SUPPORTING REPORT

PART-P

ECONOMIC EVALUATION

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

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CHAPTER 1 ECONOMIC EVALUATION

1.1 Yearly Average of Damage Alleviation

The following table shows the yearly averages of damage alleviation of Samal River and Kobi River at a 20 year return period, estimated by the Study Team:

Table-P.1.1 Yearly Averages of Damage Alleviation at a 20 Year-Return Period

Name of River	Yearly Average of Damage Alleviation
Samal River	Rp 1,657 million
Kobi River	Rp 768 million

Source: Study Team

1.2 Economic Analysis

1.2.1 Assumptions for Economic Analysis

Economic analysis was conducted under the following assumptions:

- Price level : End of December 1996
- Design scale : 20 years return period
- Project life : 50 years
- Maintenance costs : 0.5% of the total construction costs per year
- Shadow pricing : Standard Conversion Rate 85%
- Growth rate of property value : Until 2010 : 6.0% per annum
  From 2011 : 1.6% per annum

(1) Price Level

The price level for the estimation of costs and benefits was set at the end of December 1996. The exchange rate for the Master Plan was fixed at Rp 2,500 to US$ 1.00 for calculation purposes.

(2) Design Scale

The design scale was set at 20-year return period, taking into account that damage alleviation is not expected to increase significantly when the design scale is raised to more than 20-year return period.

(3) Project Life

The economic life of the project was set at 50 years; the residual value of the facilities is considered to be zero after 50 years when they will need to be replaced.

(4) Maintenance Costs

The maintenance work is assumed to require 0.5% of total construction costs every year. The maintenance activities will be necessary from the year following completion of construction until the last year of the project life.

(5) Shadow Pricing

Taxes and duties must be deducted from financial costs in order to obtain economic costs. 0.85 was used for the standard conversion rate.

(6) Growth Rate of Property Value

The value of the houses in the Pasahari Area is expected to increase significantly in accordance with the increase in rice production resulting from the completion of construction of irrigation facilities. The residents' income in the area is expected to be doubled by 2010 and most of their houses, which are currently in poor condition, will be upgraded. The Study assumed a 6.0% increase per year in property value until 2010, while from 2011, a 1.5% increase per year is assumed to be achievable due to an increase in agriculture productivity and residents' opportunities to work in cities during agricultural off-seasons.

1.2.2 Economic Analysis and Sensitivity Analysis on Samal River

Table-P.1.2 shows the results of economic analysis on the construction of the flood control facilities in Samal River, on the assumption that the facilities are constructed in three stages. Since a 16.0% IRR will be achieved in this Project component, the construction of the flood control facilities in Samal river is judged to be economically feasible.

Table-P.1.2 Economic Cost, NPV, B/C and IRR of Samal River

Stage	Economic Cost	NPV at 10%	B/C at 10%	IRR
1st Stage	Rp 5,688 million	Rp 7,885 million	1.88	16.0%
2nd Stage	Rp 5,688 million			
3rd Stage	Rp 5,688 million			
Total	Rp 17,065 million			

Table-P.1.3 shows the results of sensitivity analysis under the assumption of follow:

1) Case-1 : the growth rate in property value in the Study Area is 3 % per year until 2010.
2) Case-2 : the construction cost increases by 10%.

The Project component is economically feasible in either case since their IRR are above 12%.

Table-P.1.3 Sensitivity Analysis - Samal River

NPV at 10%		Internal Rate of Return (IRR)	
Case-1 3 % Increase in Property Value	Case-2 10% Increase in Cost	Case-1 3 % Increase in Property Value	Case-2 10% Increase in Cost
Rp 2,449 million	Rp 6,985 million	12.1%	15.0%

1.2.3 Economic Analysis and Sensitivity Analysis on Kobi River

Table-P.1.4 shows the results of economic analysis on the construction of the flood control facilities in Kobi River, under the same assumption as that of Samal River. Economic feasibility on the construction of Kobi River flood control facilities is marginal: its IRR is 8.2%.

Table-P.1.4 Economic Cost, NPV, B/C and IRR of Kobi River

Stage	Economic Cost	NPV at 10%	B/C at 10%	IRR
1st Stage	Rp 6,287 million	- Rp 2,122 million	0.79	8.2%
2nd Stage	Rp 6,287 million			
3rd Stage	Rp 6,287 million			
Total	Rp 18,862 million			

Table-P.1.5 shows the results of sensitivity analysis on Kobi River under the same assumption as those for Samal River.

Table-P.1.5 Sensitivity Analysis - Kobi River

NPV at 10%		Internal Rate of Return (IRR)	
Case-1 3 % Increase in Property Value	Case-2 10% Increase in Cost	Case-1 3 % Increase in Property Value	Case-2 10% Increase in Cost
- Rp 4,641 million	- Rp 3,116 million	5.5%	7.5%

Under the assumption that property value increase by 3% per year, construction of flood control facilities in Kobi River is not economically justifiable. However, it should be noted that flood control facilities in Kobi River can be used as roads which have additional impact on the local economy, although its benefits are difficult to quantify due to lack of traffic data.

The future development plan of the Pasahari Area is currently not yet defined by the Government. The feasibility of the construction of Kobi River's flood control facilities cannot be judged at this moment since it is contingent on future development prospects of the area.

Appendix P Economic Analysis

Economic Analysis: Samal River

Samal

Growth	(1997-2010)	1.060		Growth	(1997-2010)	1.030		Growth	(1997-2010)	1.060		
	(2011-2050)	1.015			(2011-2050)	1.015			(2011-2050)	1.015		
Fin Cost	20,077			Fin Cost	20,077			Fin Cost	22,085			
Eco-Cost	17,065			Eco-Cost	17,065			Eco-Cost	18,772			
Benefit/y	1,657			Benefit/y	1,657			Benefit/y	1,657			
Year	Cost	Benefit	Net	Year	Cost	Benefit	Net	Year	Cost	Benefit	Net	
	0		0		0		0		0		0	
1	1,138	0	(1,138)	1	1,138	0	(1,138)	1	1,251	0	(1,251)	
2	1,138	0	(1,138)	2	1,138	0	(1,138)	2	1,251	0	(1,251)	
3	1,138	0	(1,138)	3	1,138	0	(1,138)	3	1,251	0	(1,251)	
4	1,138	0	(1,138)	4	1,138	0	(1,138)	4	1,251	0	(1,251)	
5	1,138	0	(1,138)	5	1,138	0	(1,138)	5	1,251	0	(1,251)	
6	1,166	933	(233)	6	1,166	721	(445)	6	1,283	933	(350)	
7	1,166	889	(277)	7	1,166	742	(424)	7	1,283	999	(284)	
8	1,166	1,048	(118)	8	1,166	765	(402)	8	1,283	1,049	(234)	
9	1,166	1,111	(55)	9	1,166	787	(379)	9	1,283	1,111	(171)	
10	1,166	1,178	12	10	1,166	811	(355)	10	1,283	1,178	(105)	
11	1,195	2,498	1,303	11	1,195	1,671	476	11	1,314	2,498	1,184	
12	1,195	2,535	1,340	12	1,195	1,696	501	12	1,314	2,535	1,221	
13	1,195	2,573	1,378	13	1,195	1,721	527	13	1,314	2,573	1,259	
14	1,195	2,612	1,417	14	1,195	1,747	553	14	1,314	2,612	1,298	
15	1,195	2,651	1,456	15	1,195	1,773	579	15	1,314	2,651	1,337	
16	85	4,036	3,951	16	85	2,700	2,615	16	94	4,036	3,942	
17	85	4,096	4,011	17	85	2,741	2,655	17	94	4,098	4,003	
18	85	4,158	4,073	18	85	2,782	2,696	18	94	4,156	4,064	
19	85	4,220	4,135	19	85	2,823	2,738	19	94	4,220	4,126	
20	85	4,284	4,198	20	85	2,866	2,780	20	94	4,284	4,190	
21	85	4,348	4,262	21	85	2,909	2,823	21	94	4,348	4,254	
22	85	4,413	4,328	22	85	2,952	2,867	22	94	4,413	4,319	
23	85	4,479	4,394	23	85	2,997	2,911	23	94	4,479	4,385	
24	85	4,546	4,461	24	85	3,042	2,958	24	94	4,546	4,452	
25	85	4,615	4,529	25	85	3,087	3,002	25	94	4,615	4,521	
26	85	4,684	4,598	26	85	3,134	3,048	26	94	4,684	4,590	
27	85	4,754	4,669	27	85	3,181	3,095	27	94	4,754	4,660	
28	85	4,825	4,740	28	85	3,228	3,143	28	94	4,825	4,731	
29	85	4,898	4,812	29	85	3,277	3,191	29	94	4,898	4,804	
30	85	4,971	4,886	30	85	3,328	3,240	30	94	4,971	4,877	
31	85	5,046	4,960	31	85	3,376	3,290	31	94	5,046	4,952	
32	85	5,121	5,036	32	85	3,426	3,341	32	94	5,121	5,028	
33	85	5,198	5,113	33	85	3,478	3,392	33	94	5,198	5,104	
34	85	5,276	5,191	34	85	3,530	3,445	34	94	5,278	5,182	
35	85	5,355	5,270	35	85	3,583	3,498	35	94	5,355	5,262	
36	85	5,436	5,350	36	85	3,637	3,551	36	94	5,436	5,342	
37	85	5,517	5,432	37	85	3,691	3,606	37	94	5,517	5,423	
38	85	5,600	5,515	38	85	3,747	3,661	38	94	5,600	5,506	
39	85	5,684	5,599	39	85	3,803	3,717	39	94	5,684	5,590	
40	85	5,769	5,684	40	85	3,860	3,774	40	94	5,769	5,675	
41	85	5,856	5,770	41	85	3,918	3,832	41	94	5,856	5,762	
42	85	5,944	5,858	42	85	3,976	3,891	42	94	5,944	5,850	
43	85	6,033	5,947	43	85	4,036	3,951	43	94	6,033	5,939	
44	85	6,123	6,038	44	85	4,097	4,011	44	94	6,123	6,029	
45	85	6,215	6,130	45	85	4,158	4,073	45	94	6,215	6,121	
46	85	6,308	6,223	46	85	4,220	4,135	46	94	6,308	6,214	
47	85	6,403	6,318	47	85	4,284	4,198	47	94	6,403	6,309	
48	85	6,499	6,414	48	85	4,348	4,263	48	94	6,499	6,405	
49	85	6,597	6,511	49	85	4,413	4,328	49	94	6,597	6,503	
50	85	6,695	6,610	50	85	4,479	4,394	50	94	6,695	6,602	

