SUPPORTING REPORT

PART-I

IMPLEMENTATION PROGRAM

THE STUDY ON FLOOD CONTROL FOR AMBON AND PASAHARI AREA
IN THE REPUBLIC OF INDONESIA
SUPPORTING REPORT
PART-I

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CHAPTER 1 PROJECT DESCRIPTION

1.1 General

1.1.1 Background and Justification of the Project

One of the policies raised by the Government of Indonesia to achieve the basic targets of national development is the support and promotion of development of the eastern regions, which are relatively undeveloped within Indonesia. In line with this central government policy to develop the eastern regions, development investment was initially concentrated in Sulawesi, but in recent years the Government and investors have turned their attention to further eastern areas such as Maluku Province.

Maluku Province is located roughly halfway between Sulawesi and Irian Jaya and is composed of the islands of Ambon (location of the provincial capital Ambon City), Seram, Buru, Halmahera, etc. Ambon City is blessed with a good natural port and has been the social and economic center of the region ever since the days of colonial rule by the Netherlands. The population of Ambon City, which currently stands at 305,000 as of 1996, is forecast to rise to 420,000 by the end of 2015. However, despite being such an important commercial center, Ambon, like other cities in the east of the country, lacks the infrastructure to support future growth.

The people living in the center of Ambon city invariably suffer from flood damage every year. In recent years, big floods occurred in 1984, 1989 and 1996, of which the 1989/06/22 flood caused the largest damage amounting to Rp. 25 billion.One of the projects being most urgently implemented in the effort to develop the infrastructure of Ambon is that to put flood prevention measures in place in the urban districts of the city. Five main rivers flow into Ambon Bay and, although flood walls and other flood prevention facilities do exist, these are not sufficient to prevent the frequent flooding of the Ambon urban area. In order to prevent the occurrence of such flood damage, the implementation of countermeasures such as dam construction, river improvements, etc. has become an issue requiring urgent attention.

Moreover, in order to secure the urban water supply to respond to increased demand in the future, water resources development needs to be carried out in unison with the said flood prevention measures. Through the implementation of the said projects, the improvement of river environment is also required as the river course and water quality, essential components for Ambon daily life, have deteriorated badly due to the economic expansion of the city.

1.1.2 Objectives of the Project

The objectives of the Ambon flood control project are summarized as follows:

1) To mitigate flood damage which occur annually along the five rivers (Ruhu, Batu Merah, Tomu, Batu Gajah and Batu Gantung) in the central part of Ambon city;
2) To supply raw water for domestic and industrial use in Ambon city;
3) To improve river environment by appropriate facilities and to improve water quality and quantity by developed maintenance flow.

1.2 Project Composition

1.2.1 Project Components

The project is composed of the following two types of measures:

- **Structural Flood Control Measures**

  To mitigate flood damages directly, structures measures such as river improvement work, flood control dam, diversion channel, check dam and so on are constructed along or in the river courses.

- **Non-structural Flood Control Measures**

  To mitigate flood damages directly or indirectly, non-structural flood control measures including suppression of flood runoff, improvement of flood proofing function and facilitation of flood prevention activities are constructed along the river courses or in the river basins.

(1) Structural Measures

The structural flood control measures employed in the five (5) target river are summarized as shown in Table-1.1.1

Table-1.1.1 Structural Measures for Ambon Area

Item	Ruhu R.	Merah R.	Tomu R.	Gajah R.	Gantung R.
<<< Project Scale >>>	30 - year	30 - year	30 - year	30 - year	30 - year
(1) River Improvement Work					
Improvement Scale (Return Period)	5-year	5-year	30-year	10-year	10-year
River-bed Formation Length (m)	1,600	1,600	2,700	2,600	1,450
River-bed Excavation Depth (m)	1.00	1.00	0.80	1.00	1.00
Length (m)	1,600	1,600	2,100	2,100	1,450
Concrete Channel Length (m)	-	1,200	2,100	700	900
Flood Wall Heightening Left	300	1,010	130	230	100
Length (m) Right	170	1,070	20	150	100
River Widening Length (m)	350	70	-	-	50
Bridge Improvement Number	3	1	4	3	2
(2) Flood Control Dam					
Dam Type	Rock Fill	-	-	Rock Fill	Rock Fill
Dam Height (m)	41.0	-	-	31.3	34.0
Dam Length (m)	103.0	-	-	209.0	132.0
(3) Diversion Channel					
Type	-	Tunnel	-	-	-
Length	-	1,200	-	-	-
Standard Section - Width (m)	-	5.8	-	-	-
Standard Section - Height (m)	-	5.8	-	-	-
(4) Check Dam					
Dam Height (m)	10	-	7	8	11
Storage Capacity (m^3)	40,000	-	37,000	10,000	36,000

(2) Non-structural Measures

Non-structural flood control measures are defined as measures other than structural flood control measures constructed along the river courses or in the river basins to mitigate flood disasters. The targets of non-structural measures are:

1) To suppress flood runoff (including sediments),
2) To improve flood proofing function and
3) To facilitate flood prevention activities.

On the basis of the current and future forecast conditions of the target river basins, practical non-structural measures are chosen and entered into the master plan as shown in Table-I.1.2 .

Table-I.1.2 Non-structural Flood Control Measures for Ambon Area

Objectives	Methods	Contents	Target Area
(1) Suppression of Flood Runoff	Land Use Regulation	Land use restriction to maintain forest and natural flood retention areas etc. based on Land Use Plan authorized by Local Government	Whole Area
	Vegetation Improvement	Active improvement of vegetation to reduce flood and sediment discharge through reforestation and re-greening	Upland Area
	Off-site Storage	Regulation reservoir to store increasing flood and sediment discharge caused by large scale land development	Whole Area
	Lowland Infiltration	To decrease rain water discharge using permeable sewerage system , *infiltration* wells and permeable pavement roads	Lowland Area
(2) Improvement of Flood Proof Function	Land Use Regulation	To restrict land use in flood prone areas by authorized regulation	Whole Area
	Flood Proof Facilities	To promote flood proof public facilities and *private buildings by land elevation and water* proofing works	Lowland Area
(3) Facilitation of Flood Disaster Prevention Activities	Management Organization	Establishment of flood management organization for total flood control system	-
	Flood Forecast and Warning System	Establishment of flood forecast and warning system to facilitate flood fighting and evacuation	Lowland Area
	Flood Risk Map	To prepare flood risk map and officially advise inhabitants	Lowland Area
	Flood Fighting System	Organization of flood fighting system including soft and hard systems for emergency preparedness	Lowland Area
	River Management Zone	Installation of river management zone along the designated reaches	Lowland Area
	Public Awareness	Publication of flood control system including flood control measures and implementation schedule	-
	Human Resource Development	Training for personnel involved with flood control activities	-

1.2.2 Phasing of Project

The implementation of the flood control master plan (covering structural measures) is divided into two (2) phases: 1) Phase-1 Project (priority project for flood control in the Ambon central areas and urgent domestic water supply) and Phase-2 Project (flood control in the Ruhu river basin and future water supply). Refer to Table-I.1.3 and I.1.4.

Table-I.1.3 Implementation Phase of Flood Control Master Plan

Items \ Fiscal Year	(1) 1989 99	(2) 1999 00	(3) 2000 01	(4) 2001 02	(5) 2002 03	(6) 2003 04	(7) 2004 05	(8) 2005 06	(9) 2006 07	(10) 2007 08	(11) 2008 09	(12) 2009 10	(13) 2010 11	(14) 2011 12	(15) 2012 13
Structural Measure															
<<< Phase-1 >>>															
1-1 Preparation															
1-2 Consulting Services															
1-3 Construction															
<<< Phase-2 >>>															
2-1 Preparation															
2-2 Consulting Services															
2-3 Construction															
Non-Structural Measure															
- Establish Organization															
- Detailed Plan															
- Implementation															

Table-I.1.4 Project Components by Phase

Item		Ruhu R.	Merah R.	Tomu R.	Gajah R.	Gantung R.
<Phase-1 Project>						
River Improvement Work						
Improvement Scale (Return Period)		5-year	5-year	30-year	10-year	10-year
River-bed Formation Length (m)		1,600	1,600	2,700	2,600	1,450
River-bed Excavation Length (m)		1,600	1,600	2,100	2,100	1,450
Concrete Channel Length (m)		-	1,200	2,100	700	900
Flood Wall Heightening Length (m)	Left	300	1,010	130	230	100
	Right	350	1,070	20	150	100
River Widening Length (m)		900	70	-	-	50
Bridge Improvement Number		3	1	4	3	2
Multi-Purpose Dam (Rock Fill)						
Dam Height (m)			-	-	40.6	40.9
Dam Length (m)			-	-	200.0	139.0
Diversion Channel (Tunnel)						
Length		-	1,200	-	-	-
Section: Width (m) x Height (m)		-	5.8 x 5.8	-	-	-
Check Dam						
Dam Height (m)		10	-	7	8	11
Storage Capacity (m^3)		40,000	-	37,000	10,000	36,000
<Phase-2 Project>						
Multi-Purpose Dam (Rock Fill)						
Dam Height (m)		44.7				
Dam Length (m)		112.0				

1.3 Implementation Schedule

The master plan will be implemented according to the schedule as shown in Table-1.1.5.

Table-I.1.5 Implementation Schedule of Flood Control Master Plan

Items \ Fiscal Year	(1) 1989 99	(2) 1999 00	(3) 2000 01	(4) 2001 02	(5) 2002 03	(6) 2003 04	(7) 2004 05	(8) 2005 06	(9) 2006 07	(10) 2007 08	(11) 2008 09	(12) 2009 10	(13) 2010 11	(14) 2011 12	(15) 2012 13
Structural Measure															
<<< *Phase-1* >>>															
1-1 Preparation															
(a) Procurement															
- Consultant	X X														
- Contractor			X	X X											
(b) Detailed Design		X X	X X												
1-2 Consulting Services															
(a) Survey and Design		X X	X X												
(b) Tender Assistance			X	X X											
(c) Supervision					X X	X X	X X	X X	X X	X X					
1-3 Construction															
River Improvement					X X	X X	X X	X X							
Check Dam					X X	X X									
Merah Diversion					X X	X X									
Gajah Dam					X X	X X	X X	X X	X X	X X					
Gantung Dam					X X	X X	X X	X X	X X	X X					
<<< *Phase-2* >>>															
2-1 Preparation															
(a) Procurement															
- Consultant						X X									
- Contractor								X	X X						
(b) Detailed Design							X X	X X							
2-2 Consulting Services															
(a) Survey and Design							X X	X X							
(b) Tender Assistance								X	X X						
(c) Supervision										X X	X X	X X	X X	X X	X X
2-3 Construction															
Ruhu Dam										X X	X X	X X	X X	X X	X X
Non-Structural Measure															
- Management Organization	X X														
- Forecast/Warning System		X X	X X	X X	X X										
- Flood Risk Map		X X	X X												
- Flood Fighting System		X X	X X	X X	X X										
- Public Awareness		X X	X X												
- Human Development		X X	X X	X X	X X	X X	X X	X X	X X						
- Land Use Regulation		Z Z	Z Z	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =
- Vegetation Improvement		Z Z	Z Z	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =
- Off site Storage		Z Z	Z Z	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =
- Infiltration in Lowland		Z Z	Z Z	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =
- Land Use Regulation		Z Z	Z Z	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =
- Flood Proof Facility		Z Z	Z Z	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =
- River Management Zone		Z Z	Z Z	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =	= =

[Note] X X : Mainly dealt by Flood Control Project Office
Z Z : Planned by Special Committee
= = : Implemented by each Related Organization

1.4 Cost Estimate

1.4.1 Condition of Cost Estimates

In the cost estimate for the master plan, the project cost is composed of the following items:

1) Main Construction Cost
2) Cost for Land Acquisition and Compensation
3) Indirect Cost (30% of Main Construction Cost) including: Preparatory work cost for construction work, Cost for Engineering Services, Government Administration Cost, Physical Contingency and Government Tax (PPN: Value Added Tax)

The unit costs are decided based on the current costs of labor, material, equipment cost and so on. The following currency exchange rates (as of December 1996) are employed.

1) 1 US$ = 115 Japanese Yen = 2,300 Rp.
2) 1 Japanese Yen = 20.0 Rp.

1.4.2 Project Cost

The cost of the master plan (structural measures) is shown in Table-I.1.6. The total project cost amount to 234 billion Rupiah. Total land acquisition area and resettlement household number are 30.0 ha and 187 households respectively.

Table-I.1.6 Project Cost and Compensation Conditions

Project Composition	Construction Cost (Rp.Million)	Indirect Cost (Rp.Million)	L/Acquis. & Comp. Cost (Rp.Million)	Total Project Cost (Rp.Million)	Land Acquisition (m^2)	Resettlement Household (number)
Ruhu	47,339	14,202	14,950	76,491	549,500	40
River Improvement	9,323				1,500	40
Multi-Purpose Dam	36,646				515,000	0
Check Dam	1,370				33,000	0
Batu Merah	39,021	11,706	508	51,235	1,550	10
River Improvement	9,966				350	10
Diversion Channel	29,055				1,200	0
Tomu	20,223	6,067	0	26,290	30,000	0
River Improvement	18,753				0	0
Check Dam	1,470				30,000	0
Batu Gajah	60,001	18,000	4,750	82,751	164,000	30
River Improvement	9,091				0	0
Multi-Purpose Dam	49,480				148,000	30
Check Dam	1,430				16,000	0
Batu Gantung	43,963	13,189	3,475	60,627	145,000	0
River Improvement	7,327				0	0
Multi-Purpose Dam	35,306				139,000	0
Check Dam	1,330				6,000	0
Total Five	210,547	63,164	23,683	297,394	890,050	80
River Improvement	54,460				1,850	50
Multi-Purpose Dam	121,432				802,000	30
Diversion Channel	29,005				1,200	0
Check Dam	5,600				85,000	0

1.5 Project Evaluation

1.5.1 Initial Environmental Examination

The objectives of the initial environmental examination (IEE) are to examine any possible impacts on the environment in both the construction phase and operation phase. As a result of IEE, significant negative impact is identified on 3 environmental elements, namely resettlement, solid waste and groundwater. Possible negative impact is envisaged on 11 environmental elements from some project activities.

Regarding other environmental elements, no negative impacts are anticipated from any of the project activities. Therefore, these elements will not be considered in the environmental impact assessment to be conducted in the further stage of study.

1.5.2 Economic Evaluation

Economic analysis was conducted under the following assumptions:

1) Price level : end of December 1996
2) Design scale : 30-year return period
3) Project life : 50 years
4) Maintenance costs : 0.5 % of the total construction costs per year
5) Standard conversion rate : 85 %
6) Growth rate of property value : 2.5 % per annum.

Table-I.1.7 shows the results of economic analysis on the construction of the flood control facilities for each river based on the first five year construction period, and of the entire project based on the construction schedule.

Table-I.1.7 Economic Evaluation of the Master Plan

River System	Project Cost (Economic Cost) Million Rp	Net Present Value at 10% Million Rp	Benefit/Cost at 10%	Internal Rate of Return
Ruhu	77,094	18,965	1.2	12.1 %
Batu Merah	43,550	90,614	3.6	21.8 %
Tomu	22,347	36,514	3.1	19.7 %
Batu Gajah	76,594	45,628	1.7	14.4 %
Batu Gantung	53,634	6,256	1.1	10.9 %
As a Whole	273,219	179,576	2.2	16.0 %

1.5.3 Financing Plan

The DGWRD envisages that most likely two new projects could be financed by OECF every year. The flood control project in Ambon City is a strong candidate for such financing, since Ambon City is the administrative and commercial center of Maluku Province. Consistent with the Government's development policy in the eastern regions, this project is also expected to be given high priority, although the decision to invest is contingent on the cost-effectiveness and impact of the project itself.

CHAPTER 2 EXECUTING SYSTEM

2.1 Executing System for Structural Measures

The responsible agency for the project implementation is the Ambon Flood Control Project Office which will be newly established at the project site. The system and organizations for implementation of structural measures will be as shown in Figure-I.2.1.

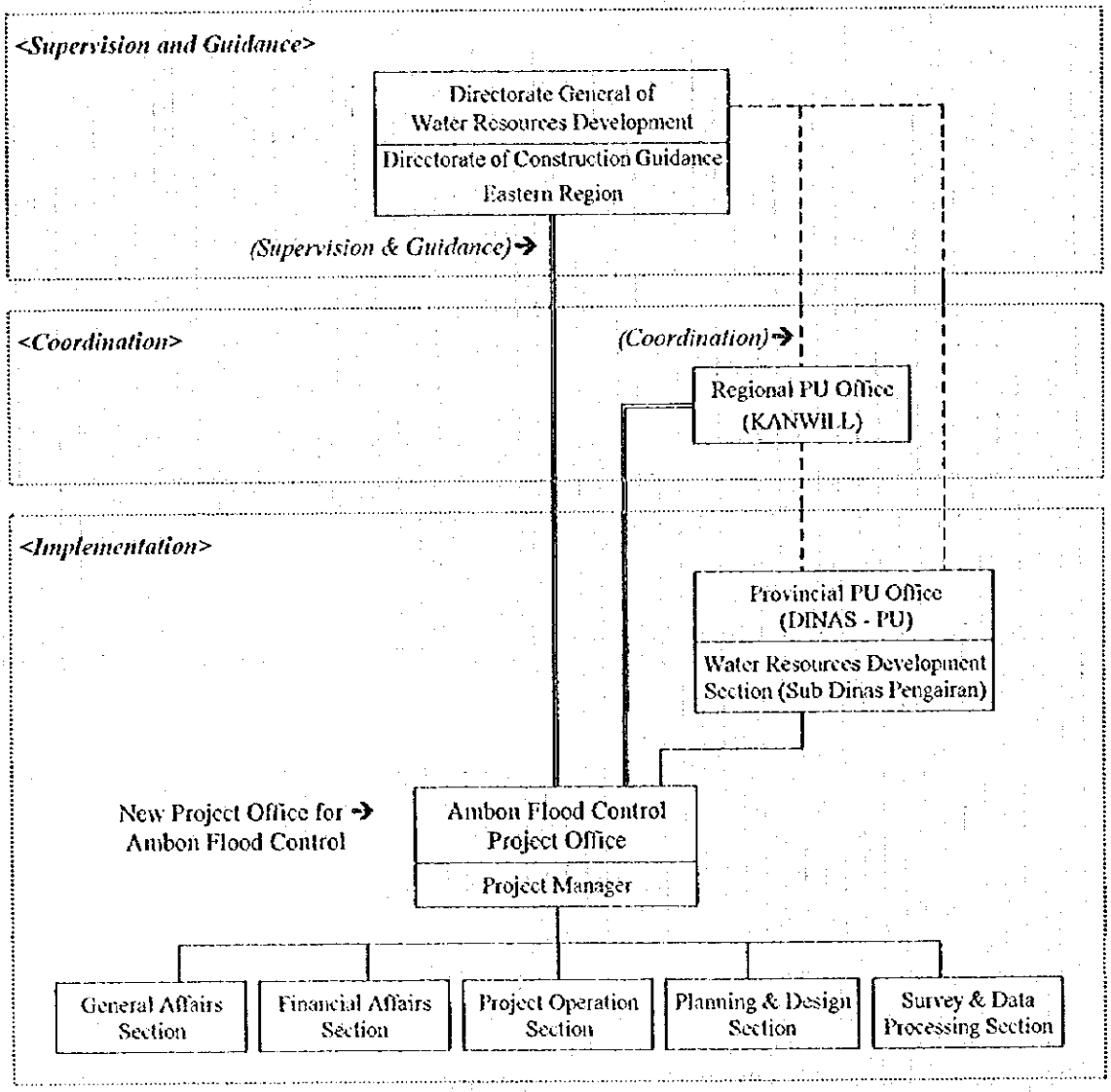

Figure-I.2.1 Organization for Implementation of Structural Measures

2.2 Executing System for Non-Structural Measures

For the implementation of non-structural measures, special committee will be established as shown in Figure-I.2.2. This committee is composed of several related organization as shown in Table-I.2.1, being chaired by the BAPPEDA of Ambon city. The special committee prepares authorized detailed plan of non-structural measures. Each measure will be implemented in cooperation with some related organization.

