0 m from the ground surface for a pile foundation, so it is judged that there would be no problem in using a pile foundation.

(3) Foundation design policy

With the project construction scale (reinforced concrete single-story), a direct foundation (type (1)) is feasible, but based on the results of the survey, the bearing ground is around —4.0 m from the ground surface, which is too deep to use a direct foundation. Also, because the site is at the coast, the ground is sandy soil, with a high coefficient of infiltration, and the fluidization of the dirt could cause uneven settling of the foundation. When the construction work is being done, as well, foundation construction at below the groundwater level would be extremely difficult, causing the costs for temporary construction to escalate, which is hardly economical. For these reasons, a pile foundation was chosen for the foundation type.

(4) Investigation of the allowable bearing capacity of the soil

When designing the size of the foundation, it is necessary to set the allowable bearing capacity of the soil. The allowable bearing capacity of the soil was calculated based on the "Architectural Foundation Structure Design Guidelines" published by the Architectural Institute of Japan and the "Soil Survey Methods" of the Soil Society of Japan.

- The following equation was used to calculate the long-term allowable bearing capacity of the soil (Ra):
  Ra = (30 x N x Ap) /3 — Formula 1

- When the ground is sandy, the relationship of the N value of the cone penetration resistance (qc) is qc= 4 x N, based on Meyerhot's formula. If the bearing ground is —6.2 m below the ground surface, then qc = 113.72 kg/cm2 is obtained from the graph of cone penetration resistance values.

Consequently, qc = 4 x N → N = qc/4 = 113.72/4 = 28.4

- ♦ The piles will be reinforced concrete piles, and will be driven in. If square piles with a diameter of 35 cm are used, the bottom surface area of the piles will be Ap= 0.35 m x 0.35m =0.12m2.

  Consequently, based on equation 1, the vertical load bearing capacity of the piles will be Ra = (30 x 28.4 x 0.12) / 3 = **34.1 t/pile**.

1.3 DESIGN STANDARDS

1.3.1 Applied Regulations and Standards

The regulations and standards noted below were applied.

(1) Architectural design standards of Indonesia

- Tata Cara Perhitungan Struktur beton untuk Bangunan Gedung
  SNI 03-2847-2002
- Tada Cara Perencanaan Kethanan Gempa untuk Bangunan Gedung
  SNI 03-1726-2003
- Pedoman Perencanaan Pembebanan untuk Rumah dan Gedung
  SKBI-1.3.53.1987, UDC; 624.042
- Pedoman Perencanaan Ketahanan Gumpa untuk Rumah dan Gedung
  SKBI-1.3.53.1987, UDC;699.841
- Petunjuk Perencanaan Beton Burtulang dan Struktur Dinding Burtulang untuk Rumah dan Gedung
  SKBI-2.3.53.1987, UDC;693.55;6, 693.25

(2) Other standards

- Structure Calculation Guidelines published by the Architectural Institute of Japan
- Reinforced Concrete Structure Calculation Guidelines published by the Architectural Institute of Japan
- Load Guidelines published by the Architectural Institute of Japan
- Architectural Foundation Structure Design Guidelines published by the Architectural Institute of Japan
- Soil Survey Methods published by the Soil Society of Japan

1.4 DRAWINGS

1.4.1 Basic Policy for Drafting Design Drawings

Based on the results of the field survey, architectural plan drawings, finishing planning drawings, structural planning drawings, and electrical equipment drawings were drafted. A list of drawings for the various facilities is attached below.

Table 1.4.1 List of Drawings

No.	Dwg. No.	Building Name	Title
01	01	ICE FACTORY	SITE PLAN
02	02	ICE FACTORY	FINISHING SCHEDULE
03	03	ICE FACTORY	FLOOR PLAN
04	04	ICE FACTORY	ROOF PLAN
05	05	ICE FACTORY	FRONT ELEVATION
06	06	ICE FACTORY	BACK ELEVATION
07	07	ICE FACTORY	SIDE ELEVATION
08	08	ICE FACTORY	SECTION-1
09	09	ICE FACTORY	SECTION-2
10	10	ICE FACTORY	FITTINGS SCHEDULE
11	11	ICE FACTORY	LIGTHING FIXTURE
12	12	ICE FACTORY	FOUNDATION, COLUMN & GROUND BEAM PLAN
13	13	ICE FACTORY	COLUMN & GRIDER PLAN
14	14	ICE FACTORY	STEEL FRAMING PLAN (ROOF)
15	15	ICE FACTORY	DETAIL OF FOUNDATION
16	16	ICE FACTORY	DETAIL OF RC MEMBERS
17	17	ICE FACTORY	DETAIL OF ROOF STRUCTURE