IRR	18.0%	IRR	12.1%
NPV (10%)	7,885	NPV (10%)	2,449
PV-Cost (10%)	9,000	PV-Cost (10%)	9,000
PV-Benefit (10%)	16,885	PV-Benefit (10%)	11,449
B/C (10%)	1.88	B/C (10%)	1.27

IRR	15.0%
NPV (10%)	6,965
PV-Cost (10%)	9,901
PV-Benefit (10%)	16,865
B/C (10%)	1.71

Economic Analysis: Kobi River

Growth	(1997-2010)	1.060
	(2011-2050)	1.015
Fin Cost		22,190
Eco-Cost		18,862
Benefit/y		768

Year	Cost	Benefit	Net
0			0
1	1,257	0	(1,257)
2	1,257	0	(1,257)
3	1,257	0	(1,257)
4	1,257	0	(1,257)
5	1,257	0	(1,257)
6	1,289	433	(856)
7	1,286	456	(830)
8	1,289	485	(803)
9	1,289	515	(774)
10	1,286	546	(743)
11	1,320	1,158	(163)
12	1,320	1,175	(145)
13	1,320	1,193	(128)
14	1,320	1,210	(110)
15	1,320	1,229	(92)
16	94	1,871	1,776
17	94	1,899	1,804
18	94	1,927	1,833
19	94	1,956	1,862
20	94	1,985	1,891
21	94	2,015	1,921
22	94	2,045	1,951
23	94	2,076	1,982
24	94	2,107	2,013
25	94	2,139	2,044
26	94	2,171	2,077
27	94	2,203	2,109
28	94	2,233	2,142
29	94	2,270	2,176
30	94	2,304	2,210
31	94	2,339	2,244
32	94	2,374	2,279
33	94	2,409	2,315
34	94	2,445	2,351
35	94	2,482	2,388
36	94	2,519	2,425
37	94	2,557	2,463
38	94	2,596	2,501
39	94	2,634	2,540
40	94	2,674	2,580
41	94	2,714	2,620
42	94	2,755	2,660
43	94	2,796	2,702
44	94	2,838	2,744
45	94	2,881	2,786
46	94	2,924	2,830
47	94	2,968	2,873
48	94	3,012	2,918
49	94	3,057	2,963
50	94	3,103	3,009

IRR	8.2%
NPV (10%)	(2,122)
PV-Cost (10%)	9,948
PV-Benefit (10%)	7,826
B/C (10%)	0.79

Kobi

Growth	(1997-2010)	1.030
	(2011-2050)	1.015
Fin Cost		22,190
Eco-Cost		18,862
Benefit/y		768

Year	Cost	Benefit	Net
0			0
1	1,257	0	(1,257)
2	1,257	0	(1,257)
3	1,257	0	(1,257)
4	1,257	0	(1,257)
5	1,257	0	(1,257)
6	1,289	334	(955)
7	1,289	344	(945)
8	1,289	354	(935)
9	1,289	365	(924)
10	1,289	376	(913)
11	1,320	774	(546)
12	1,320	786	(534)
13	1,320	798	(522)
14	1,320	810	(510)
15	1,320	822	(498)
16	94	1,251	1,157
17	94	1,270	1,176
18	94	1,289	1,195
19	94	1,309	1,214
20	94	1,328	1,234
21	94	1,348	1,254
22	94	1,368	1,274
23	94	1,389	1,295
24	94	1,410	1,315
25	94	1,431	1,337
26	94	1,452	1,358
27	94	1,474	1,380
28	94	1,496	1,402
29	94	1,519	1,424
30	94	1,541	1,447
31	94	1,565	1,470
32	94	1,588	1,494
33	94	1,612	1,518
34	94	1,636	1,542
35	94	1,661	1,566
36	94	1,686	1,591
37	94	1,711	1,616
38	94	1,736	1,642
39	94	1,763	1,668
40	94	1,789	1,695
41	94	1,818	1,721
42	94	1,843	1,749
43	94	1,871	1,776
44	94	1,899	1,804
45	94	1,927	1,833
46	94	1,956	1,862
47	94	1,985	1,891
48	94	2,015	1,921
49	94	2,045	1,951
50	94	2,076	1,982

IRR	5.5%
NPV (10%)	(4,641)
PV-Cost (10%)	9,948
PV-Benefit (10%)	5,307
B/C (10%)	0.53

Kobi

Growth	(1997-2010)	1.060
	(2011-2050)	1.015
Fin Cost		24,409
Eco-Cost		20,748
Benefit/y		768

Year	Cost	Benefit	Net
0			0
1	1,383	0	(1,383)
2	1,383	0	(1,383)
3	1,383	0	(1,383)
4	1,383	0	(1,383)
5	1,383	0	(1,383)
6	1,418	433	(985)
7	1,418	458	(959)
8	1,418	486	(932)
9	1,418	515	(903)
10	1,418	546	(872)
11	1,452	1,158	(295)
12	1,452	1,175	(277)
13	1,452	1,193	(260)
14	1,452	1,210	(242)
15	1,452	1,229	(224)
16	104	1,871	1,767
17	104	1,899	1,795
18	104	1,927	1,823
19	104	1,956	1,852
20	104	1,985	1,882
21	104	2,015	1,911
22	104	2,045	1,942
23	104	2,076	1,972
24	104	2,107	2,003
25	104	2,139	2,035
26	104	2,171	2,067
27	104	2,203	2,100
28	104	2,236	2,133
29	104	2,270	2,166
30	104	2,304	2,200
31	104	2,339	2,235
32	104	2,374	2,270
33	104	2,409	2,306
34	104	2,445	2,342
35	104	2,482	2,378
36	104	2,519	2,416
37	104	2,557	2,453
38	104	2,596	2,492
39	104	2,634	2,531
40	104	2,674	2,570
41	104	2,714	2,610
42	104	2,755	2,651
43	104	2,796	2,692
44	104	2,838	2,734
45	104	2,881	2,777
46	104	2,924	2,820
47	104	2,968	2,864
48	104	3,012	2,908
49	104	3,057	2,954
50	104	3,103	3,000

IRR	7.5%
NPV (10%)	(3,116)
PV-Cost (10%)	10,943
PV-Benefit (10%)	7,828
B/C (10%)	0.72

SUPPORTING REPORT

PART-Q

TOPOGRAPHIC SURVEY

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

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CHAPTER 1 GENERAL

1.1. Scope of Work

1. Monumentation	24	points for bench marks
2. Distance marks	498	points for two rivers and two tributaries
3. Leveling	118	km
4. Profiling	4	profiles for two rivers and two tributaries
5. Cross sectioning	63	sections for two rivers and two tributaries
	1	sections for bridges
	2	sections for staff gauges
6. Tidal observation	1	station

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

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

Aerial Photographs
1:25,000 aerial photographs covering Pasahari area BAKOSURTANAL 1988

GPS Station
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 Q.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 Q.2.