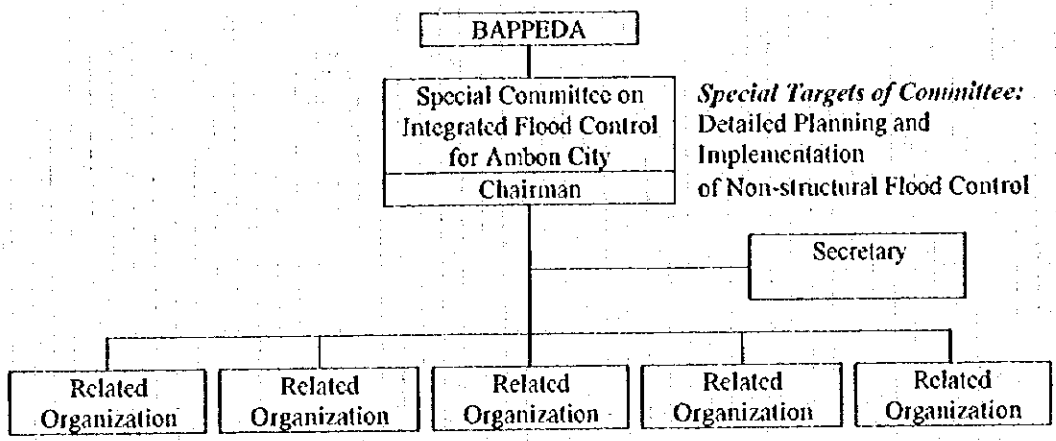

Figure-I.2.2 Organization for Implementation of Non-structural Measures

Table-I.2.1 Related Agencies for Implementation of Non-structural Measures

Methods	1 Regional Develop. Planning Board	2 Ministry of Public Works	3 Ministry of Forestry	4 Ministry of Agri-culture	5 Ministry of Social	6 National Land Agency	7 Meteoro-logical & Geophys. Agency	8 Local Govern-ment
Suppression of Flood Runoff								
Land Use Regulation	X		X	X		X		
Vegetation Improvement	X		X	X				
Off-site Storage	X	X	X	X				
Lowland Infiltration	X	X						X
Improvement of Flood Proof Function								
Land Use Regulation		X	X	X		X		X
Flood Proof Facilities		X						X
Facilitation of Flood Disaster Prevention Activities								
Management Organization		X			X			X
Flood Forecast & Warning S.		X			X		X	X
Flood Risk Map		X						X
Flood Fighting System		X			X			X
River Management Zone		X						
Public Awareness		X			X			X
Human Development		X			X			X

X: Concerned with implementation

CHAPTER 3 IMPLEMENTATION FOR PHASE-1 PROJECT

3.1 Packaging and Procurement Method

3.1.1 Packaging

Considering the work volume, site location, etc. of the Phase-1 Project components (Table-I.3.1), the project is divided into five (5) construction packages as shown in Table-I.3.2.

Table-I.3.1 Phase-1 Project Components

Item	Ruhu R.	Merah R.	Tomu R.	Gajah R.	Gantung R.
River Improvement Work					
Improvement Scale (Return Period)	5-year	5-year	30-year	10-year	10-year
River-bed Excavation Length (m)	1,600	1,500	2,700	2,200	1,450
Concrete Channel Length (m)	-	1,100	2,700	2,000	1,300
Multi-Purpose Dam (Rock Fill)					
Dam Height (m)		-	-	50.0	36.6
Dam Length (m)		-	-	240.0	100.0
Diversion Tunnel					
Length	-	900	-	-	-
Section: Diameter (m)	-	6.0	-	-	-
Check Dam					
Dam Height (m)	3.8	-	4.9	6.1	3.5
Storage Capacity (m^3)	40,000	-	37,000	10,000	36,000

Table-I.3.2 Tender Packages for Civil Works

Packaging	Scope of Works
Package - 1	- Batu Gajah Multi-purpose Dam
Package - 2	- Batu Gantung Multi-purpose Dam - Nitu River Disposal Site
Package - 3	- Batu Merah River Improvement - Batu Merah Diversion Tunnel
Package - 4	- Ruhu River Improvement - Tomu River Improvement - Ruhu Check Dam - Tomu Check Dam
Package - 5	- Batu Gajah River Improvement - Batu Gantung River Improvement - Batu Gajah Check Dam - Batu Gantung Check Dam

3.1.2 Procurement Method

(1) Consulting Engineering Services

The procurement of consulting services is to be made between July 1998 and June 1999. The procurement of contractors is to commence from October 2000 and to be completed by March 2002. The recommended method for the selection of a competent consultant is the Short List method in accordance with the Guidelines for the Employment of Consultants by OECF Borrowers. However, the direct appointment of a specific consulting engineering company should be considered, as the project was studied by the JICA Study Team. For the same reasons, the contract with the consultant should be made in one package for both the design stage and construction stage, in order to assist in the coordination and smooth execution of the project.

(2) Construction

In accordance with the Guidelines for Procurement under OECF Loans, International Competitive Bidding (ICB) is proposed for five construction packages as shown in Table-I.3.2 above. ICB is will be the best method for achieving the economic and efficient implementation of these packages. In the interests of the broadest possible competition, contract packages should be reasonable size to attract bids on an international basis. Tenders will be limited to contractors who have pre-qualified and been accepted onto the short list.

3.2 Implementation Schedule for Phase-1 Project

The project is composed of the following work items:

1) Loan procedure for OECF
2) Procurement for consulting engineering services and construction work
3) Consulting engineering services including detailed design, assistance in procurement of contractor and construction supervision
4) Construction work of five (5) packages, including 5 Rivers Improvement, Diversion Tunnel, 4 Check Dams, 2 Multipurpose Dams etc.
5) Land acquisition and compensation

The overall implementation schedule is shown in Table-I.3.3. The total required period for the main works is about ten (10) years which comprises three (3) main stages : 1) 18 months for the design, 21 months for procurement of contractors (overlaps with the design stage) and 72 months for construction.

Table-I.3.3 Implementation Schedule for Phase-1 Project

Items \ Fiscal Year / Month	(1) 1998/99		(2) 1999/00		(3) 2000/01		(4) 2001/02		(5) 2002/03		(6) 2003/04		(7) 2004/05		(8) 2005/06		(9) 2006/07		(10) 2007/08	
	Apr Sep	Oct Mar	Apr Sep	Oct Mar	Apr Sep	Oct Mar	Apr Sep	Oct Mar	Apr Sep	Oct Mar	Apr Sep	Oct Mar	Apr Sep	Oct Mar	Apr Sep	Oct Mar	Apr Sep	Oct Mar	Apr Sep	Oct Mar
1 Loan Procedure																				
a Pledge																				
b Loan Agreement																				
2 Procurement																				
a Consulting Services																				
b Construction Work																				
- Pre-qualification																				
- T/Doc. Preparation																				
- Tender Period																				
- Tender Evaluation																				
- OECF Concurrence																				
- Contract Negotiation																				
- OECF Concurrence																				
- L/C Open																				
3 Consulting Services																				
a Survey & Design																				
b Tendering																				
c Const. Supervision																				
4 Construction																				
a Package-1																				
b Package-2																				
c Package-3																				
d Package-4																				
e Package-5																				
5 Land Acquisition																				

3.3 Project Cost and Disbursement Schedule

The cost of Phase-1 Project is estimated based on the results of the field survey (topographic survey and geological survey) as shown Table-I.3.4. In this estimate the following currency exchange rates (as of September 1997) are employed.

1) 1 US$ = 120 Japanese Yen = 2,928 Rp.
2) 1 Japanese Yen = 24.4 Rp.

The total project cost is 271.94 billion Rupiah (11.15 billion Yen), estimated in September 1997 basis. Out of the total project cost, 226.36 billion Rupiah (9.28 billion Yen) will be financed by OECF loan. Other portion of the project cost: 45.58 billion Rupiah (11.15 billion Yen) will be financed by the national budget.

The project is requested to be financed by the OECF (The Overseas Economic Cooperation Fund, Japan) excluding the costs for land acquisition and compensation, government administration and government tax. The disbursement schedule of the project is summarized in Table-I.3.5.

Table-I.3.4 Summary of Phase-1 Project Cost

Item	Local Portion (Mil. Rp)	Foreign Portion (Mil. Yen)	Total Rp. Equivalent (Mil. Rp)	Total Yen Equivalent (Mil. Yen)
1. Civil Works	141,837	4,281	246,302	10,094
(a) Direct Cost	104,065	4,077	203,555	8,342
- Base Cost	90,633	3,551	177,281	7,266
- Price Escalation (2% per year)	13,432	526	26,274	1,076
(b) Physical Contingency (5% of a)	5,203	204	10,178	417
(c) Government Administration (5% of a)	10,178	-	10,178	417
(d) Government Tax (10% of (a + b + c))	22,391	-	22,31	918
2. Land Acquisition & Compensation	23,732	-	23,732	973
(a) Direct Cost	19,613	-	19,613	804
- Base Cost	17,234	-	17,234	706
- Price Escalation (2% per year)	2,379	-	2,379	98
(b) Physical Contingency (5% of a)	981	-	981	40
(c) Government Administration (5% of a)	981	-	981	40
(d) Government Tax (10% of (a + b + c))	2,157	-	2,157	89
3. Consulting Engineering Servies	17,888	585	32,015	1,312
(a) Direct Cost	14,265	557	27,719	1,136
- Base Cost	12,723	492	24,723	1,013
- Price Escalation (2% per year)	1,542	65	2,996	123
(b) Physical Contingency (5% of a)	713	28	1,386	57
(c) Government Tax (10% of (a + b))	2,910	-	2,910	119
Grand Total	183,457	4,866	302,049	12,379

[Note] Base for cost estimation : September 1997
Conversion rates : 1 US$ = Rp. 2,928 = Yen120 Yen = 24.4 Rp.

Table-1.3.5 Annual Disbursement Schedule of Phase-1 Project

Unit: Million Rupiah

Items			Total	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Consulting Engineering S.												
Construction												
Land Acquisition & Comp.												
1 Construction Cost			246,302				49,708	50,699	51,716	52,748	27,055	14,375
a	Direct Cost		203,555				41,081	41,900	42,741	43,593	22,359	11,880
	Package - 1	- Base Cost	58,471				9,745	9,745	9,745	9,745	9,745	9,746
		- Price Esc.	9,402				1014	1230	1449	1673	1901	2134
		<Total>	67,873				10,759	10,975	11,194	11,418	11,646	11,880
	Package - 2	- Base Cost	44,818				8,964	8,963	8,964	8,963	8,964	
		- Price Esc.	6,685				933	1131	1333	1539	1749	
		<Total>	51,503				9,897	10,094	10,297	10,502	10,713	
	Package - 3	- Base Cost	27,708				6,927	6,927	6,927	6,927		
		- Price Esc.	3,815				721	874	1030	1189		
		<Total>	31,523				7,648	7,801	7,957	8,116		
	Package - 4	- Base Cost	24,706				6,177	6,176	6,177	6,176		
		- Price Esc.	3,401				643	779	919	1060		
		<Total>	28,107				6,820	6,955	7,096	7,236		
	Package - 5	- Base Cost	21,578				5,395	5,394	5,395	5,394		
		- Price Esc.	2,971				562	681	802	926		
		<Total>	24,549				5,957	6,075	6,197	6,320		
b	Contingency	5% of a	10,178				2,054	2,095	2,137	2,180	1,118	594
c	Administration	5% of a	10,178				2,054	2,095	2,137	2,180	1,118	594
d	Tax : 10% of (a + b + c)		22,391				4,519	4,609	4,701	4,795	2,460	1,307
2 Land Acquisition & Comp.			23,732			3,761	3,837	3,914	3,992	4,072	4,156	
a	Direct Cost		19,613			3,109	3,171	3,234	3,299	3,365	3,435	
			17,234			2,872	2,872	2,872	2,872	2,872	2,874	
			2,379			237	299	362	427	493	561	
b	Contingency		981			155	159	162	165	168	172	
c	Administration		981			155	159	162	165	168	172	
d	Tax : 10% of (a + b + c)		2,157			342	349	356	363	370	378	
3 Consulting Engineering S.			32,015	4,456	4,545	1,236	3,784	3,859	3,936	4,015	4,095	2,088
a	Direct Cost		27,719	3,858	3,935	1,070	3,276	3,341	3,408	3,476	3,546	1,808
		- Base Cost	24,723	3,708	3,708	989	2,967	2,967	2,967	2,967	2,967	1,483
		- Price Esc.	2,996	150	227	81	309	374	441	509	579	325
b	Contingency	5% of a	1,386	193	197	54	164	167	170	174	177	90
c	Tax : 10% of (a + b + c)		2,910	405	413	112	344	351	358	365	372	190
Grand Total			302,049	4,456	4,545	4,998	57,329	58,472	59,645	60,835	35,306	16,463
OECF Loan Portion			242,838	4,051	4,132	1,124	46,575	47,504	48,456	49,423	27,200	14,373

[Note] Base for cost estimation : September 1997
Conversion rates : 1 US$ = Rp. 2,928 = Yen120 Yen = 24.4 Rp.

3.4 Evaluation of Phase-1 Project

3.4.1 Environmental Impact Assessment

Regarding all the environmental elements for which possible negative impacts were anticipated by the IEE, the extent of impacts were estimated and countermeasures were proposed to eliminate or reduce the impacts as far as possible. Regarding the three items for which significant impacts were identified, the impacts were carefully analyzed and conclusions were drawn as follows.

(1) Resettlement

Resettlement will unavoidably happen when the projects are implemented. However, efforts can be made to reduce the number of resettlement households to the minimum. This has already been considered during project planning. Resettlement may involve very sensitive social problems and need to be well solved under the responsibility of local government. Recommendations were given in the EIA report regarding impact reduction. In addition to reasonable compensation and provision of living conditions, continuous care of the resettled households was recommended.

(2) Solid Waste

Solid waste disposal is important with river improvement and dam construction. The quantity of solid waste was estimated and several methods were proposed for its disposal; namely, a land reclamation site at Wainitu, existing landfills, and construction material reuse. Through these measures, solid waste disposal will not be a significant problem during project construction.

(3) Groundwater

Impacts on groundwater may occur from the construction of the two multipurpose dams, the diversion tunnel at Batu Merah and river improvement with three-sided concrete channel. Since the dam site geology has high permeability, water proof measures for reservoir and dam sites should be taken into account in order to reduce the influence on the groundwater or springs at the downstream side.

During the diversion tunnel construction, loss of groundwater from the excavated tunnel is unavoidable. However, after tunnel construction, continuous loss of groundwater will not occur since the bottom and walls of the tunnel are concrete lined. Sealing of the diversion tunnel against groundwater flow may also affect groundwater levels. In order to reduce the impacts on people who are using groundwater from that aquifer, provision of new sources for supply of drinking water has to be considered.

Three-sided concrete channel reduces groundwater recharge and may cause a reduction in well water level. Thus countermeasures should be taken into account for the design of the three-sided channel structure during detail design.

3.4.2 Economic Analysis

Economic analysis was conducted under the following conditions:

- Price level : September 1, 1997
- Return period : 30 years
- Project life : 50 years
- Maintenance costs : 0.5% of the total construction costs
- Residual value of dams : 30 year equivalent value
- Shadow price : Equipment (85% of the market price), Material: (90%), Labor (90%)
- Growth rate of property value : 5.0 % per annum
- Value added from sediment excavation : Rp 7,000 /m^3
- Construction period : From 1999 to 2003 for separate cases; From 1999 to 2007 for the entire project
- Incremental costs and benefits for Water Supply : Rp 890 /m^3 for distribution pipes and OM costs; Rp 2,500 /m^3 for water supply benefits
- Value of Reclaimed Land : Rp 0.4 million /m^2

The following figures are the results of economic analysis. The economic analysis proved that the priority project or Phase-1 project is economically feasible. Refer to Table-I.3.6.

- Economic Cost : Rp 221,602 million
- Internal Rate of Return : 16.4 %
- NPV at discount rate 10% : Rp 168,756 million
- Benefit/Cost at discount rate 10% : 2.2

Table-I.3.6 Economic Evaluation of Phase-1 Project

Case of Economic Evaluation		Economic Cost (Mill. Rp.)	NPV at 10% (Mill. Rp.)	B/C at 10%	IRR
(1) Economic Evaluation as a Whole		221,602	168,756	2.2	16.4%
(2) Economic Evaluation by River					
Ruhu	River improvement (5 year scale)	7,768	26,154	5.3	28.1%
Batu Merah	River improvement (5 year scale)	13,480	88,955	9.6	39.1%
	River improvement and diversion channel	34,635	98,256	4.7	25.8%
Tomu	River improvement (30 year scale)	23,115	36,474	3.0	19.9%
Batu Gajah	River improvement (10 year scale)	15,761	52,938	5.4	28.0%
	River improvement (10 year scale) with multi-purpose dam	92,980	37,262	1.4	13.1%
Batu Gantung	River improvement (10 year scale)	11,211	29,932	4.4	25.1%
	River improvement (10 year scale) with multi-purpose dam	63,104	3,619	1.1	10.5%

3.5 Consulting Engineering Services

3.5.1 Objectives

The objective of the consulting engineering services is to facilitate the implementation of the Project by assisting the Ambon Flood Control Project Office of the Directorate General of Water Resources Development, Ministry of Public Works. The consulting engineering services comprise detailed design work, assistance with the preparation of tender documents and evaluation of tenders for the civil works contracts, and construction supervision.

3.5.2 Scope of Works

The scope of works for the consulting engineering services is itemized as follows :

- Detailed design work at the site, including testing and investigation.
- Preparation and evaluation of tenders for the civil works contracts.
- Assistance in supervision of construction works at the site.
- Transfer of knowledge to counterparts.

(1) Detailed Design Work

The following work items are to be accomplished by the consulting engineer for the detailed design work at the project site.

1) Review of previous studies.
   - To collect and review available data on meteorology, hydrology and geology.
   - To review the existing plan/design and previous reports.
2) Field investigation and site tests.
   - To carry out detailed field reconnaissance.
   - To carry out necessary field investigations such as topographic survey, and soil investigation / test boring.
   - To carry out necessary testing of materials for foundations and structures, both in the field and in the laboratory.
3) Detailed Design
   - To prepare basic plan of facilities necessary for the preparation of bidding documents.
   - To plan and supervise the hydraulic model test.
   - To carry out detailed design of all structures, including river improvement works, diversion tunnel, check dams, multipurpose dams and so on.

(2) Preparation and Evaluation of Tender Documents

1) To prepare draft and final bidding and contract documents.
2) To evaluate and report on pre-qualification submissions.
3) To evaluate and report on tender submissions.

(3) Assistance in Supervision

The consultants carry out the following services for the assistance in construction supervision at the project site.

1) Technical guidance for construction works and methods.
2) Home office support for engineering problems and difficulties.
3) Engineering advice for the efficient progress of works, including inspection of construction and as-built drawings to be prepared by contractors.
4) Preparation of Project completion report.
5) Preparation of work progress reports.
6) Additions and revisions to design works, if necessary.

(4) Transfer of Knowledge

The consultant will make every effort to transfer knowledge by using on-the-job training. This includes the transfer of knowledge to counterparts, other engineers and technicians concerned with the investigation, planning, design and construction methods.

(5) Reports

The following reports will be prepared and submitted in accordance with the progress of works.

1) Monthly, quarterly and annual progress reports.
2) Detailed design report with drawings.
3) Tender documents and evaluation reports.
4) Project completion report.
5) Other reports, to be prepared as necessary.

3.5.3 Staff Assignment Schedule

The staff assignment schedule for the engineering services is shown in Table-I.3.7. The required total number of man-months is estimated at 610 man-months comprising 305 man-months for the Foreign Consultant and 305 man-months for the Local Consultants.

