CHAPTER V

ECONOMIC EVALUATION

5.1. General.

The first objective of the present study is to find and propose an overall plan for the Overall Ular River Improvement Project that will include both flood control and improvement of irrigation (including drainage). In view of this objective, it was considered in commencing the present study that the Overall Project would be composed of such projects as sabo project, multipurpose-dam project, river-channel improvement project and irrigation (including drainage) improvement project.

In the course of the study, however, it was found that no sabo project is needed at present, no dam is needed for the purpose of supplying irrigation water because of abundance of river water, and dam plan for flood control falls behind channel-improvement plan in the cost, which led to only one project comprizing improvement of river-channel and irrigation as an overall plan for the Overall Project. For studying the priority order as the second objective of this study, it became unnecessary to take the above-mentioned several projects into consideration. It was decided therefore to compare the profitableness of a flood-control project by river-channel improvement alone, a project of irrigation improvement alone, and a project comprizing both flood-control by river-channel improvement and improvement of irrigation. For convenience sake, the above-mentioned three cases shall be called (1) flood control project, (2) irrigation project and (3) combined project respectively.

Economic evaluation of the three projects was made by comparing economic costs with economic benefits excluding such transfer costs as income tax, sales tax, corporation tax and import and export duties. Costs of the flood control project will consist of construction and maintenance costs, while those of the irrigation project will consist of replacement cost besides the above two.

Benefits that will arise from the flood control are effect of decrease in damages to be caused by floods mentioned in Section 3.9 of Chapter III in case of "with flood control project". Besides, the flood control project will have such effects as decrease in disease due to improvement of environment, regional development effect and other impact effects. These effects, however, were excepted from calculation of benefits in this project because they are difficult to measure in monetary term. On the other hand, benefits of irrigation project are given as a difference between two productions of paddy "with and without the project". In case of irrigation project without flood control, however, benefits must be given by deducting the

damages due to floods from the irrigation benefits mentioned above. The damages must include, in addition to direct damages to paddy due to inundation caused by floods, damages to the irrigation facilities and decrease in production of paddy which will arise therefrom.

In making the economic analysis, it was assumed that the implementation of the project will be commenced at the beginning of the fiscal year 1978/79 as a base year, completed at the end of the fiscal year 1982/83 and have an economic life of 50 years after completion.

5.2. Economic Costs.

Assuming that the domestic currency portion of the project cost estimated in Chapter III and IV includes tax of 5 percent, the economic construction costs were counted and are shown in Table 5-1.

Table 5-1 Economic Construction Costs

Unit: Million Rp.

Discharge (m^3/s)	Project		
	Flood control	Irrigation	Total
600	2,580	4,269	6,849
800	3,087	4,269	7,356
1,000	4,023	4,269	8,292
1,200	5,112	4,269	9,381

Annual operation and maintenance costs (hereinafter called the "OM costs") for the flood control project were assumed at 0.3 percent of the total construction costs. As for the irrigation project, the OM costs were estimated at about Rp.57 million per annum after deduction of tax, except 1981/82 and 1982/83 fiscal years. For these two years, the economic costs were estimated at about Rp.19 million and Rp.33 million respectively. Besides, it was assumed that the replacement costs of the irrigation facilities are invested as shown below:

Fisal year	Replacement cost (10^6 Rp.)/1
2010/11	43
2011/12	31
2012/13	51

/1: cost after deduction of tax.

5.3. Economic Benefits.

5.3.1. Benefits of Flood Control Project Without Irrigation Project.

Average annual damages caused by floods are given by using flood damages by discharges which were estimated in Section 3.9 of Chapter III. Benefits that will arise by executing the flood control project are given as effects of decrease in these damages. Table 5-2 shows average annual benefits by flood discharges with the flood control project and without the irrigation project.