1.4. Members and Equipment

Members worked for the survey are as follows:

Ir. Gatot Nugroho	Team leader
Riyanto	Co-Team leader for Pasahari area
Swadi	Surveyor for Pasahari area
Suyono	-ditto-
Tatang	-ditto-
Muchtar	-ditto-
Yahamanto Tiansyah	-ditto-
Johan	Operator for Automatic Plotter

Equipment used for the survey are as follows:

Theodolite T2	3 units
Theodolite T0	2 units
Total station	1 unis
EDM	1 unit
Level	6 units
Computer (laptop)	1 unit
Plotter HP Design Jet type 650c	1 unit

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

1.5. Datum Elevation for the Survey

Datum elevation for the survey should be mean sea level (MSL) as 0m. To know the MSL at Pasahari, 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 CONCEPTUAL PLAN IN PASAHARI AREA

2.1. Field Reconnaissance

The JICA supervisor and the Indonesian counterpart together with surveyors from the Contractor carried out the field reconnaissance in Pasahari area. During the field reconnaissance, survey methods of profiling and cross sectioning were discussed and decided. Location of the tidal observation station was selected and established at the Kobi Sadar sea port.
Boats with and without motors should have been used for the transportation in rivers for the survey, rather than cars due to the very limited access roads.

2.2. Monumentation

2.2.1. Kobi and Tinupa

Twelve (12) bench marks (SR16-19, SR21-28) were monumented approximately 2km intervals along the Kobi and Tinupa rivers. Seven (7) monuments (BM1-6 and BM11) established by the regional office of Public Works were also used as the bench mark monuments in the downstream area of Kibi river. The location of the bench marks are shown in Figure-Q.2.1.
Descriptions of the bench marks containing information such as location, access, date of establishment, elevation, were prepared for convenience to future users.

2.2.2. Samal and Musi

Twelve (12) bench marks (SR1-3, SR5-13) were monumented approximately 2km intervals along the Samal and Musi rivers.
Existing bench mark monument BMS02 by the regional office of Public Works was used as SR4, so that SR-4 was not monumented. The location of the bench marks are shown in Figure-Q.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 joint of pier in Kobi Sadar Sea Port, approximately 7km from the Samal river and 13km from Kobi river to the west.

The observation started on 29 November, continued until 8 January 1997 with interruption on 29, 30 and 31 December by the stormy weather. A temporary bench mark was also located near the staff gauge of the station.
The levels of sea water surfaces were measured with a staff gauge fixed at the pier of the Sea Port at exactly every one hour, 24 hours a day for 35 day. The observation data were plotted to decide the highest and lowest tide of each day. The plotting are as shown in Figure-Q.2.2. The mean sea level (MSL) was calculated as follows:

Highest mean sea level = Σ (highest sea level of each day) / Number of days
= 61.520/32 = 1.923m

Lowest mean sea level = Σ (lowest sea level of each day) / Number of days
= 32.500/32 = 0.703m

Mean sea level = (Highest mean sea level + Lowest mean sea level) / 2
= (1.923+0.703)/2 = 1.312m

There were two ebb and flow a day. The greater ebb and flow of each day were used to calculate the mean sea level. Graphics showing the daily tidal range are attached hereto as Figure-Q.2.2. The vertical distance between the mean sea level(MSL), staff gauge and the temporary bench mark(SR29) are as shown in Figure-Q.2.3. The elevation of SR29 from MSL at Kobi Sadar Sea Port was decided as H = 1.405m.

The highest, lowest and mean sea levels of each day were as shown in Table-Q.2.1

Table-Q.2.1 Daily Highest, Lowest and Mean sea level at Kobi Sadar Port

date	Highest	Time	Lowest	Time	Mean(m)
Nov 30	1.900	19:00	0.660	12:00	1.280
Dec 1	1.900	19:00	0.720	12:00	1.310
2	1.750	19:00	0.850	13:00	1.300
3	1.720	22:00	0.950	13:00	1.335
4	1.840	21:00	1.010	13:00	1.425
5	1.740	22:00	1.150	16:00	1.445
6	1.790	23:00	1.010	5:00	1.400
7	1.650	0:00	0.980	7:00	1.315
8	1.760	0:00	0.830	6:00	1.295
9	1.810	14:00	0.640	8:00	1.225
10	2.010	15:00	0.580	8:00	1.295
11	1.990	15:00	0.440	9:00	1.215
12	2.060	16:00	0.230	10:00	1.145
13	2.060	18:00	0.360	11:00	1.210
14	2.140	18:00	0.380	11:00	1.260
15	2.130	19:00	0.370	12:00	1.250
16	1.980	19:00	0.630	13:00	1.305
17	2.060	20:00	0.790	13:00	1.425
18	1.990	21:00	0.940	14:00	1.465
19	1.920	21:00	0.940	3:00	1.430
20	1.980	22:00	0.940	6:00	1.460
21	1.930	0:00	0.840	6:00	1.385
22	1.750	14:00	0.580	8:00	1.165
23	1.870	15:00	0.570	8:00	1.220
24	1.950	16:00	0.600	10:00	1.275
25	2.050	16:00	0.530	10:00	1.290
26	2.090	17:00	0.420	10:00	1.225
27	2.020	17:00	0.480	10:00	1.250
28	1.950	18:00	0.580	10:00	1.265
29	-		-		-
30	-		-		-
31		-		-	
Jan. 1	1.890	19:00	0.800	13:00	1.345
2	1.940	20:00	0.800	3:00	1.370
3	1.900	21:00	0.900	3:00	1.400