Table-I.3.7 Consultant Staff Assignment Schedule for Phase-I Project

Fiscal Year / Items	(1) 1999/00	(2) 2000/01	(3) 2001/02	(4) 2002/03	(5) 2003/04	(6) 2004/05	(7) 2005/06	(8) 2006/07	(9) 2007/08	Total M/M
Consulting Services										
Tender Process										
Construction										
A Professional A										***305***
1 <Project Direct>										***5***
a Project Director	1	1		0.5	0.5	0.5	0.5	0.5	0.5	5
2 <Design & Tender>										***100***
a Team Leader	9	12	12							33
b River Engineer	7	7								14
c Dam Engineer	7	7								14
d Design Engineer	6	7								13
e Construction Eng.	2	7								9
f Tunnel Engineer	1	1								2
g Hydrologist	3									3
h Soil Engineer	3									3
I Geologist	3									3
j Topo. Surveyor	3									3
k Document Specialist		3								3
3 <Supervision>										***200***
a Team Leader				12	12	12	12	12	12	72
b Construction Eng. (1)				12	12	12	12	12	6	66
c Construction Eng. (2)				12	12	12	12	12		60
d Geologist					1	1				2
A Professional A										***305***
1 <Design & Tender>										***105***
a Team Leader	9	12	12							33
b River Engineer	7	7								14
c Dam Engineer	7	7								14
d Design Engineer	6	7								13
e Construction Eng.	2	7								9
f Tunnel Engineer	1	1								2
g Hydrologist	4									4
h Soil Engineer	4									4
I Geologist	4									4
j Topo. Surveyor	4									4
k Document Specialist		4								4
2 <Supervision>										***200***
a Team Leader				12	12	12	12	12	12	72
b Construction Eng. (1)				12	12	12	12	12	6	66
c Construction Eng. (2)				12	12	12	12	12		60
d Geologist					1	1				2
Grand Total										***610***

SUPPORTING REPORT

PART-J

TOPOGRAPHIC SURVEY

THE STUDY ON FLOOD CONTROL FOR AMBON AND PASAHARI AREA
IN THE REPUBLIC OF INDONESIA
SUPPORTING REPORT
PART-J

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CHAPTER 1 GENERAL

1.1 Scope of Work

1.1.1 Scope of Work for the Master Plan Study

1. Monumentation	10	points for bench marks
2. Distance marks	252	points for five rivers and one tributary
3. Leveling	13.8	km
4. Profiling	6	profiles for five rivers and one tributary
5. Cross sectioning	238	sections for five rivers and one tributary
	59	sections for bridges
	13	sections for dam sites
	5	sections for staff gauges
6. Tidal observation	1	station

1.1.2 Scope of Work for the Feasibility Study

1. 1:200 Mapping	63	ha of five rivers
2. 1:500 Mapping	40	ha of two dam sites
3. Cross sectioning	44	sections for two reservoirs
	12	sections for four check dams
4. 1:200 Mapping	2.4	ha for inlet and outlets of diversion
5. Sounding in Ruhu estuary	7	lines x 300m

1.2 Existing Data and Information

Existing maps and data concerning the topographic survey found in the offices concerned were as follows:

Topographic maps

1:250,000	in Ambon and Pasahari areas prepared by joint operation US/UK in 1972
1:100,000	in Ambon and Pasahari areas prepared by US Army in 1944 and revised by BAKOSURTANAL in 1977
1:5,000	in Ambon area prepared by BAPEDDA in 1985
1: 1,000	in Ambon City area prepared by BPN in 1989

Profile and Cross section maps

Profile and Cross section covering five rivers in Ambon area prepared by PU in 1992

Profile and Cross section data in Kobi river in Pasahari area prepared by PU in 1996

Aerial Photographs

1:25,000	aerial photographs covering Ambon area BAKOSURTANAL in 1995
1:25,000	aerial photographs covering Pasahari area BAKOSURTANAL in 1988

GPS Station

N.5004 Ambon (GBU.23) at Ambon Pattimura Airport

N1.5007 Wahai at Wahai Camat Office

Coordinates data and location description prepared by BAKOSURTANAL in 1995, The data and descriptions are hereto attached as Appendix J.1.

1.3 Technical Specifications

Technical specifications for the survey were prepared by JICA engineer based on the JICA Standards for Survey and Mapping of Overseas Development Project. The original text in English was translated into Indonesian, so that it readily be understood by Indonesian surveyors. The technical specifications in English are hereto attached as Appendix J.2.

1.4 Members and Equipment

1.4.1 Members and Equipment for the Field Survey of the Master Plan Study

Members worked for the survey are as follows:

Ir. Gatot Nugroho	Team leader
Agus Mihadi	Co-Team leader/surveyor
Ikin Rosikin	Surveyor
Warsito	-ditto-
Djoko Sriyono	-ditto-
Purwanto	-ditto-
Muchtar	-ditto-
Riyanto	Co-Team leader for Pasahari area
Swadi	Surveyor for Pasahari area
Suyono	-ditto-
Tatang	-ditto-
Yahamanto Tiansyah	-ditto-
Johan	Operator for Automatic Plotter

Equipment used for the survey are as follows:

Theodolite	3 units	Wild T2
Theodolite	2 units	Wild T0
Total station	2 units	Topcon GTS-300
EDM	1 unit	Sokkisya
Level	6 units	Sokkya B-2 , Wild-NAK
Computer (desk top)	2 units	The survey editor ver. 1.1., C. 1989, Tripangarso
Computer (laptop)	1 unit	Toshiba, Dynabook
Plotter	1 unit	HP Design Jet type 650c

Other equipment such as staves and base plates, measuring tapes etc.

1.4.2 Members and Equipment for the Field Survey of the Feasibility Study

Members worked for the survey are as follows:

Baroto	Team leader / GPS survey
Riyanto	Sub leader / surveyor
Warsito	Surveyor
Yahmanto	-ditto-
Sudirman	-ditto-
Widodo	-ditto-
Bimo	-ditto-
Rudi	Hydrographer / sounding

Mulyono	-ditto-
Pitut	GPS survey
Johan	Digital plotting and editing operator

Equipment used for the survey are as follows:

GPS receiver, processor	3 units	Leica, Wild GPS System 200
Automatic level	3 units	Sokkia B-2, Wild-NAK
Total station	2 units	Topcon GTS-300
Theodolite	2 units	Wild T0
Computer Auto Cad	2 units	The survey editor ver. 1.1., C. 1989, Tripangarso
Digitizer	1 unit	Graphic Master-II, size A2
Plotter	1 unit	Encad Nova Jet-4
Echo sounder	1 unit	ODOM, Hydrographic Systems Inc. USA

1.5 Spheroid, Coordinates and Datum Elevation for the Survey

The reference spheroid for the survey and mapping shall be WGS 84 and the coordinates be Universal Transverse Mercator(UTM) Zone 52 with its central meridian 129° E. Datum elevation for the survey should be mean sea level (MSL) as 0m. To know the MSL at Ambon a tidal observation station was installed and the tidal observation was carried out for 35 days at the station. The details of the tidal observation are discussed later.

CHAPTER 2 FIELD OPERATIONS FOR THE MASTER PLAN STUDY IN AMBON AREA

2.1 Field Reconnaissance

JICA supervisor and the Indonesian counterpart together with surveyors from the Contractor carried out the field reconnaissance covering five(5) rivers and one(1) tributary. During the field reconnaissance, methods of profiling and cross sectioning were discussed and decided according to the natural and artificial terrain features. Location of bench marks and tidal observation station were also selected and confirmed in the field. Proposed dam sites of 13 location and 59 bridges across the rivers were confirmed and decided to be cross sectioned. The Study Team previously selected 13 candidates of dam sites and marked on the 1:5,000 map. The location were confirmed in the field and lines of the cross section were marked at the sites. Five water gauges sites i.e. one for every river, were located in the field for the cross sectioning.

2.2 Monumentation

Ten (10) bench marks were monumented in Ambon area, along the rivers at approximately 2km intervals, i.e. two(2) bench marks for each river one in down stream and one in upstream. The location of the bench marks are shown in Figure-J.2.1. Descriptions of the bench marks containing information such as location, access, date of establishment, elevation, were prepared for convenience to future users.

2.3 Tidal Observation

The station was located at the ferry terminal in Galala, approximately 6km from the City center to the north east. The observation started on 23 November. However, the station was disturbed by busy activities of the ferry. The station was relocated and the observation was restarted on 26 November continued until 30 December 1996. A temporary bench mark was also located near the staff gauge.

The levels of sea water surfaces were measured with a staff gauge fixed at the pier of the ferry terminal at exactly every one hour, 24 hours a day for 35 days. The observation data were plotted to decide the highest and lowest tide of each day. The plotting are as shown in Figure-J.2.3. The mean sea level (MSL) was calculated as follows:

Highest mean sea level	= Σ (highest sea level of each day) / Number of days = 72.900/30 = 2.430m
Lowest mean sea level	= Σ (lowest sea level of each day) / Number of days = 28.165/30 = 0.939m
Mean sea level	= (Highest mean sea level + Lowest mean sea level) / 2 = (2.430+0.939)/2=1.685m

The highest, lowest and mean sea levels of each day were as shown in Table-J.2.1.
There were two ebb and flow a day. The greater ebb and flow of each day were used to calculate the mean sea level. Graphs showing the daily tidal range are attached hereto as Figure-J.2.3. The vertical distance between the mean sea level (MSL), staff gauge and the temporary bench mark(TBM) are as shown in Figure-J.2.2. The elevation of TBM from MSL at Ambon Sea Port was decided as H = 2.090m.

Table-J.2.1 Daily Highest,Lowest and Mean Sea Level at Ambon Sea Port

Date	Highest	Time	Lowest	Time	Mean(m)
Nov. 26	2.43	2:00	0.71	9:00	1.568
27	2.42	2:00	0.69	9:00	1.555
28	2.44	3:00	0.70	10:00	1.570
29	2.42	4:00	0.81	11:00	1.615
30	2.35	4:00	0.87	11:00	1.610
Dec 1	2.25	5:00	1.00	11:00	1.625
2	2.19	19:00	1.14	11:00	1.665
3	2.22	20:00	1.10	13:00	1.660
4	2.23	21:00	1.30	14:00	1.765
5	2.25	21:00	1.48	15:00	1.865
6					
7	2.33	22:00	1.13	6:00	1.730
8	2.37	23:00	1.19	6:00	1.780
9	2.39	0:00	1.05	7:00	1.720
10	2.47	1:00	0.93	8:00	1.700
11	2.55	1:00	0.77	8:00	1.660
12	2.65	2:00	0.70	9:00	1.675
13	2.58	2:00	0.67	10:00	1.625
14	2.65	3:00	0.70	11:00	1.675
15	2.59	4:00	0.78	11:00	1.685
16	2.50	5:00	0.89	12:00	1.695
17	2.44	19:00	1.00	12:00	1.720
18	2.45	20:00	1.18	13:00	1.815
19					
20	2.47	20:00	1.20	4:00	1.835
21	2.45	22:00	1.10	5:00	1.775
22	2.46	23:00	0.95	6:00	1.705
23	2.44	0:00	0.85	7:00	1.645
24	2.46	1:00	0.82	8:00	1.640
25	2.43	2:00	0.72	9:00	1.575
26	2.44	3:00	0.78	10:00	1.610
27	2.58	3:00	0.74	10:00	1.660
28	No observations due to rough seas				
29					
30					

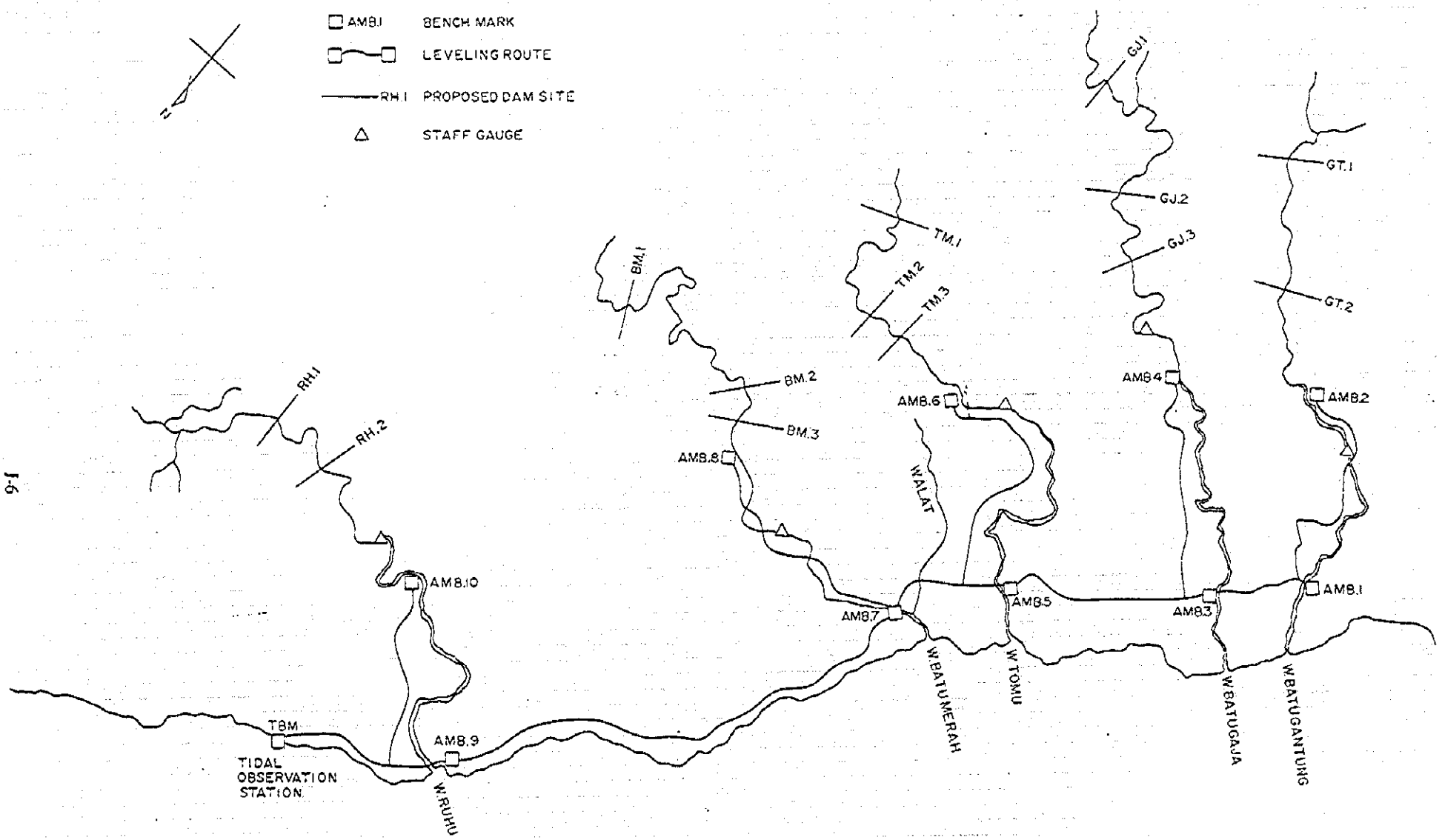


Figure-J.2.1 Location of Five Rivers, Bench Marks, Leveling Routes and Proposed Dam Sites in Ambon

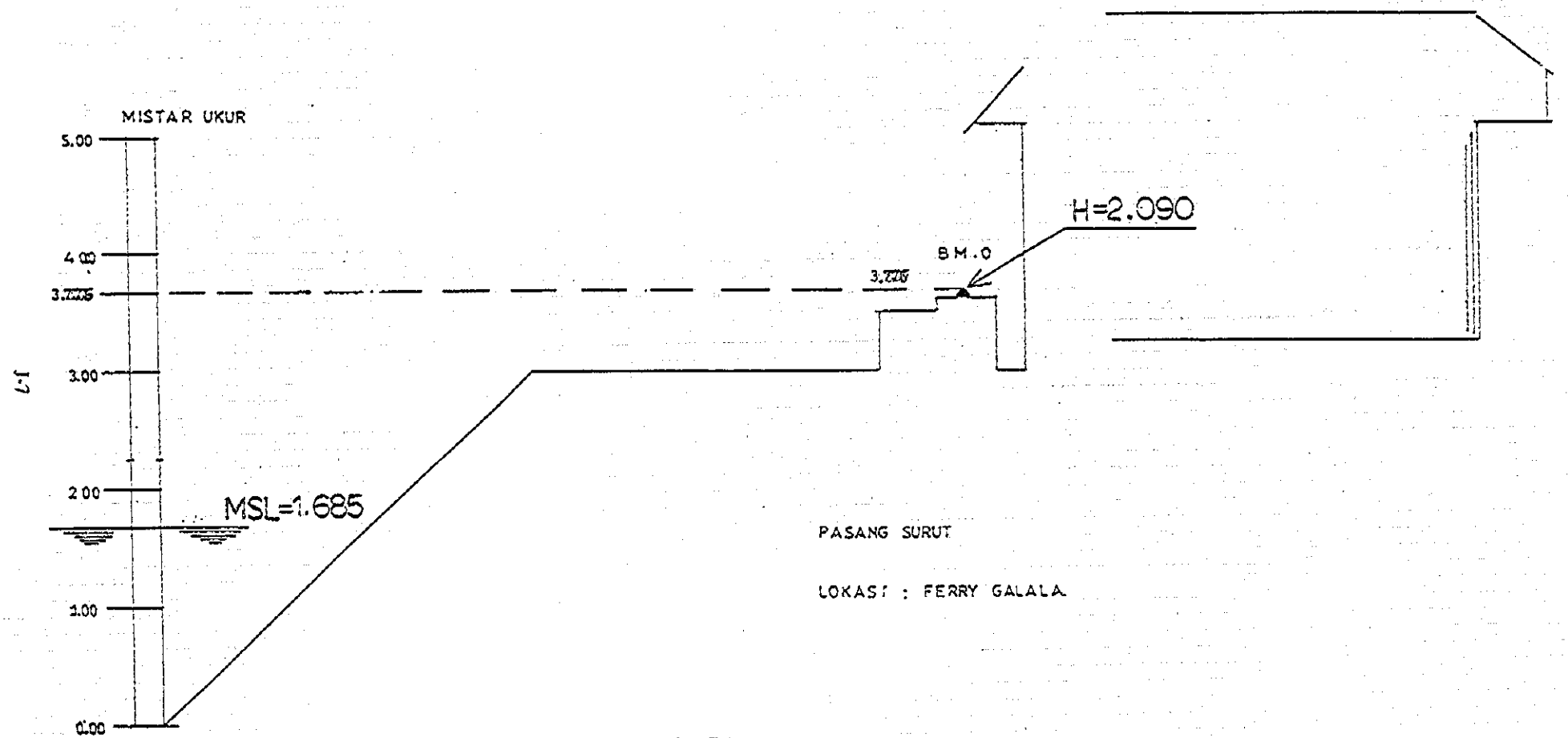


Figure-J.2.2 Tidal Observation Station and Temporary Bench Mark at Ambon Sea Port

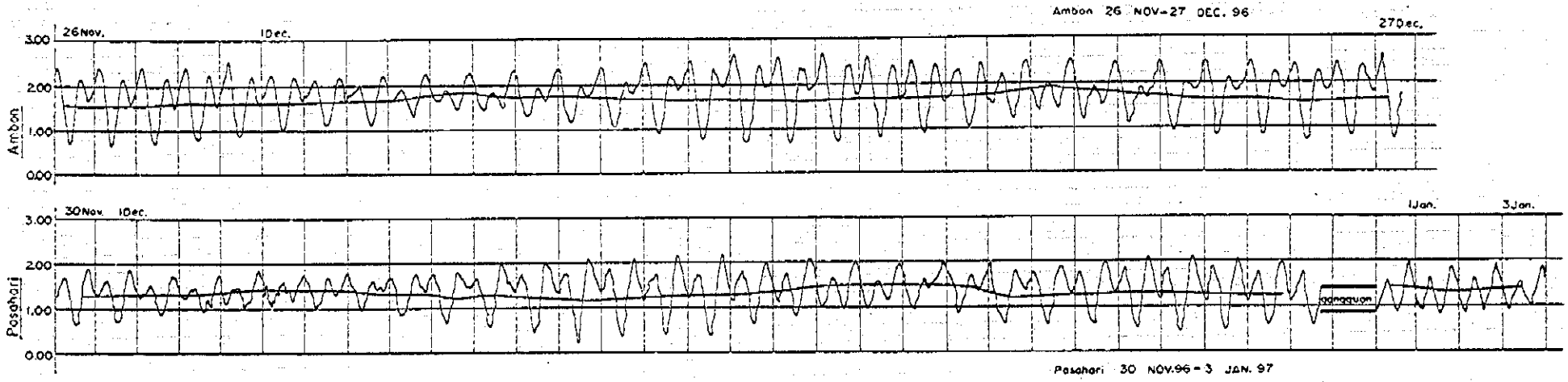


Figure-J.2.3 Graph of Daily Tidal Range at Ambon and Kobi Sadar

2.4 Setting Out Distance Marks

Distance marks at every 100m from the estuaries and confluence on the left and right banks of five rivers and one tributary were set out and shown with iron nails or concrete piles. Also distances at every 50m were marked with paint to facilitate the cross sectioning work. The distance marks set out for the rivers were as follows:

Ruhu River	17 points on the each bank, a total of 34 points
Batu Merah Rivers	17 points on the each bank, a total of 34 points
Alat River	11 points on the each bank, a total of 22 points
Tomu River	30 points on the each bank, a total of 60 points
Batu Gajah River	30 points on the each bank, a total of 60 points
Batu Gantung River	21 points on the each bank, a total of 42 points

2.5 Leveling

The leveling to establish ten (10) bench marks, AMB-1 -10 was started from the temporary bench marks (TBM) at the tidal observation station, connected every bench marks and ended on the TBM again. The total leveling distance was 13.8km and the location of bench marks and leveling routes are shown in Figure-J.2.1. The measurement of double standing and double run were adopted, so that the accuracy of observation and measurement were confirmed.