Table 5-2 Average Annual Benefits of the Case with Flood Control and without Irrigation Improvement

Discharges (m^3/s)	Benefits (10^6 Rp.)
600	340
800	645
1,100	778
1,200	817

These benefits accrue from 1983/84 after completion of the construction. Besides, as for the benefits that will arise during the construction, it was assumed that they will be allocated in the ratio of the invested cost to the total construction cost as shown in Table 5-6-1 through 5-6-9.

5.3.2. Benefits of Irrigation Project.

Benefits of the irrigation project are given by deducting flood damages to irrigation facilities and paddy from the irrigation benefits which were estimated in Chapter IV. The damages to irrigation facilities and paddy to be deducted were estimated on the following condition.

(1) Damages to Canals and Intakes.

Based on the ratios of flood damages to canals in the past, the ratio of damages to new canals was assumed at 14 percent of the total length in the flooded area by flood discharges of 600, 800, 1,000 and 1,200 m^3/s, and as for intakes, the damages were assumed by flood discharges as below:

Flood discharge (m^3/s)	Number of damaged intakes	
	Entirely	Partially
600	0	0
800	2	4
1,000	3	6
1,200	3	6

(2) Decrease in Production of Paddy due to Damages to Canals and Intakes.

To estimate the decrease in production of paddy, assumptions were made as follows.

a. Owing to damages to canals, paddy fields irrigated thereby will return to rain-fed fileds for one year.

b. Owing to damages to intakes, paddy fields irrigated thereby will return to rain-fed fields for three years and be rehabilitated in equal parts for three years.

c. Influenced area will be 3,100 ha in case of flood discharge of 600 m^3/s and 18,500 ha in case of flood discharges of 800, 1,000 and 1,200 m^3/s.

Besides, direct damage to paddy due to flood will be deducted from the benefits of the irrigation project. The results are summarized in Table 5-3.

Table 5-3 Amount to be Deducted from Benefits of the Irrigation Project in the Case Without the Flood Control Project

Unit: Million Rp.

	Flood discharge (m^3/s)			
	600	800	1,000	1,200
(a) Damages to canals	8	44	60	68
(b) Damages to intakes	0	92	137	137
(c) Decrease in paddy production	763	6,421	6,538	6,690
Total	771	6,557	6,735	6,895

Based on the values given in the above table, average annual flood damage was estimated at Rp.681 million in the case without the

Table 5-4 Annual Benefits of the Irrigation Project

(A) Without flood control project.

Unit: Million Rp.

Item	Fiscal year 1981 -82	1982 -83	1983 -84	1984 -85	1985 -86	1986 -87	1987 -88	1988 -89	1989/3 -90
(1)/1	109	157	675	1,043	1,396	1,760	2,125	2,371	2,478
(2)/2	33	91	188	285	382	480	577	641	681
(3) Project benefits	76	66	487	758	1,014	1,280	1,548	1,730	1,797

(B) With flood control project (Flood discharge: 600 m^3/S)

Unit: Million Rp.

(1)	109	157	675	1,043	1,396	1,760	2,125	2,371	2,478
(2)	27	73	152	230	309	387	466	518	550
(3) Project benefits	82	84	523	813	1,087	1,373	1,659	1,853	1,928

(C) With flood control project. (Flood discharge: 800 m^3/S)

Unit: Million Rp.

(1)	109	157	675	1,043	1,396	1,760	2,125	2,371	2,478
(2)	10	27	56	84	114	143	172	191	203
(3) Project benefits	99	130	619	959	1,282	1,617	1,953	2,180	2,275

(D) With flood control project. (Flood discharge: 1,000 m^3/S)

Unit: Million Rp.

(1)	109	157	675	1,043	1,396	1,760	2,125	2,371	2,478
(2)	3	7	14	22	29	37	44	49	52
(3) Project benefits	106	150	661	1,021	1,367	1,723	2,081	2,322	2,426

(E) With flood control project (Flood discharge: 1,200 m^3/S)

Unit: Million Rp.