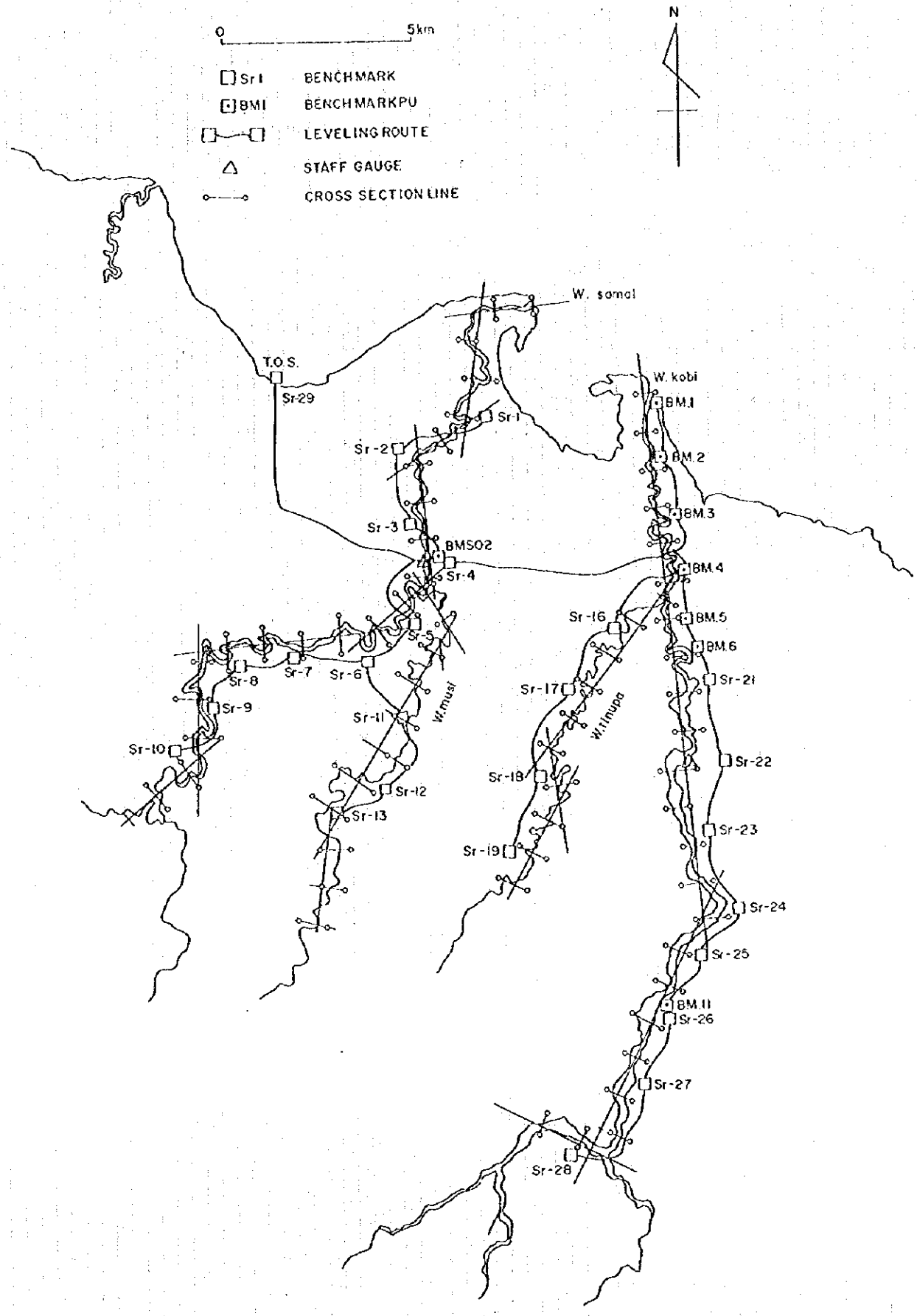


Figure-Q.2.1 **Location of Bench Marks, Cross Sections, Tidal Station and Leveling Routes**

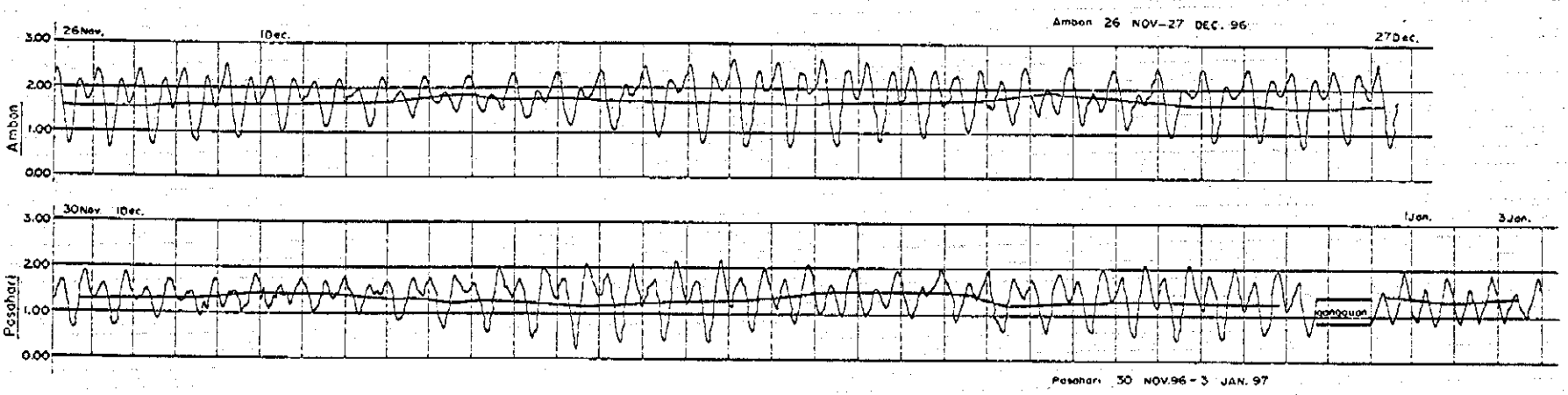


Figure-Q.2.2 Graph of Daily Tidal Ranges at Ambon and Kobi Sadar

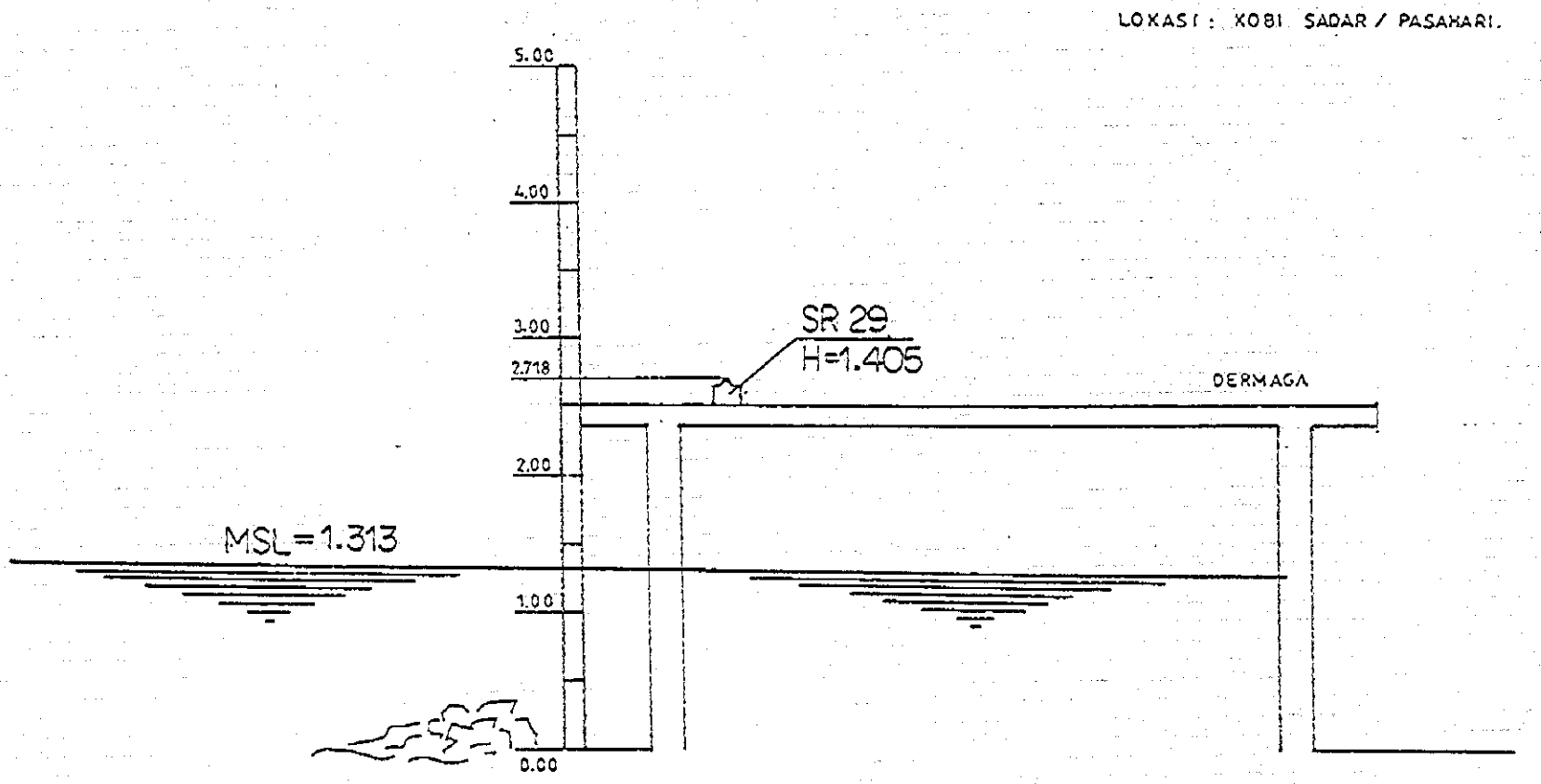


Figure-Q.2.3 Tidal Observation Station and Temporary Bench Mark at Kobi Sadar

2.4. Setting Out Distance Marks

Setting out of the distance marks for the rivers in Pasahari area was carried out not along the partial water flow of the rivers but along the overall directions of the rivers due to their meandering across the fields. The direction lines were staked out from the azimuth by a theodolite, and the distances were measured along the direction lines. Distance marks were set out perpendicular to the direction lines across the rivers. The direction lines and distance marks at every 1km are shown in Figure-Q.2.1.