The misclosures of the each leveling route were as follows:

Route	From	To	Distance(km)	Misclosure(mm)	mm $\sqrt{S}$
1	T.O. station	BM-1	6.2	30	12
2	BM-9	BM-10	1.7	4	3
3	BM-7	BM-8	1.4	6	5
4	BM-5	BM-6	1.8	22	16
5	BM-3	BM-4	1.4	1	1
6	BM-1	BM-2	1.3	1	1

The elevation of the bench marks obtained by the leveling are as follows:

Code	Elevation(m)	Code	Elevation(m)
AMB-1	3.553	AMB-2	18.992
AMB-3	4.379	AMB-4	12.748
AMB-5	3.428	AMB-6	11.501
AMB-7	3.040	AMB-8	6.774
AMB-9	3.234	AMB-10	7.609

The elevation are from Mean Sea Level at Ambon Sea Port as 0m.

2.6 Profiling

To plot the rivers' longitudinal profiles, distance marks at every 50m intervals which was previously set out on the right and left banks of the rivers were measured its elevation by the leveling from the bench marks. Structures relevant to rivers such as bridges, small tributaries or drains etc. were also measured their elevation and distances. Elevation of the river beds were obtained from the measurements of the cross sectioning.

2.7 Cross Sectioning

2.7.1 River Cross Sections

The cross sectioning of five rivers and one tributary at every 50m intervals were carried out as follows:

River	Length (m)	No. of Sections
Ruhu	1,600	33
Batu Merah	1,600	33
Alat	1,000	21
Tomu	2,900	55
Batu Gaja	2,900	55
Batu Gantung	2,000	41
Total	12,000	238

River bed of Batu Merah river from a bridge at 1+000 to a bridge at 0+387 were excavated on an average of approximately 30cm after the cross sectioning was carried out.

2.7.2 Bridge Cross Sections

Cross sectioning of all the existing bridges including pipes containing electric and telephone lines across the five rivers and one tributary were carried out.

Number of the bridges of each river were as follows:

River	No. of bridges
Ruhu	6
Batu Merah	9
Alat	7
Tomu	13
Batu Gajah	16
Batu Gantung	8
Total	59 bridges

2.7.3 Dam Site Cross Sections

Proposed dam sites of 13 lines were cross sectioned as follows:

River	Dam Site	Max. Dam Height (Proposed)	Cross sectioned height from river bed Left bank	Right bank
Ruhu	RH-1	50 m	64 m	64 m
	RH-2	50	94	92
Batu Merah	BM-1	20	20	20
	BM-2	50	77	95
	BM-3	50	92	90
Tomu	TM-1	30	49	29
	TM-2	50	56	104
	TM-3	50	50	50
Batu Gajah	GJ-1	20	22	37
	GJ-2	35	79	31
	GJ-3	40	82	62

Batu Gantung	GT-1	40	115	80
	GT-2	50	95	76

The cross section lines of the proposed dam sites are shown in Figure-J.2.1.

2.7.4 Staff Gauge Cross Sections

The cross sectioning was carried out at five staff gauges of the five rivers. For every staff gauge and 25m to the upstream and 25m to the downstream, i.e. three cross sectioning were carried out at every staff gauge site. The location of the staff gauges are shown in Figure-J.2.1.

2.8 Plotting and Drawing

2.8.1 Plotting and Drawing of Cross Sections

Data obtained by the fieldurvey were processed with computers and stored in disk. The plotting of cross section was carried out with a computer program "The survey editor ver. 1.1., C. 1989, Tripangarso" directly by a computerized automatic plotter. Plotted manuscripts were edited and checked, and sometimes inspected in the field. After the completion work, the cross sections were drawn on the polyester base #300.
The drawing sheet was basically A1(50cmx70cm) size. Occasionally, however, larger sizes were used depending on the terrain features. The plotting and drawing scales were as follows:

Five rivers and one tributary in Ambon	horizontal 1:100	vertical 1:100
Bridges across rivers in Ambon	horizontal 1:100	vertical 1:100
Staff gauge sites in rivers in Ambon	horizontal 1:100	vertical 1:100
Proposed dam sites in Ambon	horizontal 1:500	vertical 1:500

2.8.2 Plotting and Drawing of Profiles

Data obtained by the fieldurvey were processed with computers and stored in disk. The plotting of profile was carried out with a computer program "The survey editor ver. 1.1., C. 1989, Tripangarso" directly by a computerized automatic plotter. Plotted manuscripts were edited and checked, and completed. Elevation of the river beds were obtained from the cross section data. After the completion work, the profiles were drawn on the polyester base #300.
The drawing sheet was basically A1(50cmx70cm) size. Occasionally, however, larger sizes were used depending on the terrain features especially in the Pasahari area. The plotting and drawing scales were as follows:

Five rivers and one tributary in Ambon	horizontal 1:2,500	vertical 1:100

CHAPTER 3 FIELD OPERATIONS FOR THE FEASIBILITY STUDY IN AMBON AREA

3.1 1:200 Mapping of Five Rivers

3.1.1 Areas

Areas covered by the 1:200 topographic mapping are the five rivers in Ambon City as shown in the Figure-J.3.1. The mapping area of each river is as follows:

River	Distance from estuary	Width	Area
Ruhu	1,600 m	60 m	9.6 ha
Batu Merah	1,600 m	60 m	9.6 ha
Tomu	2,900 m	60 m	17.4 ha
Batu Gajah	2,900 m	60 m	17.4 ha
Batu Gantung	1,500 m	60 m	9.0 ha
Total	10,500 m		63.0 ha

3.1.2 Existing Topographic Maps

To complete the 1:200 topographic mapping within a limited study period, the existing 1:1,000 topographic maps which prepared by BPN in 1989 were used for base maps. Every terrain features of the 1:1,000 maps were digitized and plotted at the scale of 1:200. The plotted 1:200 maps were updated and additional details necessary to the 1:200 maps were added with data and information collected in the field. Index shown number and map sheets is attached as Appendix-J.3.

3.1.3 UTM Coordinates and MSL Datum Elevation

For a local coordinates was used for the 1:1,000 topographic maps, they were transformed from local coordinates into UTM coordinates in Zone 52. For this conversion, GPS survey at three points was carried out. The details of the GPS survey are discussed in paragraph 3.2.2. and the transformation data are attached as Appendix- J.4. MSL at Ambon Sea Port determined by the JICA Study in 1996 was used for the datum elevation for the 1:200 mapping.

3.1.4 Field Updating and Correction

Copies of plotted 1:200 maps were updated in the field. And also more detailed data and information necessary to compile 1:200 topographic maps for river improvement were collected in the field and added to the manuscripts.
Areas where no 1:1,000 BPN maps exist were surveyed its terrain features directly with the total station system in the field. Those areas were as follows:

River	Distance from estuary	length x width
Ruhu	1+200 ~ 1+600m	400m x 60m
Batu Gajah	2+700 ~ 2+900m	200m x 60m
Batu Gantung	1+300 ~ 1+500m	200m x 60m

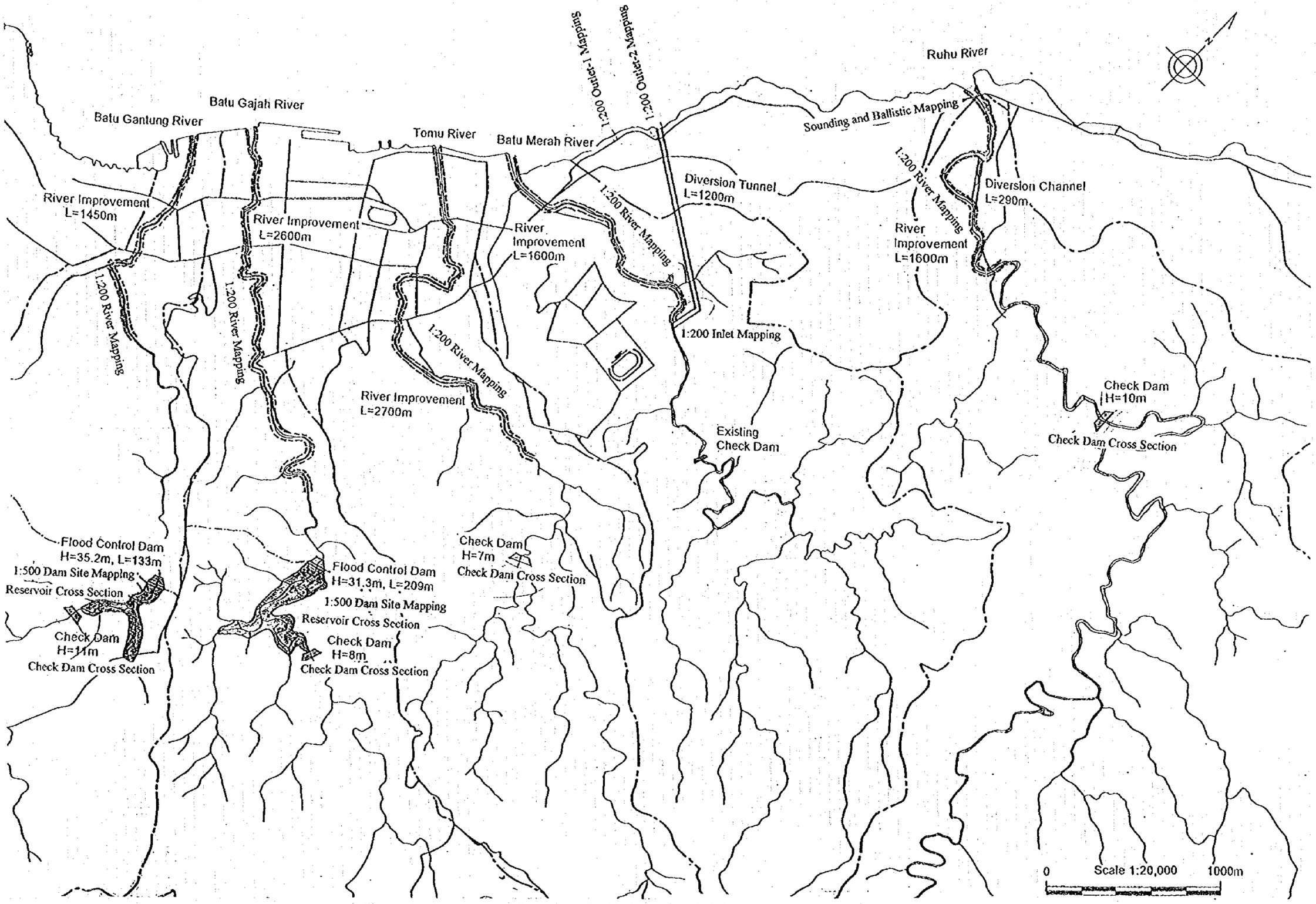


Figure-J.3.1 Areas and Location of 1:200 Mapping, 1:500 Mapping, Cross Section of Reservoirs and Check Dam, and Outlets, Inlet of Diversion

3.1.5 Spot Leveling and Contour Lines

Spot leveling approximately one point per ha was carried out covering the mapping areas of the five rivers to strengthen the accuracy of vertical information of the 1:200 maps. Contour lines of 50cm intervals were plotted from the spot heights set up by the spot leveling. Reference to the spot leveling were bench marks and distance marks established by the JICA Study in 1996.

3.1.6 Digital Editing

Data and information collected in the field were digitized with Digitizer Graphic Master-II and added to the 1:200 map manuscripts for the compilation of 1:200 topographic maps. The spot heights and contour lines were also digitized and overlaid to the map manuscripts. All of the digitized data and information were kept in floppy disks.

3.1.7 Digital Plotting

After completion of the editing and proofing, final plotting of the 1:200 topographic maps was carried out with the Plotter Encad Nova Jet-4 on #300 polyester film bases. Marginal information such as titles, sheet number, scales and so forth were also plotted on the map sheets. The sheets sizes were A1 (50cm x 70cm).

3.1.8 Results

The 1:200 topographic maps were prepared as follows:

Ruhu	14 sheets
Batu Merah	14 sheets
Tomu	23 sheets
Batu Gajah	25 sheets
Batu Gantung	13 sheets
Total	89 sheets

The sheets index is shown in Figure- J.3.2..

3.2 1:500 Mapping of Proposed Dam Sites

3.2.1 Areas

The proposed dam sites in Batu Gajah River and Batu Gantung River were mapped at the scale of 1:500. The mapping areas of 400m x 500m = 20ha for each site are shown in Figure-J.3.3.

3.2.2 Vertical and Horizontal Ground Controls

Reference bench marks for the 1:500 mapping of Batu Gajah dam site and Batu Gantung dam site were AMB-4 and AMB -2 respectively.
GPS survey was carried out to establish two horizontal ground controls for Batu Gajah dam site (GJ-L and GJ-R) and two for Batu Gantung (GT-L and GT-R). The points were marked with10 cm diameter concrete piles. Location of these points were shown in Figure-J.3.4. Reference for this GPS survey was existing GPS station N 5004 established by

BAKOSURTANAL in Ambon Air Port in 1992.
GPS observation was carried out in five session with three units of GPS sensors and controllers as follows:

Session	Points included in each session
1	L3 - AMB9 - 03
2	N5004 - L3 - 01
3	ABM9 - 02 - GJR
4	GJR - GTR - GJL
5	GTR - GTL - 01

One session consisted of three points and satellite signals were simultaneously received at three points for over two hours for session 2 and one hour for other session. Observation started at session 1 to 2, 3, up to 5 as a closed traverse as shown in Figure-J.3.4.
The results and the accuracy of the GPS survey are shown in Table-J.3.1.

Table-J.3.1 Results and Accuracy of the GPS survey

Code	Lat./ Lon.(geodetic)	Northing/Easting(UTM)	Residuals (m)
N5004	Lat 3 42 26.8493	N. 9,590,156.724 m	fixed
	Lon. 128 5 20.0978	E 398,825.664 m	fixed
01*	Lat. 3 42 15.6690	N. 9,590,509.451	0.00111
	Lon. 128 10 31.5367	E. 408,432.922	0.00138
02*	Lat. 3 41 47.9529	N. 9,591,361.718	0.00234
	Lon. 128 11 13.1313	E . 409,715.280	0.00249
03*	Lat . 3 39 59.2093	N. 9,594,702.101	0.00204
	Lon. 128 11 55.5191	E. 411,019.900	0.00211
AMB09	Lat. 3 40 1.3905	N. 9,594,635.077	0.00185
	Lon. 128 11 53.8409	E. 410,968.187	0.00196
GJL**	Lat. 3 42 34.4492	N. 9,589,934.530	0.00250
	Lon. 128 11 33.7255	E. 410,351.888	0.00266
GJR**	Lat. 3 42 36.4858	N. 9,589,872.236	0.00221
	Lon. 128 11 42.4455	E. 410,620.945	0.00233
GTL**	Lat. 3 42 56.8450	N. 9,589,246.396	0.00459
	Lon. 128 11 18.7474	E. 409,890.468	0.00559
GTR**	Lat. 3 42 56.0491	N. 9,589,270.967	0.00220
	Lon. 128 11 23.3757	E. 410,033.222	0.00219
L3***	Lat . 3 40 4.2317	N. 9,594,547.757	0.00123
	Lon. 128 11 51.1196	E. 410,884.312	0.00153

* The points were used for the coordinates transformation from local to UTM.
** The points were used for the 1:500 mapping of dam sites.
*** The point was used for the reference of sounding.