(1)	109	157	675	1,043	1,396	1,760	2,125	2,371	2,478
(2)	1	2	4	6	8	10	12	13	14
(3) Project benefits	108	155	671	1,037	1,388	1,750	2,113	2,358	2,464

/1 : Irrigation benefits that were estimated in Chapter IV.

/2 : Flood damages to be deducted from irrigation benefits.

/3 : During the project life, the values of benefits for the years after 1989/90 are the same as in 1989/90.

flood control project. In the case with the flood control project, it was estimated at Rp.550 million in case of flood discharge of 600 m^3/s, Rp.203 million in case of 800 m^3/s, Rp. 52 million in case of 1,000 m^3/s, and Rp.14 million in case of 1,200 m^3/s. As for each year (1981/82-1988/89) before completion of the construction work, the annual flood damage was calculated taking the construction schedule of the irrigation project into consideration as shown in (2) of Table 5-4. Accordingly, annual benefits of the irrigation project are given as shown in (3) of Table 5-4.

5.3.3. Benefits of Combined Project.

In the case with both projects of flood control and irrigation improvement, the flood damages shown in Section 5.3.2 will disappear in case of floods less than the design discharge. In other words, the disappeared damages must be regarded as benefits of the flood control project. Therefore, the amounts should be added to the benefits of the project of flood control alone (see Table 5-5).

Table 5-5 Annual Benefits to Be Added to Benefits of the Project of Flood Control Alone in Case of the Combined Project

Unit: Million Rp.

River discharge (m^3/s)	Year								
	1981 -82	1982 -83	1983 -84	1984 -85	1985 -86	1986 -87	1987 -88	1988 -89	1989 -90
600	5	14	29	44	59	74	89	89	105
800	21	56	116	176	237	297	357	397	421
1,000	27	74	155	235	315	395	475	528	561
1,200	29	79	162	247	332	416	501	557	591

5.4. Cost-Benefit Analysis.

Tables 5-6-1 through 5-6-9 show the economic costs and benefits of separate and combined projects. Using them, benefit-cost ratio, net present value and internal rate of return were calculated with regard to the three cases of projects described in Section 5.1 and are shown in Table 5-7. As is evident from Table 5-7, in every case of the projects, the benefits exceed the costs when both are discounted at 12 percent. It means that all of the proposed projects are feasible economically. The internal rate of return exceeds 20 percent in both cases of the flood control project with river discharge of 800 m^3/s and the irrigation project, and the result further indicates that all of the combined projects surpass any of the separate projects in the economic evaluation made in monetary terms. Among the four combined projects, the projects with river discharge of 800 m^3/s and 1,000 m^3/s are the best with no significant difference between them in the values of IRR and B/C ratio.

Table 5-6-1 Economic Costs and Benefits
(Flood Control Project; 600 m^3/s)

Unit: Million Rp.

	Year	Costs		Benefits
		Construction costs	O.M. costs	
1	1978/79	71		
2	1979/80	232		
3	1980/81	827		
4	1981/82	761		147
5	1982/83	689		249
6	1983/84		8	340
7	1984/85		8	340
8	1985/86		8	340
9	1986/87		8	340
10	1987/88		8	340
11	1988/89		8	340
12	1989/90		8	340
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32	2009/10		8	340
33	2010/11		8	340
34	2011/12		8	340
35	2012/13		8	340
36	2013/14		8	340
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55	2032/33		8	340
Total		2,580	400	17,396

Table 5-6-2 Economic Costs and Benefits
(Flood Control Project; 800 m^3/s)

Unit: Million Rp.

	Year	Costs		Benefits
		Construction costs	O.M. costs	
1	1978/79	86		
2	1979/80	260		
3	1980/81	982		
4	1981/82	917		277
5	1982/83	842		469
6	1983/84		9	645
7	1984/85		9	645
8	1985/86		9	645
9	1986/87		9	645
10	1987/88		9	645
11	1988/89		9	645
12	1989/90		9	645
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32	2009/10		9	645
33	2010/11		9	645
34	2011/12		9	645
35	2012/13		9	645
36	2013/14		9	645
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55	2032/33		9	645
Total		3,087	450	32,996

able 5-6-3 Economic Costs and Benefits
(Flood Control Project; 1,000 m^3/s)

Unit: Million Rp.