2.4.1. Kobi and Tinupa

Distance marks at every 250m from the estuaries and confluence on the left and right banks of Kobi river and its tributary Tinupa river were set out and shown with concrete piles. The distance marks set out for the rivers were as follows:

Kobi River	87 points on the each bank, a total of 174 points
Tinupa Rivers	38 points on the each bank, a total of 76 points

2.4.2. Samal and Musi

Distance marks at every 250m from the estuaries and confluence on the left and right banks of Samal river and its tributary Musi river were set out and shown with concrete piles. The distance marks set out for the rivers were as follows:

Samal River	82 points on the each bank, a total of 164 points
Tinupa Rivers	42 points on the each bank, a total of 84 points

2.5. Leveling

The leveling to establish thirty three (33) bench marks, SR1-3, SR5-13, BM1-BM6, SR16-19, SR21-29 and BM11 was started from the temporary bench marks (SR29) at the tidal observation station, connected every bench marks and ended on the SR29 again. The total leveling distance was 119km and the location of bench marks and leveling routes are shown in Figure-Q.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:

Table-Q.2.2 Accuracy of Leveling

Route	From	To	Distance(km)	Misclosure(mm)	mm $\sqrt{S}$
1	SR29 - BMS02	BM4	19.9	27	6
2	BMS02	SR1	7.1	5	2
3	BMS02	SR10	18.3	1	1
4	BMS02	SR13	14.0	8	2
5	BM4	BM1	9.1	35	12
6	BM4	SR19	15.0	41	11
7	BM4	SR28	35.4	27	6

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

Table-Q.2.3 Elevation of Bench Marks

Code	Elevation(m)	Code	Elevation(m)
SR1	2.294	SR2	5.286
SR3	7.237	BMS02	7.248
SR5	9.768	SR6	14.950
SR7	21.871	SR8	27.34
SR9	32.900	SR10	39.512
SR11	18.646	SR12	26.351
SR13	34.477	BM1	0.825
BM2	1.575	BM3	2.790
BM4	4.600	BM5	6.432
BM6	8.252	BM8	13.329
BM9	20.439	BM10	27.469
BM11	39.177	SR16	8.039
SR17	12.112	SR18	19.747
SR19	24.874	SR21	9.296
SR22	14.486	SR23	21.651
SR24	29.529	SR25	38.310
SR26	46.930	SR27	78.296
SR28	71.349	BM11	39.177

The elevations are from Mean Sea Level at Kobi Sadar Sea Port as 0m.

2.6. Profiling

2.6.1. Kobi and Tinupa

To plot the rivers' longitudinal profiles, distance marks at every 250m 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 at every 500m intervals were obtained from the measurements of the cross sectioning.

2.6.2. Samal and Musi

Profiling for the Samal and Musi rivers were similar to those of the Kobi and Tinupa rivers. Elevation of the river beds at every 500m intervals were also obtained from the measurements of the cross sectioning.

2.7. Cross Sectioning

2.7.1. Kobi and Tinupa

The cross sectioning of Kobi river and its tributary, Tinupa river at every 500m intervals from the estuary and confluence were carried out as follows:

River	Length (m)	No. of sections	
Kobi	22,000	44	+ one bridge + two staff gauges
Tinupa	9,000	19	
Total	31,000	63	+ 3

The distance marks setting out and cross sectioning at the upper most section(22+000) of Kobi river could not be carried out due to the local territorial problem.

One bridge across Kobi river and former staff gauge site at Seti Bakti village and new staff gauge site at Kobi Intake site were also measured their cross section.

2.7.2. Samal and Musi

The cross sectioning of Samal river and its tributary, Musi river at every 500m intervals from the estuary and confluence were carried out as follows:

River	Length (m)	No. of sections	
Samal	20,000	41	+ one bridge + two staff gauges
Musi	10,000	21	
Total	30,000	62	+ 3

One bridge across Samal river and new staff gauge site at the bridge and former staff gauge site at the Samal Intake site were also measured their cross section.

2.8. Drawing Cross Section and Profile

2.8.1. Plotting and Drawing Cross Section

Data obtained by the field survey 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 fields. 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 especially in the Pasahari area. The plotting and drawing scales were as follows:

Two rivers and two tributary in Pasahari	horizontal 1:1,000	vertical 1:1,000
Bridges across rivers in Pasahari	horizontal 1:1,000	vertical 1:1,000
Staff gauge sites in rivers in Pasahari	horizontal 1:1,000	vertical 1:1,000

2.8.2. Plotting and Drawing Profile

Data obtained by the field survey 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. The plotting and drawing scales were as follows:

Five rivers and one tributary in Ambon	horizontal 1:2,500	vertical 1:100
Two rivers and two tributary in Pasahari	horizontal 1:10,000	vertical 1:1,000

CHAPTER 3 PROGRESS

Progress of the topographic survey for the Conceptual Plan in Pasahari areas is shown in Table-Q.3.1.

Table-Q. 3.1 Work Progress of Topographic Survey for the Conceptual Plan Study

Items	1996		1997
	November	December	January
Field Operation in Pasahari	28		20
(1) Field reconnaissance	28	29	
(2) Monumentation	28	31	4 20
(3) Tidal observation	29		8
(4) Setting out distance marks	28		20
a) Kobi and Tinupa	28	31	
b) Samal and Musi			4 20
(5) Leveling	28		20
(6) Profiling	28		20
(7) Cross sectioning	28		20
a) River cross sectioning	28		20
b) Bridges cross sectioning	28		20
c) Staff gauge cross section		25	11
(8) Plotting and drawing			11 20
			18 30

APPENDICES

Appendix Q.1. Existing GPS station ; NI5007

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 48305 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 : NI.5007 Nama : Wahai

Koordinat Geografi		Koordinat UTM	
Lintang	: S 2° 47' 44.2453"	Timur	: 555167.944 m
Bujur	: E 129° 29' 46.8995"	Utara	: 9690985.468 m
Tinggi Ellipsoid	: 64.0170 m	Zone	: 52 Sf : 0.9996400
		Konv. Grid	: 1' 27.156"

Koordinat Kartesian

X : -4851926.3750 m Y : 4916015.8680 m Z : -309007.0020 m

BADAN KOORDINASI SURVEY DAN PEMETAAN NASIONAL

(BAKOSURTANAL)

LAPORAN DESKRIPSI STASIUN G P S

STASIUN

N1.5007

01. NOMOR PILAR	: N1.5007	02. NAMA	: Air Buaya
03. DESA / KAMPING	: Air Buaya	04. KECAMATAN	: Buru Utara Barat
05. KABUPATEN / KOTAMADYA	: Maluku Tengah	06. PROPINSI	: Maluku

07. PENGAMATAN OLEH	: Geodesi Bakosurtanal
08. RECEIVER	: Ashtech LM XII 3
09. WAKTU	: 08:00 - 21:00 UTC
10. TANGGAL / JULIAN DAY	: 21 Juli 1995

11. KETERANGAN PILAR	: Standar pilar GPS

KOORDINAT PENDEKATAN	:
12. LINTANG	: S 3 5' 11"
13. BUJUR	: E 126 26' 5"
14. TINGGI (dihitas dllsold)	: 71.9362 m

15. DRAPAN LOKASI STATION : Pilar terletak di halaman depan Kantor Camat Buru Utara Barat di Air Buaya

16. KENAMPAKAN YANG MENONJOL : Kantor Camat Buru Utara Barat (Air Buaya)

17. JALAN KE LOKASI : Dari pelabuhan Slamet Riyadi di Ambon naik kapal motor 12 jam ke Namlea atau dari pelabuhan Ferry Galala di Ambon naik Ferry 10 jam ke Namlea. Lalu dari pasar Lama di Namlea naik bis ke Air Buaya 5 jam (96 km).