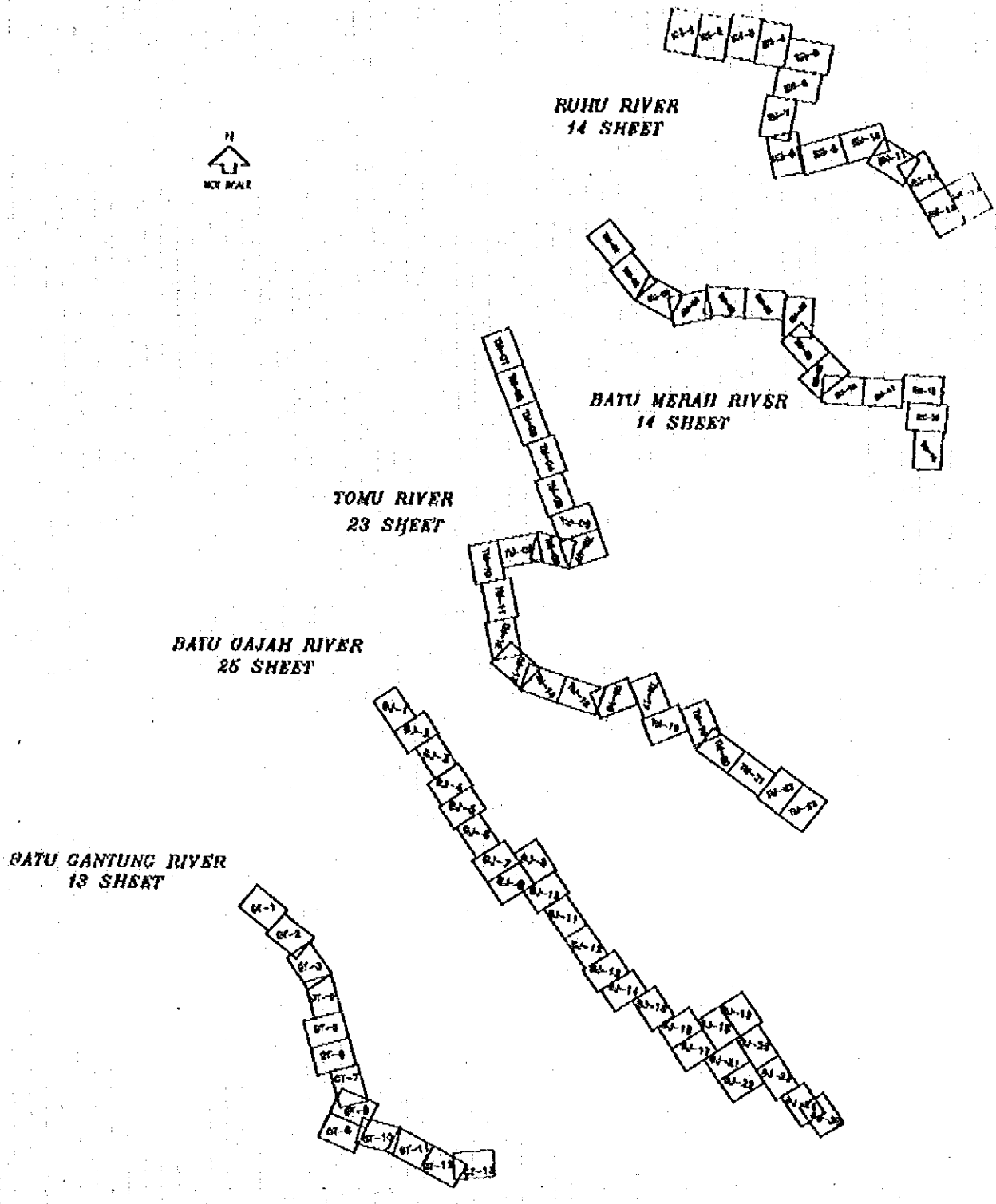


Figure-J.3.2 1:200 Topographic Maps Sheet Index

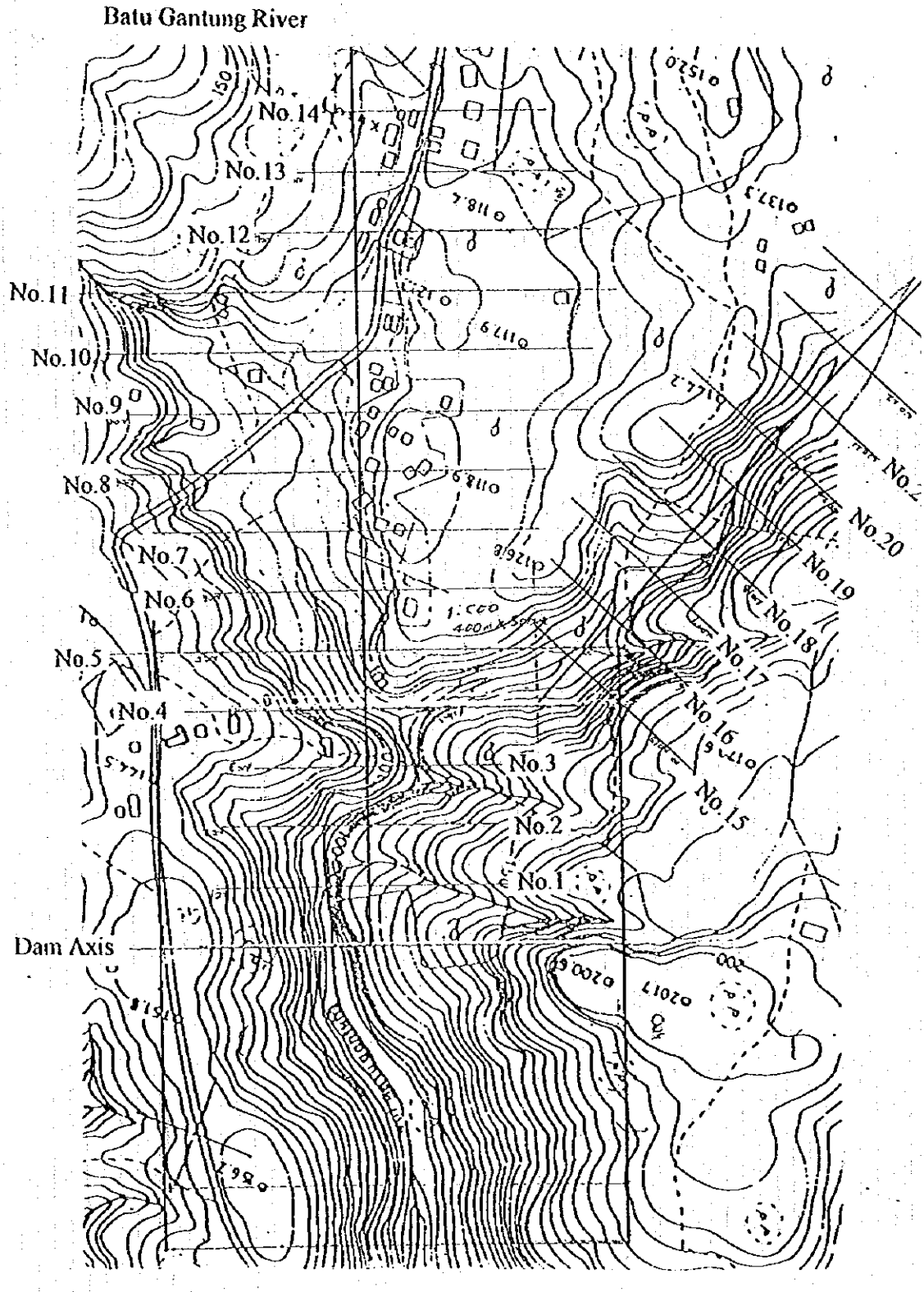
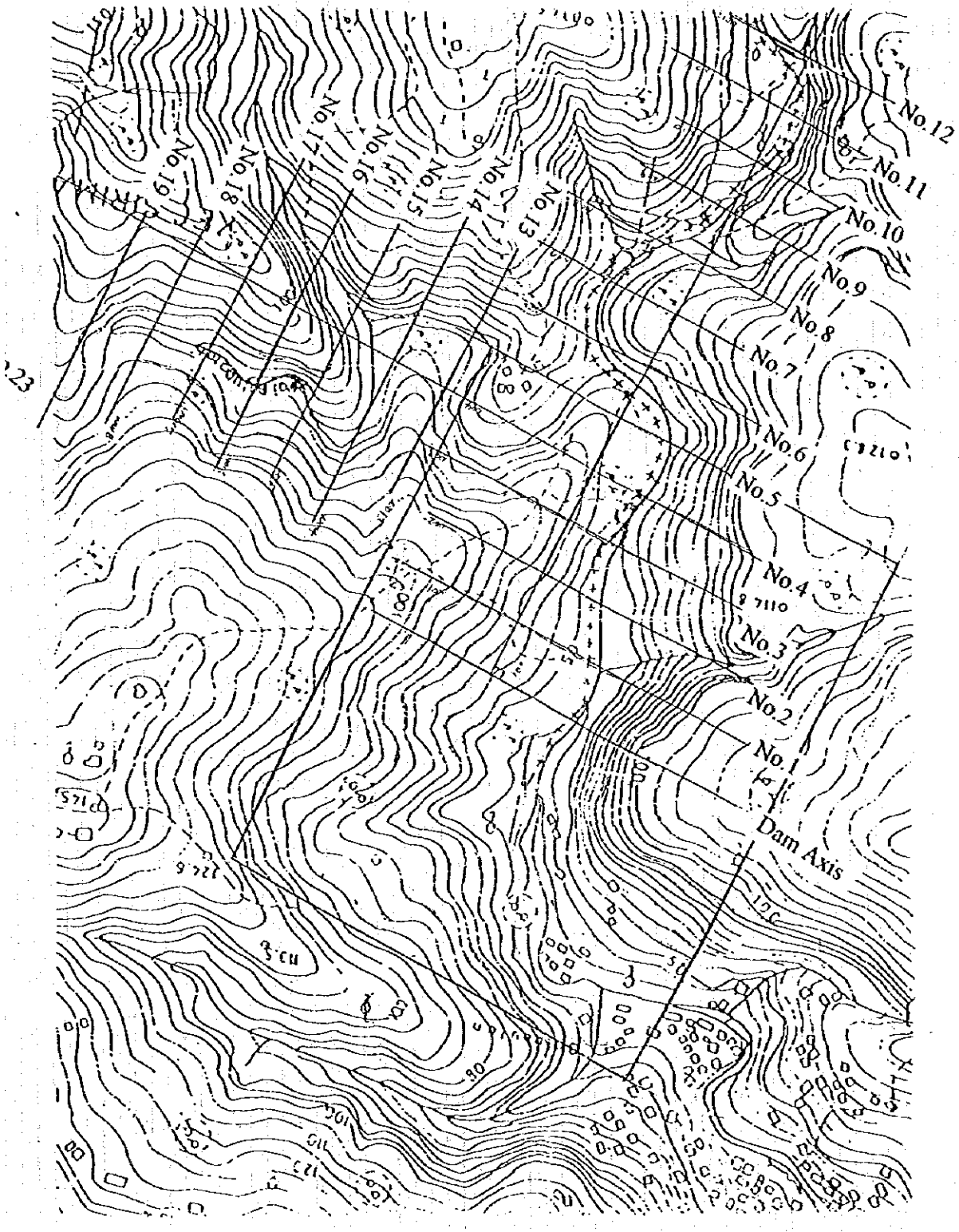


Figure-J.3.3 1: 500 Dam Sites Mappi

Batu Gajah River



eas and Cross Section in Reservoir Areas

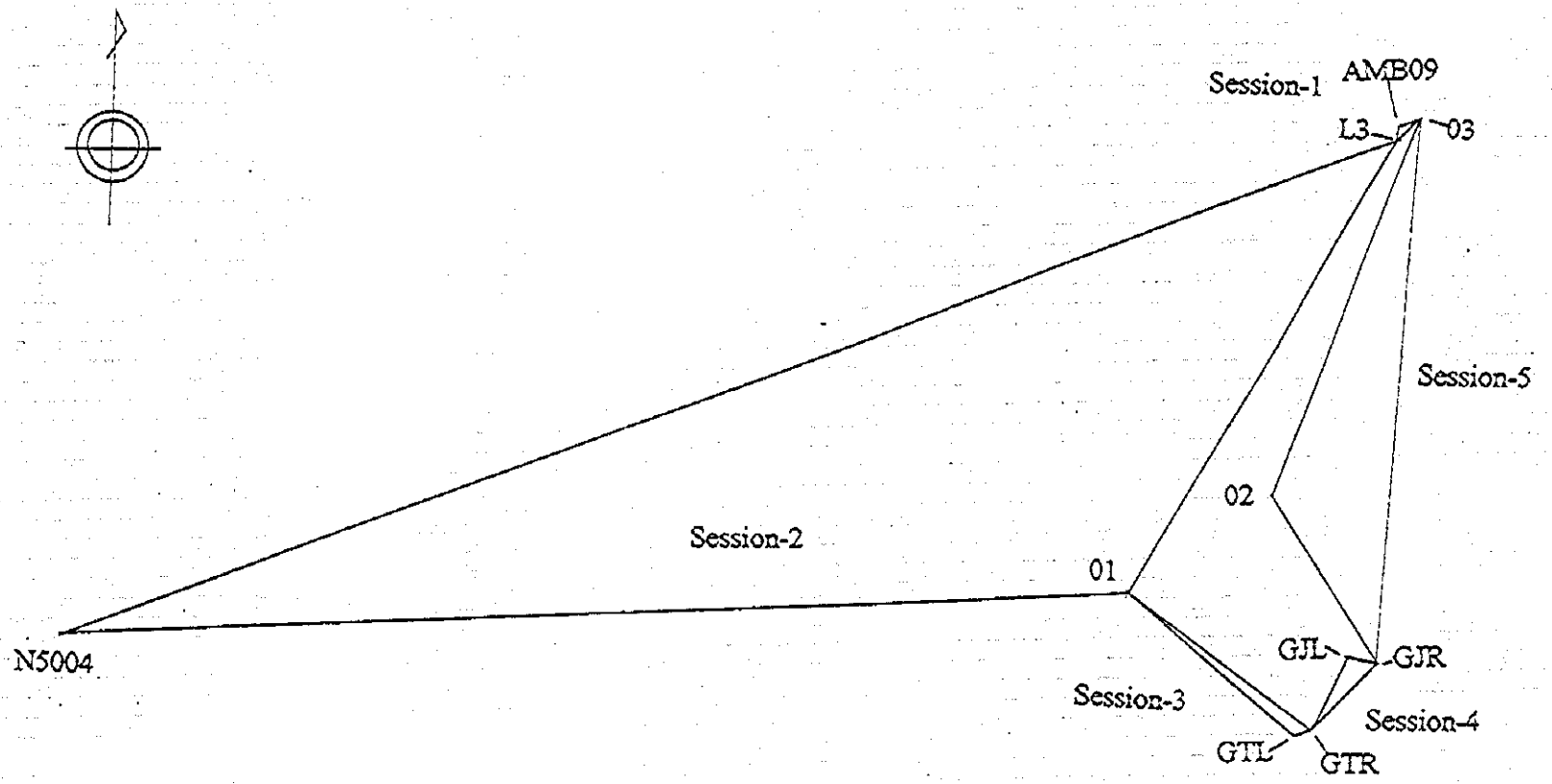


Figure-J.3.4 GPS Observation Network

3.2.3 Field Measurement

Every natural and artificial terrain features were measured of their distances, angles and heights from the control points with the total stations. Spot heights every 10m intervals were also measured to draw the contour lines.

3.2.4 Digital Editing

Data and information collected in the field were digitized with Digitizer Graphic Master-II and edited to compile the 1:500 topographic maps. The spot heights and contour lines were also digitized and overlaid to the map manuscripts. All of the digitized data and information were kept in floppy disks.

3.2.5 Digital Plotting

After completion of the editing and proofing, final plotting of the 1:500 topographic maps was carried out with the Plotter Encad Nova Jet-4 on #300 polyester film bases. Marginal information such as titles, sheet number, scales and so forth were also plotted on the map sheets. The sheets sizes were A1 (50cm x 70cm).

3.2.6 Results

The 1:500 topographic maps were prepared as follows:

Batu Gajah	4 sheets
Batu Gantung	4 sheets
Total	8 sheets

3.3 Cross Sectioning in Reservoir Areas

3.3.1 Areas and Location

Twenty four (24) cross sections for the dam axis and the reservoir of Batu Gantung dam and Twenty (20) cross sections for the dam axis and the reservoir of Batu Gajah dam were carried out at an interval of 50m across the rivers.
The areas and the lines are shown in Figure-J.3.3.

3.3.2 Field Measurement

Elevation and distances were measured along the cross section lines shown in the Figure-J.3.4. The reference BM for the Batu Gantung Dam and Reservoir cross section was AMB-2 and that of Batu Gajah Dam and Reservoir was AMB-4.

3.3.3 Digital Editing and Plotting

Data and information collected in the field were digitized and edited to plot 1:500 cross section maps. All of the digitized data and information were kept in floppy disks. The editing of cross section was carried out with a computer program "The survey editor ver. 1.1., C. 1989, Tripangarso" and plotted directly by a computerized automatic plotter, Encad Nova Jet-4. Plotted manuscripts were edited and checked, and sometimes inspected in the

field. After the completion work, the cross sections were plotted on the polyester base #300. The drawing sheet was basically A1 (50cmx70cm) size. Occasionally, however, larger sizes were used depending on the terrain features. The final plotting was carried out at the scale of 1:500 with Encad Nova Jet-4.

3.3.4 Results

The 1:500 dam and reservoir cross sections maps were prepared as follows:

Batu Gajah	1 section for dam axis	1 sheets
	19 sections for reservoir	11 sheets
Batu Gantung	1 section for dam axis	1 sheets
	23 sections for reservoir	12 sheets
Total	45 sections	25 sheets

3.4 Cross Sectioning for Proposed Check Dam Sites

3.4.1 Areas and Location

One (1) cross section for the check dam axis and two (2) cross sections for the reservoir of Batu Gantung River, Batu Gajah River, Tomu River and Ruhu River, a total of 12 cross sections were carried out at an interval of 20m across the rivers.
The cross section lines of the check dam are shown in Figure-J.3.1.

3.4.2 Field Measurement

Elevation and distances were measured along the cross section lines shown in the Figure-J.3.1. The reference BMs for the check dams and their reservoirs cross sectioning were as follows:

River	Reference
Batu Gantung	AMB-2
Batu Gajah	AMB-4
Tomu	AMB-6
Ruhu	AMB-10

3.4.3 Digital Editing and Plotting

Data and information collected in the field were digitized and edited to plot 1:500 cross section maps. All of the digitized data and information were kept in floppy disks. The editing of cross section was carried out with a computer program "The survey editor ver. 1.1., C. 1989, Tripangarso" and plotted directly by a computerized automatic plotter, Encad Nova Jet-4. Plotted manuscripts were edited and checked, and sometimes inspected in the field. After the completion work, the cross sections were plotted on the polyester base #300. The drawing sheet was basically A1(50cmx70cm) size. Occasionally, however, larger sizes were used depending on the terrain features. The final plotting was carried out at the scale of 1:500 with Encad Nova Jet-4.

3.4.4 Results

The 1:500 check dam and reservoir cross sections maps were prepared as follows:

Batu Gajah	1 section for dam axis	1 sheet
	2 sections for reservoir	1 sheet
Batu Gantung	1 section for dam axis	1 sheet
	2 sections for reservoir	1 sheet
Tomu	1 section for dam axis	1 sheet
	2 sections for reservoir	1 sheet
Ruhu	1 section for dam axis	1 sheet
	2 sections for reservoir	1 sheet
Total	12 sections	8 sheets

3.5 1:200 Mapping for Outlet and Inlet of Diversion

3.5.1 Areas

Areas covered by the 1:200 topographic mapping are the inlet, outlet-1 and outlet-2 of the diversion of Batu Merah River as shown in the Figure-J.3.1. and Figure-J.3.5. The mapping areas are as follows:

Inlet	100m x 120m	1.2ha
Outlet-1	50m x 100m	0.5ha
Outlet-2	70m x 100m	0.7ha
Total		2.4ha

3.5.2 Existing Topographic Maps

The existing 1:1,000 BPN maps were used for the 1:200 topographic mapping of inlet and outlets in the same manner as described in paragraph 3.1.2.

3.5.3 UTM Coordinates and MSL Datum Elevation

Local coordinates of 1:1,000 BPN maps were transformed into UTM, Zone 52. The methods were similar to those described in paragraph 3.1.3. MSL at Ambon Sea Port determined by the JICA Study in 1996 was used for the datum elevation for the 1:200 mapping.

3.5.4 Field Updating and Correction

Copies of plotted 1:200 maps were updated in the field. And also more detailed data and information necessary to compile 1:200 topographic maps for diversion planning were collected in the field and added to the manuscripts.

3.5.5 Spot Leveling and Contour Lines

Spot leveling approximately one point per ha was carried out covering the mapping areas of the inlet and outlets to strengthen the accuracy of vertical information of the 1:200 maps. Contour lines of 50cm intervals were plotted from the spot heights set up by the spot leveling. Reference to the spot leveling were bench marks and distance marks established by the JICA Study in 1996.