1.5 ESTIMATION OF CONSTRUCTION COSTS

1.5.1 Basic Policy for Rough Estimation of Construction Costs

The rough construction costs were estimated using the volume of construction calculated based on the design drawings and specifications that were drafted and the unit prices for construction in the Aceh region of Indonesia. For the unit prices for construction and labor, the principal unit prices described in Indonesia's official standard construction unit prices (noted below) were used, and then indirect costs were added in. Costs such as transportation costs are included in the indirect costs, and comprise approximately 15 to 20% of the principal unit prices. Construction unit prices that could not be obtained from the principal unit prices were calculated by taking the standard measure used in Indonesia for the ratio of work that can be accomplished in a certain unit period of time and calculating the complex unit prices.

- PENETANPAN HARGA SATUAN BAHAN BANGUNAN DAN JAYA PPASCA BENCANA
- KUBUTUHAN PEMERINTAH PROVINVE NANGGRE ACHE DARUSSALAM TAHUN 2005 NOMOR ;050.205/082/2005. TANGGAL 27 MEI 2005.

（2005 edition of the Aceh Province Official Standard Construction Unit Prices）

1.5.2 Overview of the Rough Construction Costs

The table below shows the results of the rough estimate of construction costs.

Table 1.5.1 Rough Construction Costs

Name of facility	Construction classification	Rough construction costs (converted to Japanese yen) Unit: 1,000 yen
Fish Market	New building construction costs	19,500

1.5.3 Appropriateness of the Rough Construction Costs

It is difficult to verify the appropriateness of costs necessary for repair construction, so the appropriateness of the costs was verified by calculating the construction costs per unit area for a newly constructed building. The results showed that the rough construction costs per unit area for a newly constructed building would be approximately 40,500 yen/ m^2. The average unit price for new construction of a reinforced concrete structure in Aceh Province in Indonesia is between 2,500,000 Rp/ m^2 and 3,000,000 Rp/m^2 (approximately 31,500 yen/ m^2 and 37,800 yen/ m^2). Thus, the costs involved in the project are slightly higher than the usual costs in Indonesia, but this is because pile construction is being used for the foundation, and the estimate of the rough construction costs involved in the project is deemed to be appropriate.

Table 1.5.2 Rough Construction Costs per Unit Area

Total floor area of newly constructed building (m^2)	Total construction costs for new building Unit: 1,000 yen	Rough construction costs per unit area (Unit: yen/ m^2)
432.0	19,500	45,138

CHAPTER 2 PREPARATION OF TECHNICAL REPORT

2.1 TENDER CONDITION

2.1.1 Source of Fund

The Government of Indonesia has received from the Government of Japan a Grant Aid amounting to Fourteen Billion Six Hundred Million Japanese Yen (Yen 14,600,000,000) as per Exchanged Note dated on January 17, 2005, for the purchase of products and services necessary for the execution of Program by the Government of Indonesia for Efforts to cope with the Damages caused by the Great Earthquake of the Coast of Sumatra, and by the Indian Ocean Tsunami Disaster which includes the Project.

Under this program, the Japan International Cooperation System (JICS) acts as an implementing agency for and on behalf of the Government of Indonesia in accordance with the Exchange of Notes.

2.1.2 Mode of Tender

The Contractor for construction will be procured through international competitive bidding which will be executed by JICS.

The contract is presumed to be unit price contract with bill of quantities.

2.2 TECHNICAL REPORT

The tender documents will comprise three (3) volumes as listed up here under:

(1) VOLUME I	Section 1	Invitation for Bids
	Section 2	Instructions to Bidders
	Section 3	Bid Data
	Section 4	Bill of Quantities
	Section 5	Forms, Annexes and Enclosures
	Section 6	Conditions of Contract
	Part I:	General Conditions of Contract
	Part II:	Conditions of Particular Application
	Part III:	Appendix to Bid
(2) VOLUME II	Section 7	Technical Specifications
(3) VOLUME III	Section 8	Drawings

Technical report was prepared. Composition of the report is same as that of the Project: RECOVERY OF WATER SUPPLY SYSTEM IN BANDA ACEH CITY. JICA Study Team has produced Volumes II: Technical Specifications and III: Drawings as Technical Report.