18. TRANSPORTASI/AKOMODASI : Dengan kapal motor ferry dan bis.
Akomodasi diperoleh dari Namlea.

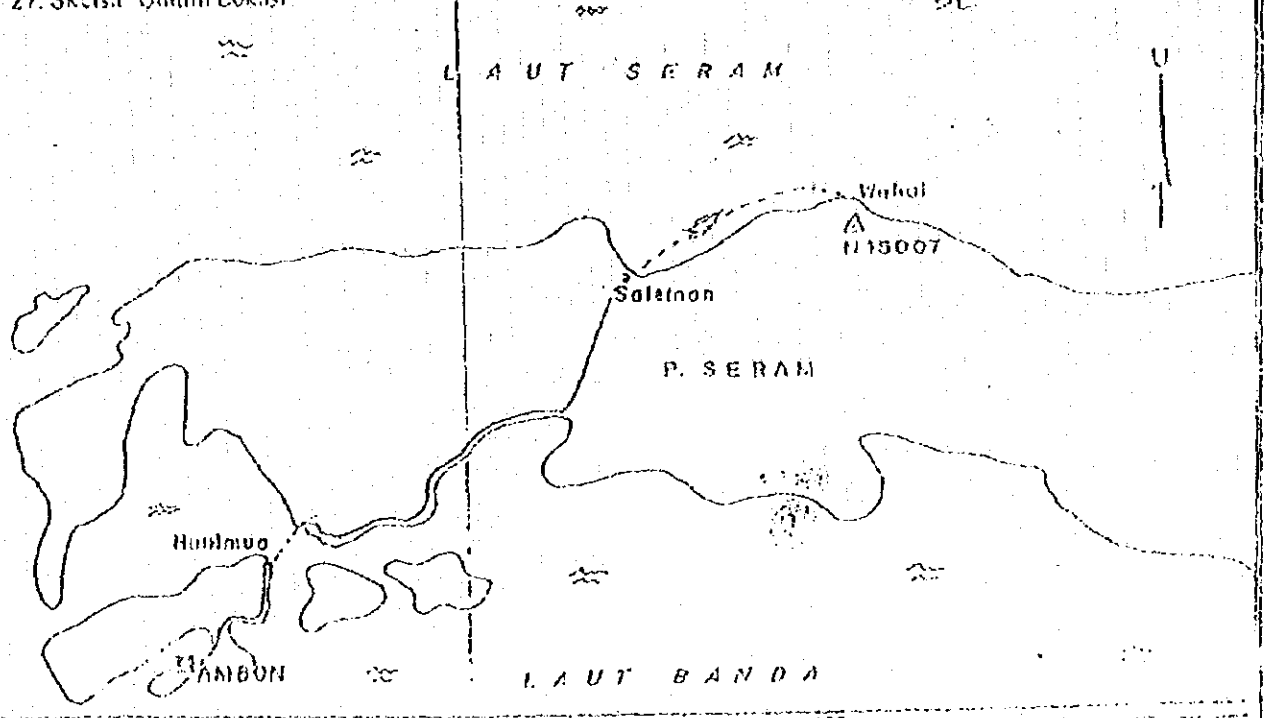
19. DIBUAT OLEH	: Heru O. & Abun P.	20. TANGGAL	: 07/21/95
21. DIPERIKSA OLEH	: C. Subarya M.Surv.Sc.		

BADAN KOORDINASI SURVEY DAN PEMETAAN NASIONAL
(BAKOSURTANAL)
DESKRIPSI STASIUN GPS

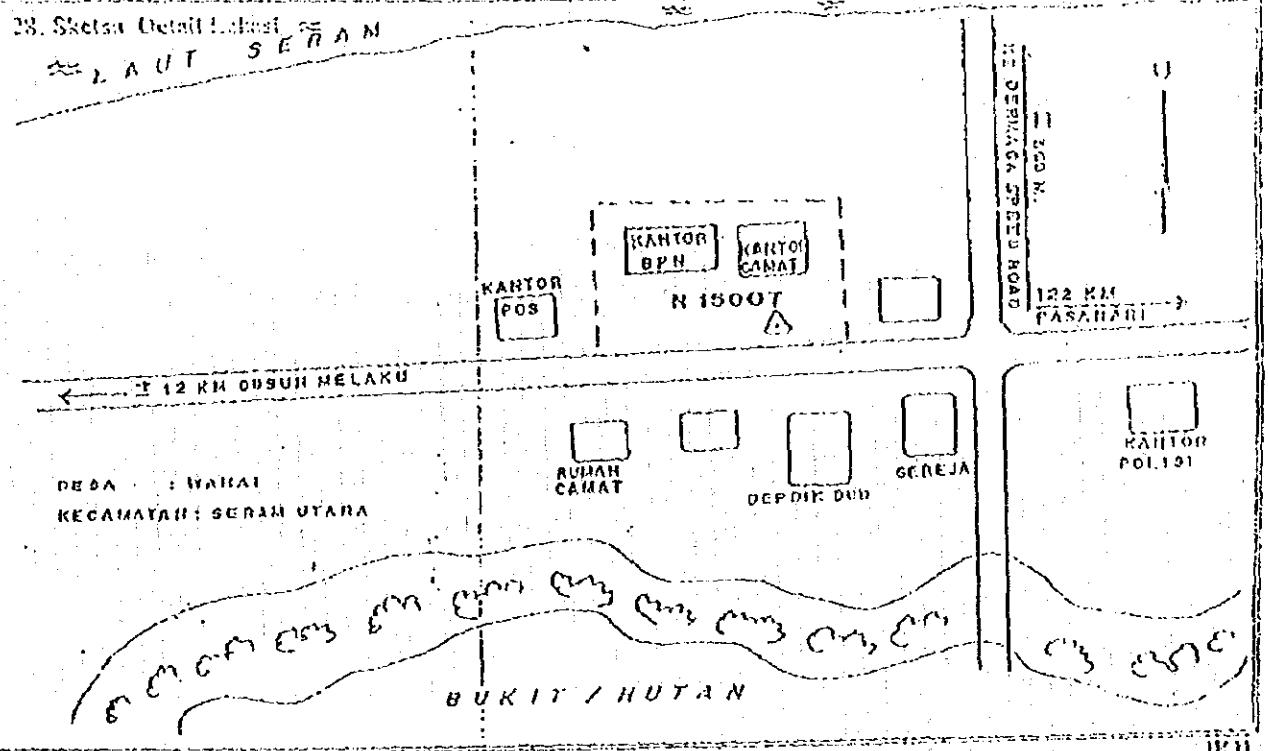
Halaman : 2
No. Stasiun : N 15007
Lembar Peta : 2713

SKETSA

27. Sketsa Umum Lokasi



28. Sketsa Detail Lokasi



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JKH

Appendix Q.2. Technical specifications

D. Technical Specifications
for
The Study on Flood Control for Ambon and Pasahari Areas in the Republic of Indonesia

1. Survey Areas

The survey areas covered by the Contract shall consist of the Ambon Central Area including five rivers and the Pasahari Area including two rivers in Seram Island. The location of each area is shown in Figure 1.

2. Scope of Work

(1) Work Items

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

- Mobilization
- Monumentation
- Distance Marks Setting
- Leveling
- Profiling
- Cross Sectioning
- Plotting
- Drawing
- Reporting