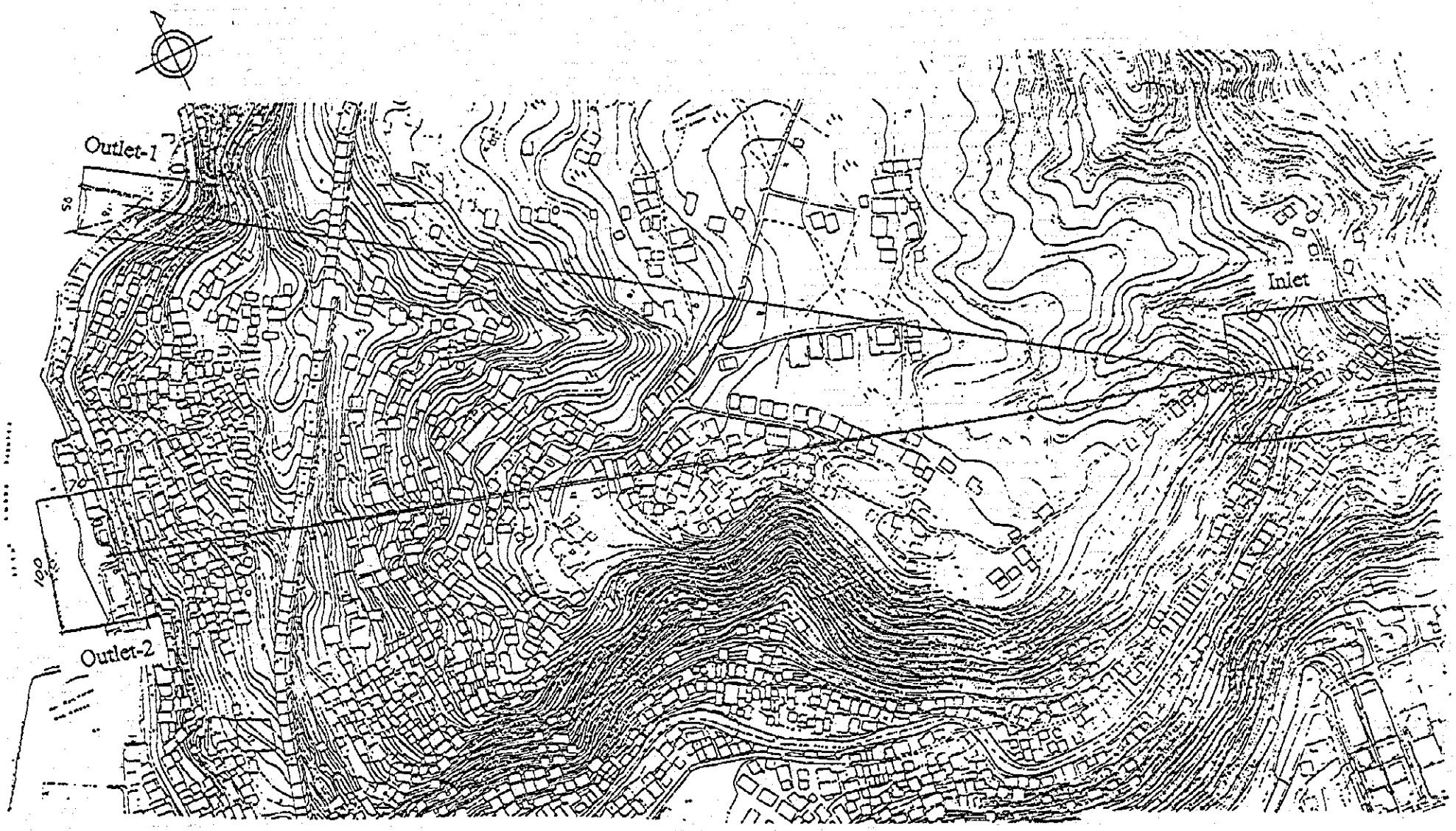


Figure-J.3.5 1:200 Mapping Areas for Diversion

3.5.6 Digital Editing

Data and information collected in the field were digitized with Digitizer Graphic Master-II and added to the 1:200 map manuscripts for the compilation of 1:200 topographic maps. The spot heights and contour lines were also digitized and overlaid to the map manuscripts. All of the digitized data and information were kept in floppy disks.

3.5.7 Digital Plotting

After completion of the editing and proofing, final plotting of the 1:200 topographic maps was carried out with the Plotter Encad Nova Jet-4 on #300 polyester film bases. Marginal information such as titles, sheet number, scales and so forth were also plotted on the map sheets. The sheets sizes were A1 (50cm x 70cm).

3.5.8 Results

The 1:200 topographic maps were prepared as follows:

Inlet	1 sheets
Outlet-1	1 sheets
Outlet-2	1 sheets
Total	3 sheets

3.6 Sounding in the Estuary of Ruhu River

3.6.1 Area and Location

An area covered by the sounding and bathymetric mapping was shallow water around the estuary of Ruhu River approximately 36ha (300m x 1,200m) along the sea shore. Survey lines of the sounding were 300m from the shore and an interval of 200m with its direction 301° 45' from the north approximately perpendicular to the shore line. The area and lines are shown in Figure-J.3.6.

3.6.2 Setting Up Sounding Lines and Tidal Staff Gauge

Seven (7) sounding lines of 200m intervals were staked out with its horizontal angle of 301° 45' from the azimuth. A tidal staff gauge was set up near the sounding area to know the tidal heights immediate before and after the sounding.

3.6.3 Out Line Mapping of Shore Line

Terrain features such as roads along the shore, houses, bridges etc. were measured with traversing method, and plotted as the references for the bathymetric map.

3.6.4 Sounding

The sounding along the sounding lines was carried out by the leveling method in the water shallower than 1m, and by the echo sounding method in the water deeper than 1m. Data obtained by the echo sounder was corrected with tidal elevation data obtained from the tidal gauge.

3.6.5 Digital Editing and Plotting

Data and information obtained by the traversing, leveling and sounding in the field were digitized and edited to plot 1:2,000 bathymetric maps. All of the digitized data and information were kept in floppy disks.

The editing of bathymetric map was carried out with a computer program "The survey editor ver. 1.1., C. 1989, Tripangarso" and plotted directly by a computerized automatic plotter, Encad Nova Jet-4. Plotted manuscripts were edited and checked, and sometimes inspected in the field. After the completion work, the bathymetric map was plotted on the polyester base #300.

The drawing sheet was A1(50cmx70cm) size. The final plotting was carried out at the scale of 1:2,000 with Encad Nova Jet-4.

3.6.6 Results

One sheet of the 1:2,000 bathymetric map was prepared.

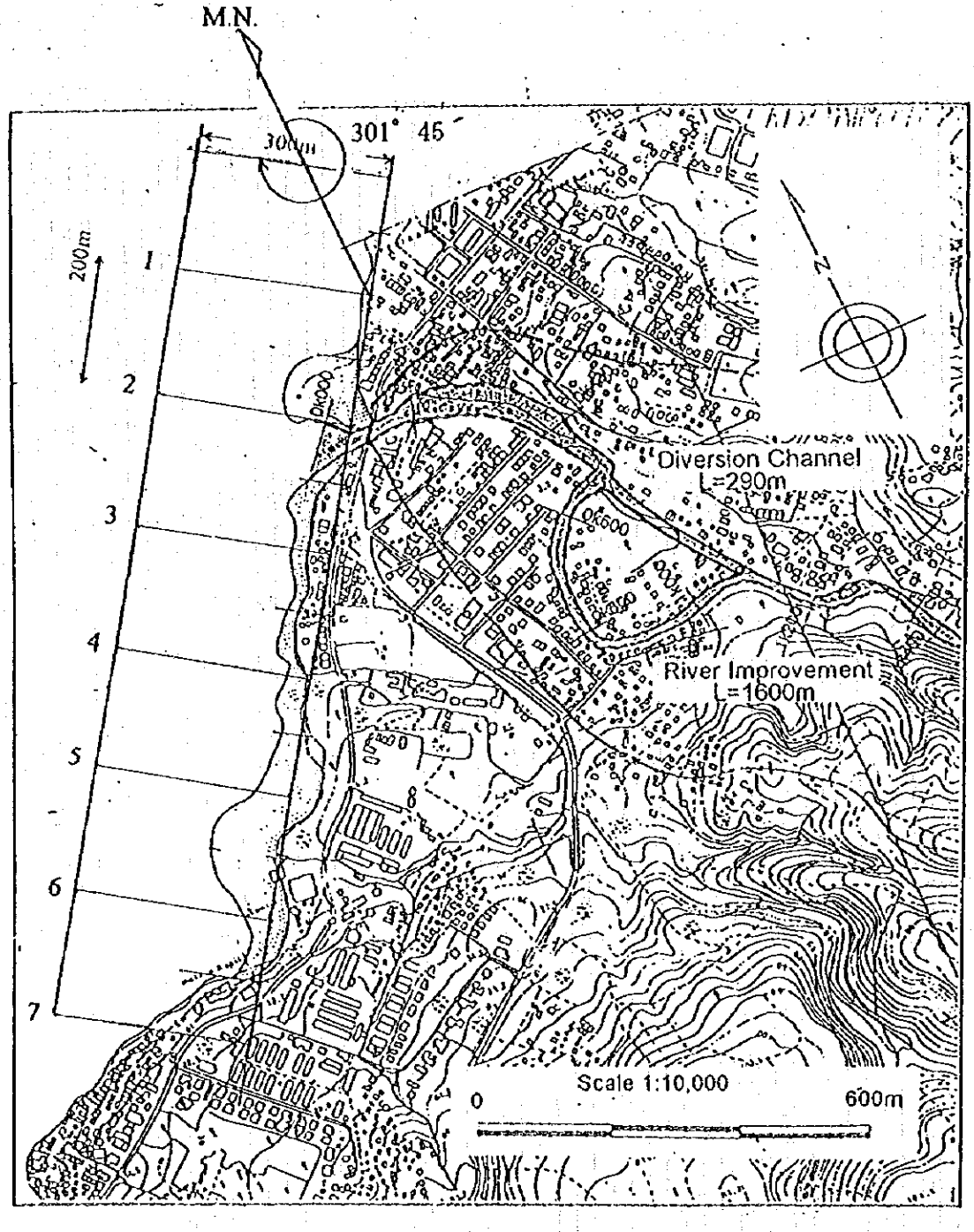


Figure-J.3.6 Area and Lines of Ruhu River Mouth Sounding

CHAPTER 4 PROGRESS

4.1 Progress of Topographic Survey for Master Plan Study

Progress of the topographic survey for the Master Plan Study in Ambon area is shown in Table-J.4.1.

4.2 Progress of Topographic Survey for Feasibility Study

Progress of the topographic survey for the Feasibility Study in Ambon area is shown in Table-J.4.2

Table-J.4.1 Work Progress of Topographic Survey for the Master Plan Study in Ambon

Items	1996		1997
	November	December	January
Field Operation in Ambon	13 ———	——— 30	
(1) Field reconnaissance	13 14 21	5•6 11	
(2) Monumentation	22 26		
(3) Tidal observation	26	——— 30	
(4) Setting out distance marks	25 ———	———	1
(5) Leveling	26	5	
(6) Profiling	30	——— 25	
(7) Cross sectioning	30	——— 25	
a) River cross sectioning	30	——— 18	
b) Bridges cross sectioning	30	——— 15	
c) Dam sites cross section		13 ——— 25	20 24
d) Staff gauge cross section		11•12	
(8) Plotting and drawing			6 ——— 20

Table-J.4.2 Work Progress of Topographic Survey for the Feasibility Study in Ambon

Items	1997		
	June	July	August
1:200 Mapping of Five Rivers			
Plotting of existing maps	20		
Field updating and correction	20 —	— 29	
Editing and plotting		10 —	— 10
1:500 Mapping of Dam Sites			
Batu Gajah-field survey	25 —	— 20	
-edit & plotting		20 —	— 10
Batu Gantung-field survey	25 —	— 20	
-edit & plotting		20 —	— 10
Cross Section of Reservoirs			
Batu Gajah-field survey	10 —	— 5	
-edit & plotting		5 —	— 15
Batu Gantung-field survey	20 —	— 10	
-edit & plotting		10 —	— 20
1:200 Mapping of Diversion			
Batu Merah inlet		20 —	— 5
Batu Merah outlet-1		20 —	— 5
Batu Merah outlet-2		20 —	— 5
1:2000 Bathymetric Mapping			
Sounding	20 —	— 5	
Editing and Plotting		5 —	— 15 — 1 — 5

Appendix J.1. Descriptions and Data of GPS Stations in Ambon

BADAN KOORDINASI SURVEY DAN PEMETAAN NASIONAL
(B A K O S U R T A N A L)
Jl. Raya Jakarta Bogor KM-46 - Cibinong, Telepon (021)8754654, Telex 49305 BAKOST IA
Fax. (021)8752064 - 8753067, PO BOX 46/CBI Cibinong

P U S A T P E M E T A A N
B I D A N G S U R V E Y G E O D E S I
SISTEM INFORMASI GEODESI

JARING KONTROL HORISONTAL NASIONAL

Datum : WGS - 84 a : 6378137.000 m 1/f : 298.257223563 m

No.Stasiun : N.5004 Nama : AMBON (GBU.23)

Koordinat Geografi		Koordinat UTM		
Lintang	: S 3° 42' 26.8493"	Timur	: 398825.664	m
Bujur	: E 128° 5' 20.0978"	Utara	: 9590156.726	m
Tinggi Ellipsoid	: 82.9840 m	Zone	: 52 Sf : 0.9997300	
		Konv. Grid	: 3' 32.104"	

Koordinat Kartesian

X : -3926440.1142 m Y : 5009570.2248 m Z : -409674.5778 m

Form. II/24

BADAN KOORDINASI SURVEY DAN PEMETAAN NASIONAL

(BAKOSURTANAL)

LAPORAN DESKRIPSI STASIUN G P S

STASIUN

N.5004

01. NOMOR PILAR	: N. 5004	02. NAMA	: Bandara Pattimura
03. DESA / KAMPUNG	: Laha	04. KECAMATAN	: Teluk Ambon
05. KABUPATEN / KOTAMADYA	: Ambon	06. PROPINSI	: Maluku

07. PENGAMATAN OLEH	: Bidang Survey Geodesi - Pusat Pemetaan
08. RECEIVER	:
09. WAKTU	:
10. TANGGAL / JULIAN DAY	: 05 - 01 - 1992

11. KETERANGAN PILAR	: Standard pilar GPS Orde Satu 20 x 20 x40 Cm diatas permukaan tanah dengan brasscap ditengah atasnya

KOORDINAT PENDEKATAN	:
12. LINTANG	:
13. BUJUR	:
14. TINGGI (diatas ellisoid)	:

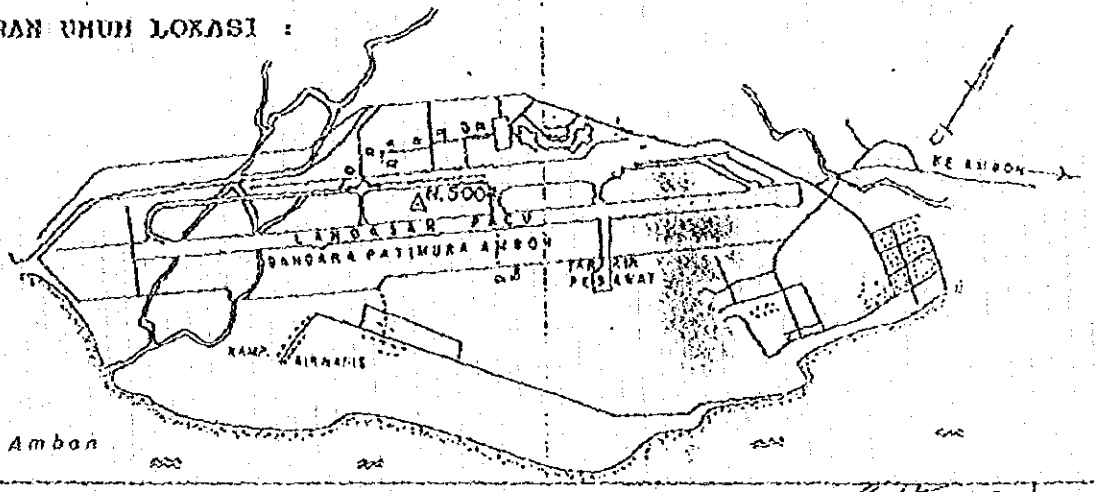
15. URAIAN LOKASI STATIUN	: Pilar terletak di dalam kawasan Transisional Slove Bandara Pattimura, sebelah barat tiang pencatat angin.
16. KENAMPAKAN YANG MENONJOL	: Tiangpencatat kecepatan angin dan hanggar Pesawat
17. JALAN KE LOKASI	: Dari terminal Bandara Pattimura ke arah Barat Daya, belok ke kiri di muka menara pengawas belok ke kanan dan di muka Depo Pertamina belok ke kiri lalu belok ke kanan dari pertigaan ± 75 meter terdapat jalan setapak
18. TRANSPORTASI/AKOMODASI	: Kenderaan darat atau jalan kaki, Akomodasi, makanan dan minuman dari Ambon.

19. DIBUAT OLEH	: Agus Suyono	20. TANGGAL	: 05/01/92
21. DIPERIKSA OLEH	: Ir. Rustandi Poerawiardi		

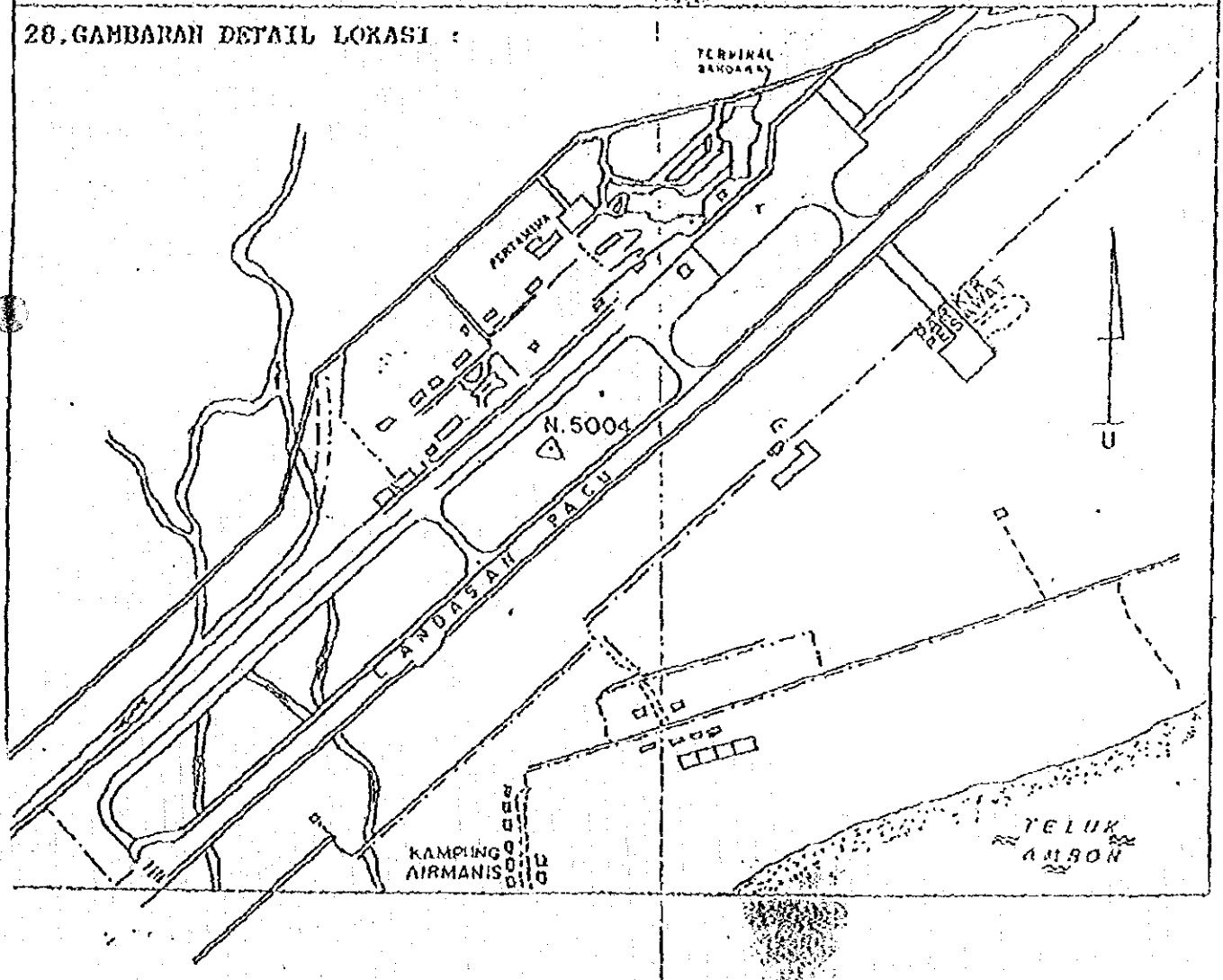
BADAN KOORDINASI SURVEY DAN PEMETAAN NASIONAL (BAKOSURTANAL)
LAPORAN GAMBAR REKONESEN STASIUN G P S

STASIUN
N.5004

27. GAMBARAN UMUM LOKASI :



28. GAMBARAN DETAIL LOKASI :



Appendix J.2. Technical Specifications for the River Survey

Technical Specifications for Survey and Mapping for The Study on Flood Control for Ambon and Pasahari Area in the Republic of Indonesia -second phase-

1. Survey Areas

The survey areas covered by the Contract shall consist of the five rivers in Ambon Central Area. The location of each area is shown in Fig. 1.

2. Scope of Work

2.1. Work Items

The Work consists of the following items. The work quantities of each item are stipulated in the Bill of Quantities.

- Mobilization
- 1:200 mapping for five(5) rivers
- 1:500 mapping for dam sites in Batu Gajah and Batu Gantung Rivers
- Cross section in reservoir areas
- Cross section for check dams
- 1:200 mapping for diversion area in Batu Merah River
- Sounding in sea shore around estuary of Ruhu River
- Reporting

2.2. General Specifications

2.2.1. JICA Standard

For the accuracy of the survey, "Technical Standards of Survey and Mapping for Overseas Development Project" (JICA) shall be applied with the instructions by the Engineer unless otherwise specified.

2.2.2. Spheroid and Coordinates

The reference spheroid for the survey and mapping shall be WGS 84 and the coordinates be Universal Transverse Mercator(UTM) Zone 52 with its central meridian 129° E.

2.2.3. Reference point for the horizontal ground controls

Reference point for the GPS survey shall be GPS station N.5004 established by BAKOSURTANAL in Ambon Airport, Bandara Pattimura.

2.2.4. Datum Elevation

The datum elevation shall be mean sea level(MSL) at Ambon sea port as 0m. The existing bench marks established by the JICA Study Team in 1996 can be used as reference bench marks.

2.2.5. Standard of Drawing

Style of drawing sheets, marginal information, legend and symbols will basically follow those of the drawings previously prepared for the projects of the Ministry of Public Work. Special styles may be prepared for the Study, if any.

3. Period

The working period of the survey and mapping shall be from 15 June 1997 to 15 August 1997. A tentative shedule is shown in Table 1.

4. Methods of the Work

4.1. Mobilization

Mobilization shall include the followings:

a) Preparation of materials, equipment and laborers including supervising personnel of the Contractor
b) Transportation of materials, equipment and laborers including supervising personnel of the Contractor
c) Accommodation for laborers and supervising personnel of the Contractor
d) Transportation of the Engineer of the JICA Study Team for the supervision of the Work

4.2. Updating and correction of 1:200 maps for five(5) rivers

4.2.1. Areas

The areas to be mapped shall be as follows:

River	Length	Width	Remarks
Ruhu	1,600m (1550)	60m	Length shall be distance from the estuary of each river.
Batu Merah	1,600	60	
Tomu	2,900	60	Width shall be 30m from the center of the river to both the right and left banks.
Batu Gajah	2,900 (2700)	60	
Batu Gantung	1,500 (1300)	60	
Total	10,500m	63ha	

In case, the width of the rivers are larger than 20m, the mapping areas shall be 20m from the river banks to town areas. (Refer to the Fig.2)

4.2.2. Methods

a. Digitizing and plotting of existing maps

The 1:200 mapping areas of the existing 1:1,000 maps prepared by Badan Pertanahan Nasional(BPN) in 1989 shall be digitized by the digitizer and the digitized data be stored in a computer system. The digitized data shall be plotted into 1:200 maps.

b. Updating and correction of the plotted 1:200maps

The plotted 1:200 digital maps shall be updated and corrected with total station in the field. Updating and correction of the 1:200 maps shall be carried out with the data collected in the fields by the digitizer.

c. Spot leveling

Spot leveling covering 63ha of whole 1:200 mapping areas shall be carried out at an interval of 10m, i.e. 100 points per ha. Reference bench marks(BM) for the spot leveling shall be existing distance marks and BM established by JICA Study Team in 1996. The spot heights shall be plotted on the 1:200 maps.

d. Contour lines

Contour lines at an interval of 50cm shall be drawn with the spot heights from the spot leveling. Supplementary contour lines at an interval of 25cm will be drawn in necessary areas.

e. Plotting

The updated and corrected 1:200 maps shall be plotted with the processed field data by the computer aided automatic plotter.

Information identified and collected in the fields such as names of places, official and public building and facilities etc. shall be annotated to the plotted maps.

The plotted points will be digitized and stored in floppy disks to be submitted to the Engineer.

The sample sheet on which the 1:200 maps be plotted will be shown by the Engineer before commencement of the plotting.

Materials to be used for the 1:200 maps plotting sheets shall be polyester base with thickness of #300.

4.2.3. 1:200 Mapping of Batu Gantung River

An area of 3.6ha, approximately 60m x 600m of Batu Gantung River where the 1:1,000 BPN maps do not exist, shall be newly mapped at a scale of 1:200 by the field total station method. (refer to the Fig. 3)

a. Ground control survey

The Differential Global Positioning System(D-GPS) shall be used to establish four(4) ground controls for the 1:200 mapping. Elevation of the ground controls shall be decided by the leveling from the JICA BM.

b. Measurement and identification for 1:200 mapping

Every natural and artificial terrain features necessary to the 1:200 maps shall be measured with the total station and the data be stored in memory cards. The field data shall be processed to be plotted with the total station system which includes computer and automatic plotter.

Names of places, official and public buildings and facilities shall be identified in the fields and shown on the 1:200 maps.

c. Spot leveling

Spot leveling covering approximately 60m x 600m of Batu Gantung mapping area shall be carried out with the total station at an interval of 10m, i.e. 100 points per ha. Reference BM for the spot leveling shall be existing distance marks and BM established by JICA Study Team in 1996.

d. Plotting and drawing

The 1:200 maps shall be plotted with the processed field data by the computer aided automatic plotter. Contour lines at an interval of 50cm shall also be drawn from the plotted spot heights. Supplementary contour lines at an interval of 25cm will be drawn in necessary areas.

Information identified and collected in the fields such as names of places, official and public building and facilities etc. shall be annotated to the plotted maps.

The plotted points will be digitized and stored in floppy disks to be submitted to the Engineer.

The sample sheet on which the 1:200 maps be plotted will be shown by the Engineer before commencement of the plotting.

Materials to be used for the 1:200 maps plotting sheets shall be polyester base with thickness of #300.

4.2.3. Equipment

Equipment to be used for the 1:200 mapping are as follows:

Digitizer	Computer aided digitizer
GPS unit	Leica or Trimble GPS receiver, controller and processor units two units or more
Total station system	5 seconds angle reading, 5mm+3ppm x D in distance measurement
Automatic plotter	HP Design Jet 750c plus Plotter or equivalent
Level	Automatic levels, 40 second / 2mm second order level Metric staves, 3 or 5 m wooden or metal staff with base plates.

4.2.4. Accuracy

The accuracy of each work item of the 1:200 mapping shall be as follows:

Digitizing	within 0.2mm on the scaled map
Measurement	within 20 seconds in angles and 5cm in distances
Plotting	within 0.3mm on the scaled map
Differential GPS	within 5cm in distances
	within 10cm in elevation
Spot leveling	within 5cm

4.3. 1:500 mapping for dam sites in Batu Gajah and Batu Gantung Rivers

4.3.1. Areas

The areas to be mapped shall be as follows:

Proposed dam site of GJ-2	400m x 500m = 20ha
Proposed dam site of GT-1	400m x 500m = 20ha
Total area	40ha

The location of GJ-2 and GT-1 are shown in the Fig. 1.

4.3.2. Methods

a. Ground control survey

The Differential Global Positioning System(D-GPS) shall be used to establish four(4) ground controls as two(2) points in GJ-2 area and two(2) points in GT-1 area for the 1:500 mapping. Elevation of the ground controls shall be decided by the leveling from the JICA BM.

b. Measurement and identification for 1:500 mapping

Every natural and artificial terrain features necessary to the 1:500 maps shall be measured with the total station and the data be stored in memory cards. The field data shall be processed to be plotted with the total station system which includes computer and automatic plotter.

Names of places, official and public buildings and facilities shall be identified in the fields and shown on the 1:500 maps.

c. Spot leveling

Spot leveling covering the two proposed dam sites approximately 40ha mapping areas shall be carried out with the total station at an interval of 10m, i.e. 100 points per ha. Reference BM for the spot leveling shall be existing distance marks and BM established by JICA Study Team in 1996.

d. Plotting and drawing

The 1:500 maps shall be plotted with the processed field data by the computer aided automatic plotter. Contour lines at an interval of 1m shall also be drawn from the plotted spot heights. Supplementary contour lines at an interval of 50cm will be drawn in necessary areas.

Information identified and collected in the fields such as names of places, official and public building and facilities etc. shall be annotated to the plotted maps.

The plotted points will be digitized and stored in floppy disks to be submitted to the Engineer.

The sample sheet on which the 1:500 maps be plotted will be shown by the Engineer before commencement of the plotting.

Materials to be used for the 1:500 maps plotting sheets shall be polyester base with thickness of #300.

4.3.3. Equipment

Equipment to be used for the 1:500 mapping are as follows:

Digitizer	*Computer aided digitizer*
GPS unit	Leica or Trimble GPS receiver, controller and processor units two units or more
Total station system	5 seconds angle reading, 5mm+3ppm x D in distance
Automatic plotter	HP Design Jet 750c Plus Plotter or equivalent
Level	Automatic levels, 40 second / 2mm second order level Metric staves, 3 or 5 m wooden or metal staff with base plates.

4.3.4. Accuracy

The accuracy of each work item of the 1:500 mapping shall be as follows:

Digitizing	within 0.2mm on the scaled map
Measurement	within 20 seconds in angles and 5cm in distances

Plotting	within 0.3mm on the scaled map
Differential GPS	within 5cm in distances
	within 10cm in elevation
Spot leveling	within 5cm

4.4. Cross section in reservoir areas

4.4.1. Areas

The areas to be covered by the cross section are as follows:

Reservoir of proposed dam site GJ-2	15 cross sections at 50m intervals across the Batu Gajah river from GJ-2 dam to the upper stream, elevation up to 100m from the river bed
Reservoir of proposed dam site GT-1	11 cross sections at 50m intervals across the Batu Gantung river from GT-1 dam to the upper stream, elevation up to 100m from the river bed

4.4.2. Methods

a. Cross sectioning

Cross section lines shall be staked out from the center line of proposed dams which were established by the JICA Study Team in 1996. Ground height every 5m intervals and points where slopes abruptly change on the cross section lines shall be measured and recorded.

Elevation of water surface of the rivers at the measuring time shall be measured and recorded. Sounding in the rivers shall be carried out every 2m intervals on the cross section lines. The cross sectioning shall be carried out up to elevation of 100m from the river bed on both the left and right banks.

b. Plotting and drawing

Elevation and distance data acquired in the fields shall be plotted at a scale of 1:500. The sample sheet on which the cross sections be plotted will be shown by the Engineer before commencement of the plotting. The plotted points will be digitized and stored in floppy disks to be submitted to the Engineer.

The drawing will be carried out directly from the digitized data with a computerized automatic plotter.

c. Materials

Materials to be used for the cross section plotting sheets shall be polyester base with thickness of #300.

4.4.3. Equipment

Equipment to be used for the cross section shall be:

- Automatic levels	40 second / 2mm second order level
- Metric staves	3 or 5 m wooden or metal staff with base plates.
- Automatic plotter	HP Design Jet 750c Plus Plotter or equivalent

4.4.4. Accuracy

Accuracy of the cross sectioning on the ground shall be within 5cm and that of sounding in the rivers be within 20cm in elevation, and 1: 300 in distance.

4.5. Cross section for check dams

4.5.1. Location

The location of proposed check dams will be in upper stream of Ruhu, Tomu, Batu Gaja and Batu Gantung rivers.

The areas to be covered by the cross section are as follows:

Ruhu river proposed check dam	3 cross sections at 20m intervals across the Ruhu river in the check dam site, elevation up to100 from the river bed
Tomu river proposed check dam	3 cross sections at 20m intervals across the Tomu river in the check dam site, elevation up to100m from the river bed
Batu Gajah river proposed check dam	3 cross sections at 20m intervals across the Batu Gajah river in the check dam site, elevation up to100m from the river bed
Batu Gantung river proposed check dam	3 cross sections at 20m intervals across the Batu Gantung river in the check dam site, elevation up to100m from the river bed

The location of check dam will be shown by the Engineer before commencement of the cross section.

4.5.2. Methods

The methods shall be similar to those of the cross section in reservoir areas.

4.5.3. Equipment

The equipment to be used for the cross section of the check dam shall be equivalent to those of the cross section in reservoir areas.

4.5.4. Accuracy

The accuracy of the cross section of the check dam shall be equivalent to those of the cross section in reservoir areas.

4.6. 1:200 mapping for diversion area in Batu Merah River

4.6.1. Areas

The areas to be mapped shall be as follows:

Proposed outlet site of diversion of Batu Merah river	600m x 300m = 1.8ha
Proposed inlet site of diversion of Batu Merah river	100m x 100m = 1.0ha
Total area	2.8ha

4.6.2. Methods

The methods shall be similar to those of the 1:200 mapping of the Batu Gantung area.

4.6.3. Equipment

The equipment to be used for the mapping shall be equivalent to those of 1:200 mapping of the Batu Gantung area.

4.6.4. Accuracy

The accuracy of the mapping shall be equivalent to those of 1:200 mapping of the Batu Gantung area.

4.7. Sounding in sea shore around estuary of Ruhu River

4.7.1. Areas

Area to be covered by the sounding shall be 1400m x 300m = 42ha around the estuary of Ruhu river. The sounding of sea bed along seven(7) sounding lines as shown in the Fig. 4 shall be carried out to prepare the 1:500 hydrographic maps

4.7.2. Methods

a. Setting a tidal station

A tidal station shall be set up near the sounding area to correct the water depth from the sea surface. Tidal level at the station shall be measured immediately before and after the sounding of one sounding line is carried out. The datum elevation shall be mean sea level(MSL) at Ambon seaport established by JICA Study Team in 1996.

b. Staking out sounding lines

A base line parallel to the sea shore shall be staked out as shown on the Fig.4. Seven(7) sounding lines perpendicular to the base line at intervals of 200m shall also be staked out as shown on the Fig. 4.

c. Sounding

The sounding shall be carried out on 300m from the shore to the sea at intervals of 10m along the sounding lines .

The sounding will be carried out with sounding rods in areas shallower than 5m, and with echo sounders in areas deeper than 5m.

Positioning of the sounding will be carried out with a total station by observing directions and distances.

d. Plotting

Field data acquired from the sounding shall be plotted at a scale of 1:500 after processed and corrected.

The sample sheet on which the hydrographic maps be plotted will be shown by the Engineer before commencement of the plotting. The plotted points will be digitized and stored in floppy disks to be submitted to the Engineer.

Materials to be used for the cross section plotting sheets shall be polyester base with thickness of #300.

4.7.3. Equipment

The equipment to be used for the sounding will be as follows:

Total station	5 seconds angle reading, 5mm+3ppm x D in distance
Sounding rod	5m length, with10mm graduation
Echo sounder	30-200khz frequency band with automatic recorder
Automatic plotter	HP Design Jet 750c Plus Plotter or equivalent

4.7.4. Accuracy

Accuracy of the sounding in the sea shall be within 20cm in elevation, and 1: 300 in distance.

4.8. Reporting

The Contractor shall submit to the Engineer the following final survey results:

1) Original drawing of 1:200 topographic maps of five rivers	1 set
2) Original drawing of 1:500 topographic maps of dam sites	1 set
3) Original drawing of cross section of reservoir areas	1 set
4) Original drawing of cross section of check dams	1 set
5) Original drawing of 1:200 topographic maps of diversion area	1 set
6) Original drawing of 1:500 hydrographic maps in estuary of Ruhu River	1 set
7) Data and results of ground controls for topographic mapping, cross section and sounding	1 set
8) Digitized data of plotting for topographic maps, cross section, and sounding stored in floppy disks	1 set
9) Survey Report	5 sets

Table 1. Time schedule (Revised)

Work Items	May	June	July	August
Preparation Digitizing existing map	15 – – – – – 11			
Mobilization		16		
Updating 1:200maps for five rivers				
Field updating		16 ——— 15		
Spot leveling		16 ——— 20		
Plotting			10 ——— 10	
1:200 mapping for Batu Gantung and others				
GPS survey		11—15		
Field mapping		16 ——— 10		
Spot levling		16 ——— 10		
Plotting			10 ——— 30	
1:500 mapping for dam sites				
GPS survey		6 –10		
Field mapping		11 ——— 25		
Spot leveling		26 ——— 1		
Plotting			1 ——10	
Cross section in reservoirs				
Cross section		6 ——— 23		
Plotting		24 ——— 10		
Cross section in Check dams				
Cross section		24 ——— 10		
Plotting			11 ——— 21	
1:200 mapping in diversion				
GPS survey		16 ——22		
Field mapping		23 ——— 10		
Spot leveling			5 ——— 15	
Plotting			16 ——— 30	
Sounding in estuary of Ruhu river				
Setting tidal station		16 18		
Staking sounding lines		18 –20		
Sounding		21 ——— 15		
Plotting			16 ——— 5	