(2) General Specifications

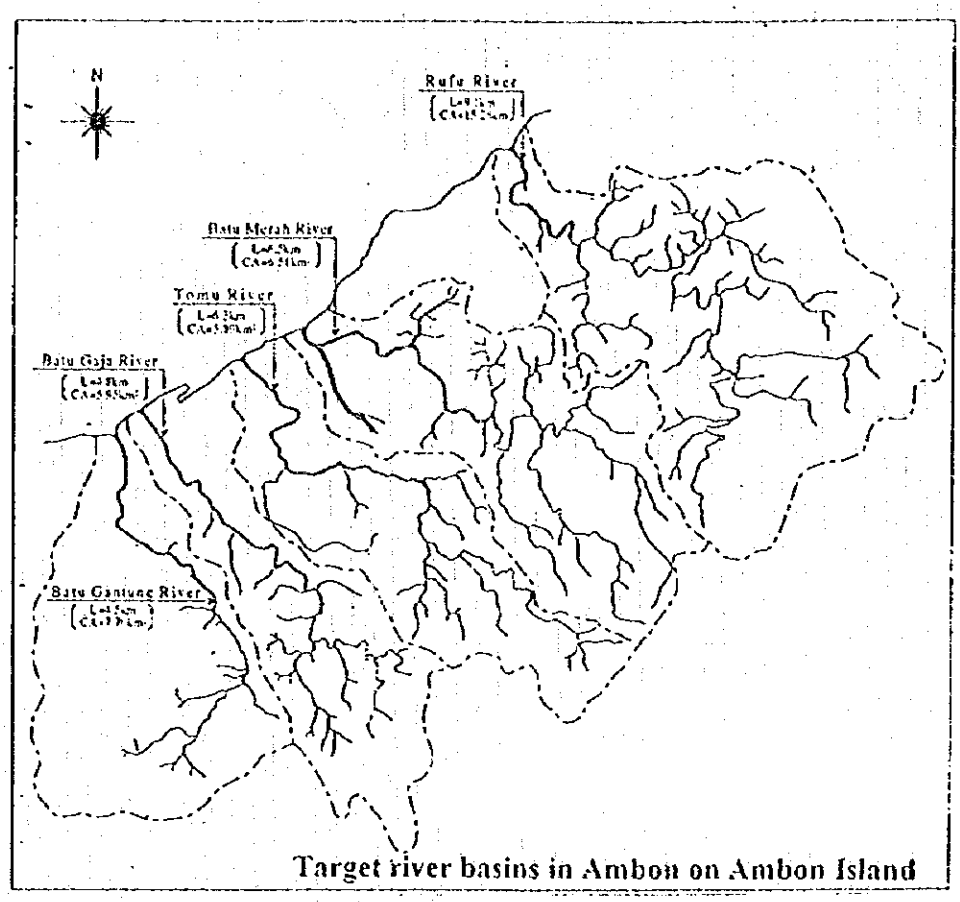
(2-1) JICA Standard

For the accuracy of the survey, "Specifications of Geodetic and Photogrammetric Surveying for Overseas (JICA) shall be applied with the instructions by the Engineer unless otherwise specified.

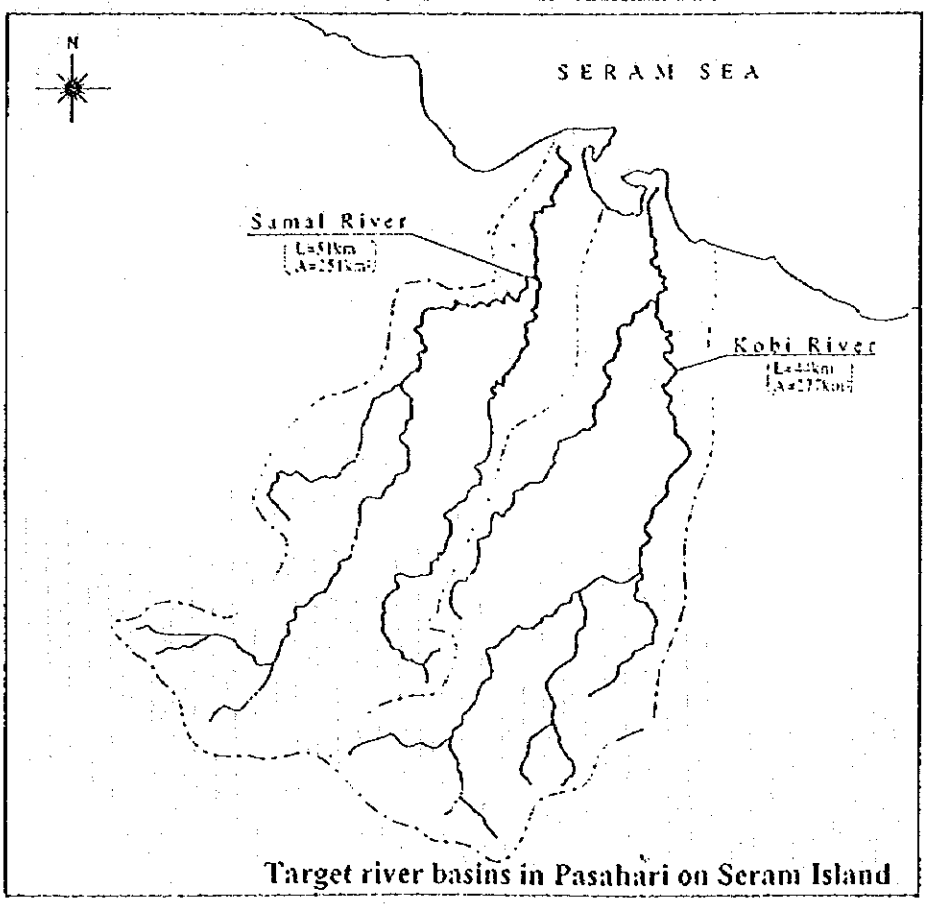
(2-2) Datum Elevation

The datum elevation shall be mean sea level(MSL) at Ambon sea port and Pasahari in Seram Island as 0m. This datum elevation shall connect the existing bench marks.

Figure 1 Survey Area for Profiling and Cross Sectioning



Target river basins in Ambon on Ambon Island



Target river basins in Pasahari on Seram Island

(2-3) 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. Methods of the Work

(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

(2) Monumentation

Forty (40) monuments of bench marks shall be marked with concrete piles. The size and features of the concrete piles are shown in Figure 2. The location of the monumentation shall be approximately 2 km intervals along the left banks of rivers selected on the existing maps and confirmed in the fields. The bench mark monuments can be used as distance marks.

(3) Distance Marks Setting

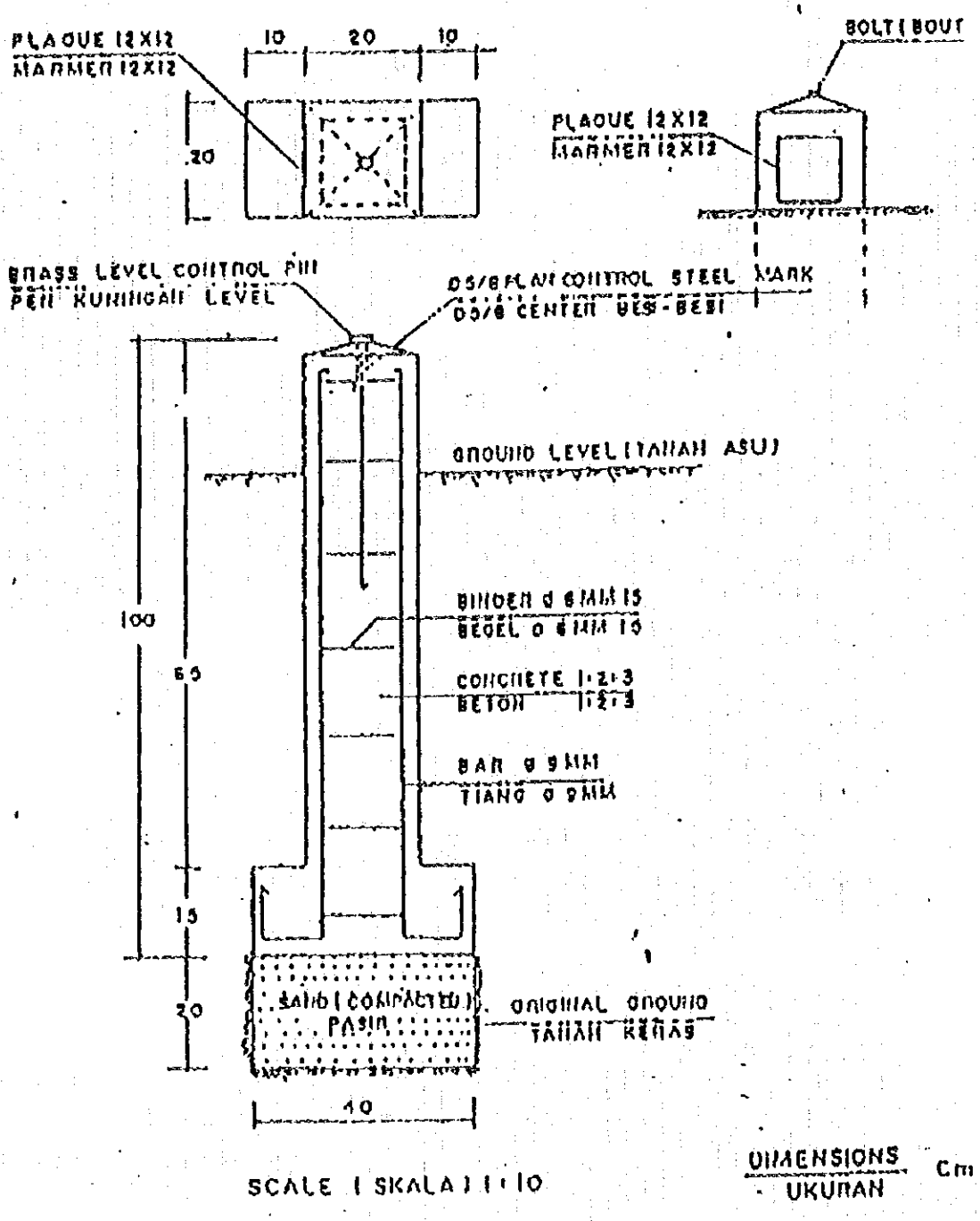
(3-1) Location

Distance marks with every 100m intervals along the rivers in Ambon area, and with 250m intervals along the rivers in Pasahari area shall be set out from their estuary or confluence on the right and left banks.