Survey Team

2 teams for updating 1:200 1 team for 1:200 mapping Batu Gantung

1 team for 1:500 and 1:200 mapping dam sites and diversion

1 team for cross section reservoirs and check dam

1 team for sounding 1 GPS team join to other teams

Fig. 2. 1:200 mapping areas

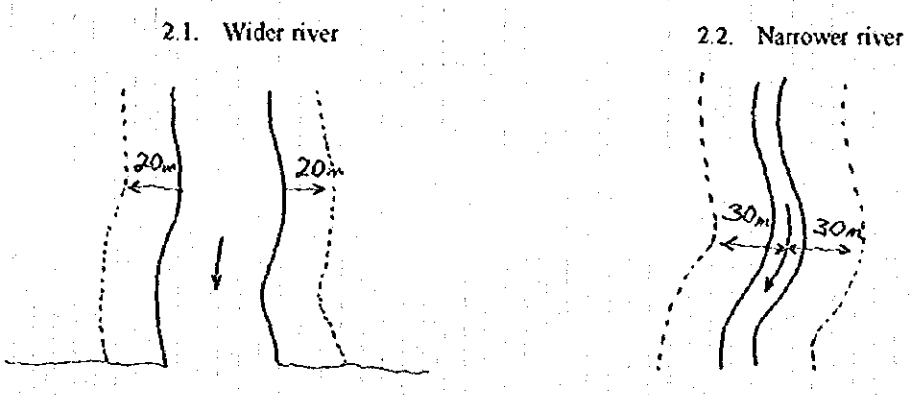


Fig. 3. 1:200 Mapping areas of B. Gantung and other rivers

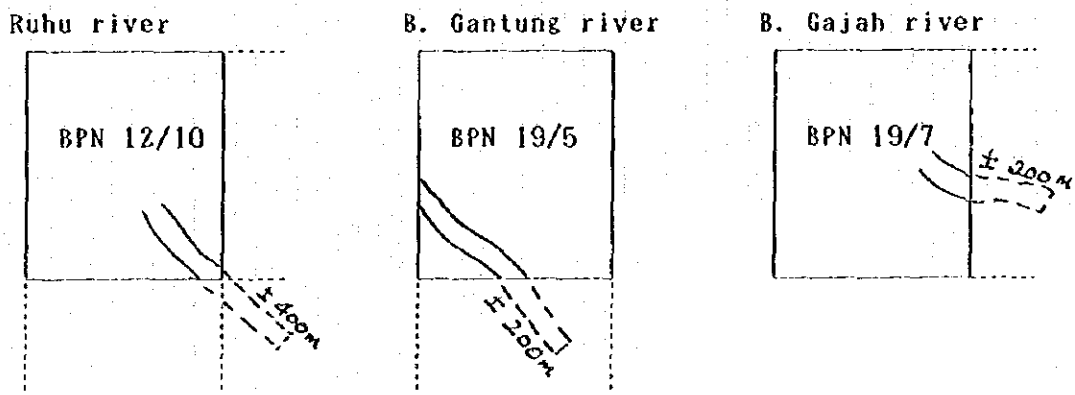


Fig. 4 Sounding area around estuary of Ruhu River

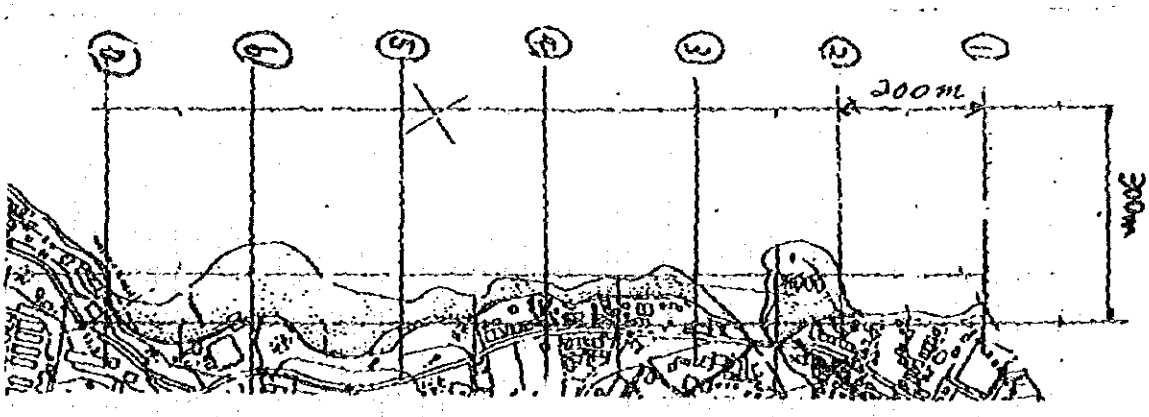


FIG .1. LOCATION OF FIVERIVERS, BENCHMARKS, LEVELING ROUTE AND PROPOSED DAM SITES

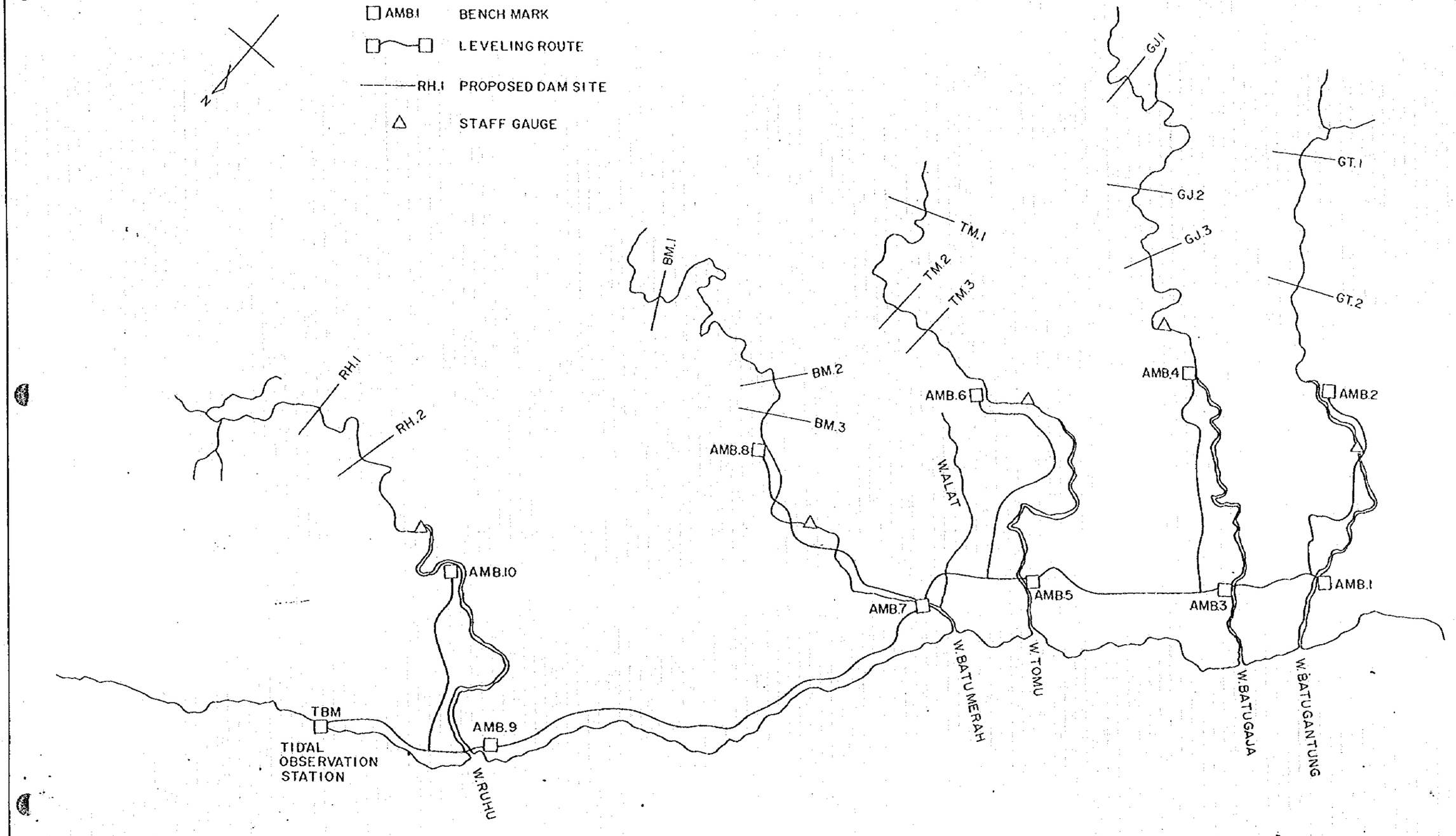
AMB.I BENCH MARK

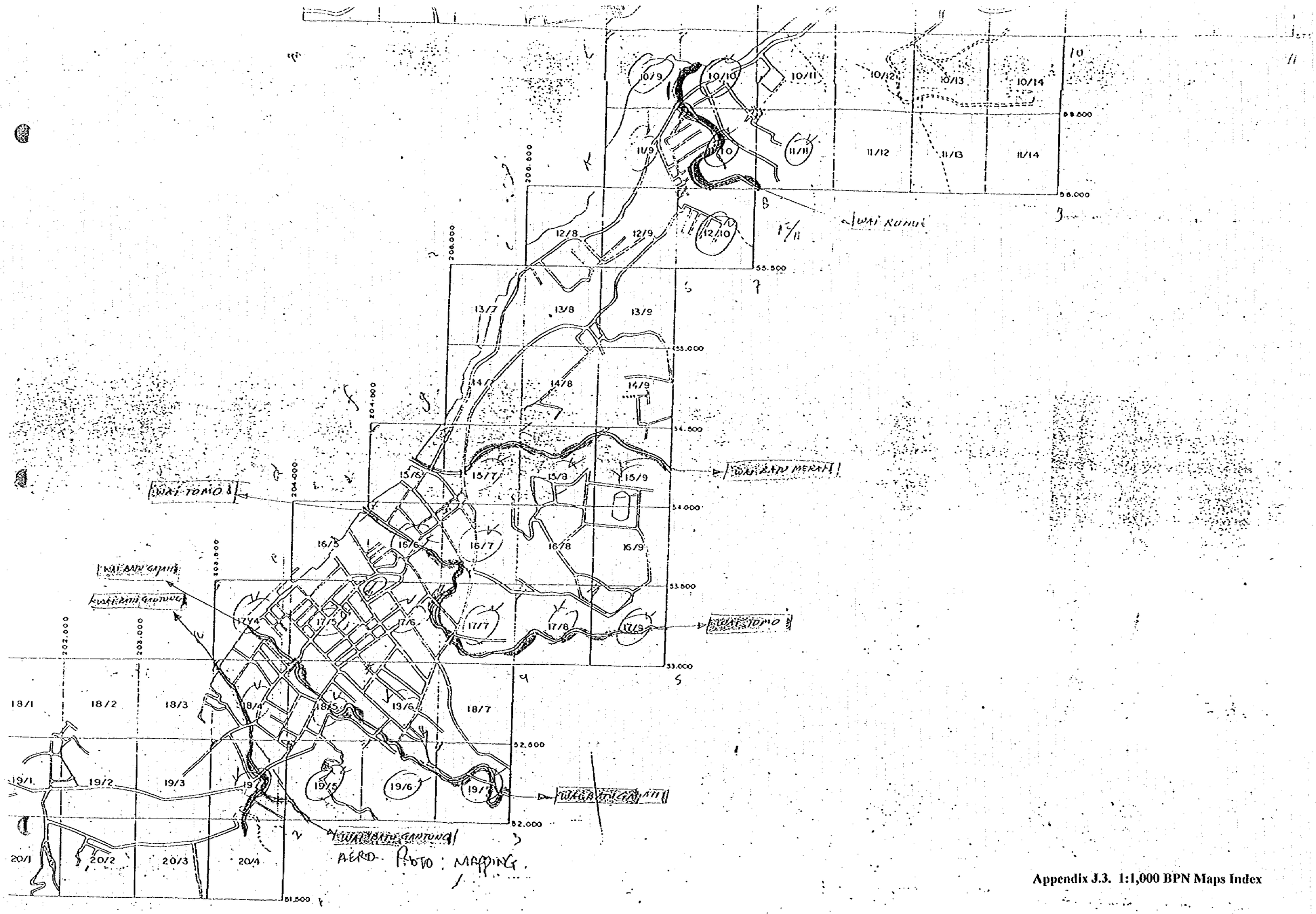
LEVELING ROUTE

RH.I PROPOSED DAM SITE

STAFF GAUGE

N

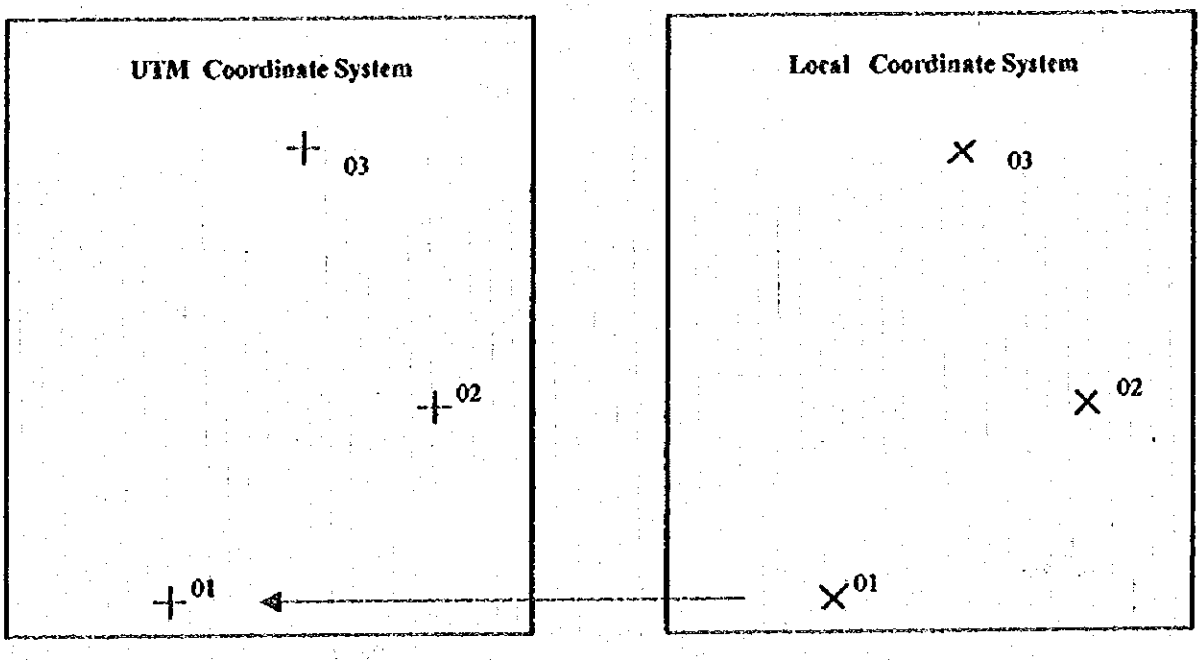




Appendix J.3. 1:1,000 BPN Maps Index

Appendix J.4. Coordinate Transformation by GPS Survey

PELAKSANAAN PEKERJAAN
MERUBAH SISTIM KOORDINAT PETA BPN 1991
KE SISTIM KOORDINAT UTM



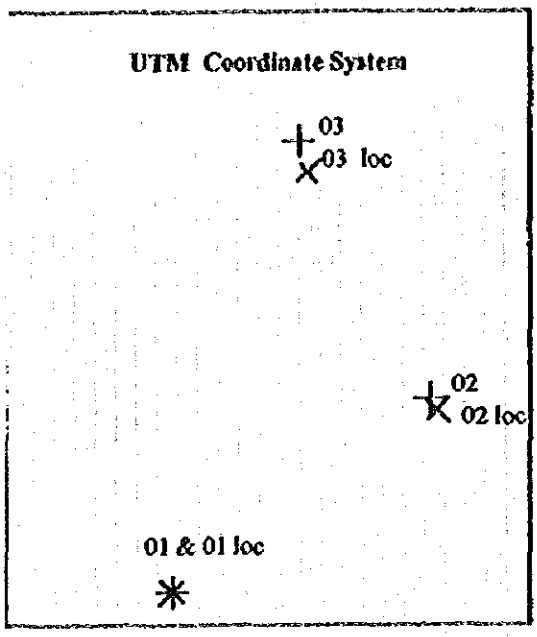
Koordinat UTM (GPS)

01	408,432.922	9,590,509.451
02	409,715.280	9,591,361.718
03	411,019.900	9,594,702.101

Koordinat Lokal (Prick Peta Digitized 1 / 200)

01	203,871.310	52,327.033
02	205,152.524	53,175.612
03	206,462.504	56,514.253

1. Membuat Template pada sistim koordinat UTM dengan base point sebanyak 3 buah. (01 , 02 , 03)
2. Peta BPN (lokal) di insert ke template sistim koordinat UTM dengan base point 01

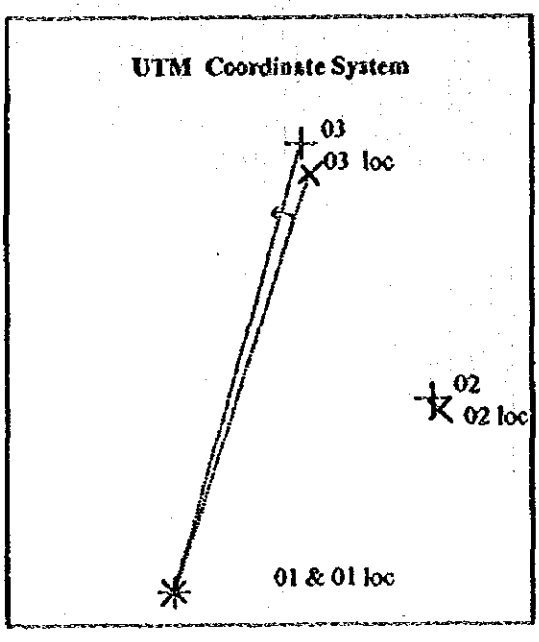


3. Setelah 01 loc diimpitkan dengan 01 UTM , keadaan terlihat seperti gambar sebelah.

4. Karena Autocad hanya butuh 2 titik untuk melakukan Rotasi , maka dipilih 2 buah titik yang saling berjauhan yaitu titik 01 dan 03

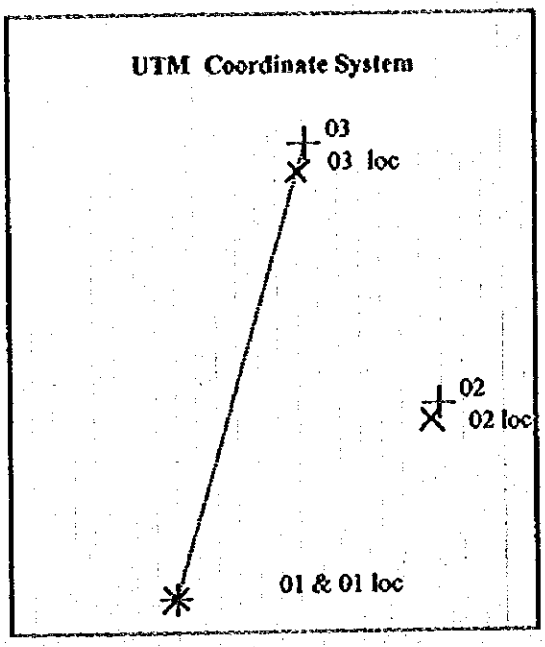
5. Dari keadaan diatas, didapat koordinat titik-titik sebagai berikut :

01& lokal	:	408,432.922	9,590,509.451
03	:	411,019.900	9,594,702.101
03 lokal	:	411,024.116	9,594,696.671



6. Dari koordinat diatas dapat dihitung :

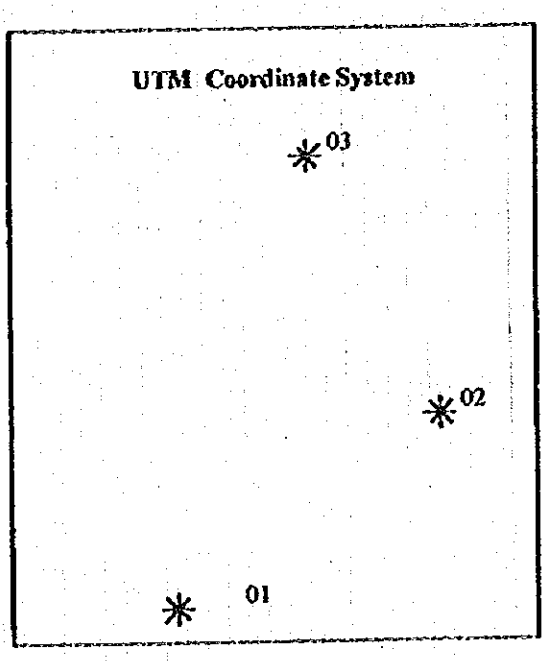
jarak 01 - 03	:	4,926.537
jarak 01 - 03 lokal	:	4,924.134
skala faktor	:	1.000488004591
sudut 03-01-03 loc	:	0° 04' 29"



7. Peta BPN yang sudah dalam sistem UTM di Rotasi sebesar **- 0° 04' 29"** dengan pusat rotasi di titik **01**.

8. Hasilnya dapat dilihat pada gambar sebelah.

9. Sesudah di Rotasi , peta BPN di perbesar dengan skala faktor : **1.000488004591**



10. Setelah di rotasi , maka titik-titik 01 dan 03 berimpit (lihat gambar sebelah)

GPS RESULTS
OF
AMBON FLOOD CONTROL PROJECT

Reference Coordinate : N.5004 Patimura Airport
Reference Ellipsoid : WGS 84
Projection set : Universal Transverse Mercator Zone : 52 Central Meridien : 129° East

No.	Station	Latitude	Longitude	Northing (m)	Easting (m)	Remarks
1	N.5004	3 42 26.8493 S	128 5 20.0978 E	9,590,156.724	398,825.664	Reference
2	01	3 42 15.6690 S	128 10 31.5367 E	9,590,509.451	408,432.922	Batu Gantung prick point
3	02	3 41 47.9529 S	128 11 13.1313 E	9,591,361.718	409,715.280	Tonu prick point
4	03	3 39 59.2093 S	128 11 55.5191 E	9,594,702.101	411,019.900	Ruhu Prick point
5	AMB 09	3 40 1.3905 S	128 11 53.8409 E	9,594,635.077	410,968.187	PU Existing BM
6	GJ L	3 42 34.4492 S	128 11 33.7255 E	9,589,934.530	410,351.888	Batu Gajah Dam Site
7	GJ R	3 42 36.4858 S	128 11 42.4455 E	9,589,872.236	410,620.945	Batu Gajah Dam Site
8	GT L	3 42 56.8450 S	128 11 18.7474 E	9,589,246.396	409,890.468	Batu Gantung Dam Site
9	GT R	3 42 56.0491 S	128 11 23.3757 E	9,589,270.967	410,033.222	Batu Gantung Dam Site
10	L 3	3 40 4.2317 S	128 11 51.1196 E	9,594,547.757	410,884.312	Sounding Point