(3-2) Setting

Distance and angle measurement to set out the distance marks shall be carried out on the left banks of the rivers. The marks on the right banks will be staked out from the established marks on the left banks perpendicular to direction of water flow. These points shall be marked with concrete piles cast in plastic pipes 10cm diameter and 80cm long.

Figure 2 Specification of Bench Mark



(3-3) Equipment

Equipment to be used for the setting out shall be electro-optical distance meter (EDM) and/or measuring tapes and theodolite. Capacity of the equipment shall be as follows:

- EDM 1km measuring capacity
  10mm ± 5ppm x D D: measuring distance
- Theodolite 20 ` direct reading

(3-4) Accuracy

The accuracy of the setting out shall be within 1:2,000 of the measuring distance.

(4) Leveling

(4-1) Routes and Reference Points

Direct leveling shall be carried out to determine the elevation of the profiling and cross sectioning. Datum elevation for the leveling shall be derived from the existing MSL bench marks in and around the Study Areas. The routes of the leveling shall be loops along the right and left banks of the rivers. In case, there are no existing MSL bench marks in and around the Study areas, tidal observation for over one(1) month shall be carried out to provide the datum elevation for the leveling. The specifications of the tidal observation will be shown by the Engineer.

(4-2) Measurement

The direct leveling shall be started at and ended on the existing MSL bench marks in and around the Study areas. Double run or double stand methods shall be employed to check the accuracy of the observation. Every leveling route shall form a loop to check the accuracy of the leveling. Lines of sights shall not exceed 60m and length of back and fore sights shall be equalized.

(4-3) Equipment

Equipment to be used for the direct leveling shall be:

- Automatic levels : 40 second / 2mm second order level
- Metric staves : 3 or 5 m wooden or metal staff with base plates.

Before starting the observation, the equipment shall be tested and adjusted.

(4-4) Accuracy

Accuracy of direct leveling shall be within 30mm $\sqrt{S}$ misclosure in double run or in loop. Where, S is the length of leveling in kilometer.

(5) Profiling

(5-1) Profiling routes

Profiling routes shall be left and right banks of the rivers. Elevation of every distance mark previously set out and marked, its ground height and existing river structures shall be measured and recorded.

(5-2) Equipment

Equipment to be used for the profiling shall be equivalent to those used for the leveling.

(5-3) Accuracy

Accuracy of the profiling shall be equivalent to those stipulated for the leveling.

(6) Cross Sectioning

(6-1) Location

The cross sectioning shall be carried out every 50m intervals along the rivers in the Ambon area, and 500m intervals in the Pasahari area including the sounding of the rivers. The cross sectioning of the existing bridges shall also be carried out in the Ambon area. The areas and lines of the cross section will be shown by the Engineer to the Contractor. Survey length and number of section are shown in Table-1.

(6-2) Cross Sectioning and Sounding

Cross section lines shall be staked out from the distance marks on the left and right banks. Cross section lines in the proposed dam sites will be shown by the Engineer. Ground height every 2m intervals in the Ambon area and 10m in the Pasahari area, 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 shall be carried out every 2m intervals on the cross section lines. The cross sectioning shall be carried out 50m from the shore lines both the left and right banks. However, in city areas, cross section lines may be stopped at houses' walls, regardless of the stipulation above.

(6-3) Equipment

Equipment to be used for the cross sectioning shall be equivalent to those of the leveling. Equipment to be used for the sounding will be sounding rods and measuring tapes.

(6-4) 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.

(7) Plotting

(7-1) Plotting Profiles

Elevation and distance data acquired in the fields shall be plotted at scales of 1:5,000 or 1:10,000 for the length and 1:100 or 1:200 for the elevation depending on the features of the rivers. Scales of the plotting will be decided by the Engineer before the commencement of the plotting.

The profiles shall be plotted from estuary or confluence at the left, towards the upper stream to the right on the sheets. Profiling data and information such as station No., distance, accumulated distance, planned river bed height, planned high water, planned bank heights etc. shall be shown on the sheets. The sample sheet of the profiling will be shown by the Engineer before the commencement of the plotting. The plotting points will be digitized and stored in floppy disks to be submitted to the Engineer.

(7-2) Plotting Cross Section

Elevation and distance data acquired in the fields shall be plotted at scales of 1:100 or 1:200 depending on features of the rivers. The scales of the cross section shall basically be equivalent to the vertical scale of the profile. The scales of the cross section and sample sheet 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.

(7-3) Materials

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

(8) Drawing

(8-1) Drawing Profiles

Plotted profiles manuscripts shall be traced with black ink on the polyester bases to prepare original profiles. Marginal information such as scales, titles sheet number etc. shall also be drawn on the sheets. The drawing may be carried out directly from the digitized data with a computerized automatic plotter.

(8-2) Drawing Cross Sections

Plotted cross sections manuscripts shall be traced with black ink on the polyester bases to prepare original cross sections. Marginal information such as scales, titles, sheet number etc. shall also be drawn on the sheets. The drawing may be carried out directly from the digitized data with a computerized automatic plotter.

(8-3) Materials

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

(9) Report

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

1) Data and results of the Distance Marks setting out	1 set
2) Data and results of the Leveling	1 set
3) Data and results of the Profiling including the floppy disks	1set
4) Data and results of the Cross Sectioning including the floppy disks	1 set
5) Original Drawing of the Profiling	1 set
6) Original Drawing of the Cross Sectioning	1 set
7) Blue prints of the Drawing o the Profiling	5 sets
8) Blue prints of the Drawing of the Cross Sectioning	5 sets
9) Survey Report	5 sets

Table-1. Cross Section Survey

Area	River	Length(m)	No. of Section
Ambon City	Rufu	1,600	32
	Batu Merah	2,600	52
	Main river	1,600	32
	Tributary	1,000	20
	Tomu	2,900	58
	Batu Gaja	2,900	58
	Batu Gantung	2,000	40
	Total	12,000	240
Pasahari	Samal	19,000	38
(Seram Island)	Musi(tri.)	9,000	18
	Kobi	22,000	55
	Chinupa(tri.)	7,000	14
	Total	57,000	114
Ambon Bridges			15
Dam sites	Rubu		2
	Batu Merah		3
	Tomu		3
	Batu Gaja		3
	Batu Gantung		2
	Total		13

Cross Sectioning: 50m intervals in Ambon

500m intervals in Pasahari

Specifications on the Tidal Observation

1. Location

The tidal observation station shall be established one in Ambon sea port and one in Pasahari. The stations shall be located at points near the survey areas, free from disturbance by winds, waves, current and water from rivers.

2. Duration

Duration of the observation shall be 35days from the middle of November, 1996.

3. Equipment

Equipment to be used for the tidal observation shall be staffs and 2nd order levels.

4. Methods

A staff shall be fixed firmly and perpendicularly in the sea water. A bench mark shall be monumented at a place within 50 to 100m from the station. The vertical distance between the 0m 00 point of the fixed staff and the monumented bench mark shall be measured and recorded. (refer to Fig.1.)

Observation and reading of the elevation of water surface with the fixed staff shall be carried out every one(1) hour, 24hours a day for consecutive 35days.

5. Data processing

Acquired data shall be processed to obtain MSL as follows:

1. Mean highest sea level(MHL) = Σ highest sea level of each day / number of days
2. Mean lowest sea level(MLL) = Σ lowest sea level of each day / number of days
3. Mean sea level (MSL) = (MHL + MLL) / 2.

Fig. 1. Vertical distance between bench mark and tidal observation station