	Year	Costs		Benefits
		Construction costs	O.M. costs	
1	1978/79	112		
2	1979/80	320		
3	1980/81	1,267		
4	1981/82	1,200		329
5	1982/83	1,124		561
6	1983/84		12	778
7	1984/85		12	778
8	1985/86		12	778
9	1986/87		12	778
10	1987/88		12	778
11	1988/89		12	778
12	1989/90		12	778
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32	2009/10		12	778
33	2010/11		12	778
34	2011/12		12	778
35	2012/13		12	778
36	2013/14		12	778
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55	2032/33		12	778
Total		4,023	600	39,790

Table 5-6-4 Economic Costs and Benefits
(Flood Control Project; 1,200 m^3/s)

Unit: Million Rp.

	Year	Costs		Benefit
		Construction costs	O.M. costs	
1	1978/79	142		
2	1979/80	390		
3	1980/81	1,713		
4	1981/82	1,473		359
5	1982/83	1,394		594
6	1983/84		15	817
7	1984/85		15	817
8	1985/86		15	817
9	1986/87		15	817
10	1987/88		15	817
11	1988/89		15	817
12	1989/90		15	817
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32	2009/10		15	817
33	2010/11		15	817
34	2011/12		15	817
35	2012/13		15	817
36	2013/14		15	817
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55	2032/33		15	817
Total		5,112	750	41,803

Table 5-6-5 Economic Costs and Benefits
(Irrigation Project)

Unit: Million Rp.

	Year	Costs		Benefits
		Construction costs	O.M. & Replacement costs	
1	1978/79	103		
2	1979/80	288		
3	1980/81	1,167		
4	1981/82	1,480	19	76
5	1982/83	1,231	33	66
6	1983/84		57	487
7	1984/85		57	758
8	1985/86		57	1,014
9	1986/87		57	1,280
10	1987/88		57	1,548
11	1988/89		57	1,730
12	1989/90		57	1,797
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32	2009/10		57	1,797
33	2010/11		100	1,797
34	2011/12		88	1,797
35	2012/13		108	1,797
36	2013/14		57	1,797
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55	2032/33		57	1,797
Total		4,269	3,027	86,027

Table 5-6-6 Economic Costs and Benefits
(Flood Control & Irrigation Project)

Discharge: 600 m^3/s Unit: Million Rp.

Year		Costs		Benefits
		Construction costs	O.M. & Replacement costs	
1	1978/79	174		
2	1979/80	520		
3	1980/81	1,994		
4	1981/82	2,241	19	233
5	1982/83	1,920	33	343
6	1983/84		65	892
7	1984/85		65	1,192
8	1985/86		65	1,486
9	1986/87		65	1,786
10	1987/88		65	2,088
11	1988/89		65	2,291
12	1989/90		65	2,373
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32	2009/10		65	2,373
33	2010/11		108	2,373
34	2011/12		96	2,373
35	2012/13		116	2,373
36	2013/14		65	2,373
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55	2032/33		65	2,373
Total		6,849	3,427	114,728

Table 5-6-7 Economic Costs and Benefits
(Flood Control & Irrigation Project)

Discharge: 800 m^3/s Unit: Million Rp.

Year		Costs		Benefits
		Construction costs	O.M. & Replacement costs	
1	1978/79	189		
2	1979/80	548		
3	1980/81	2,149		
4	1981/82	2,397	19	385
5	1982/83	2,073	33	640
6	1983/84		66	1,380
7	1984/85		66	1,780
8	1985/86		66	2,164
9	1986/87		66	2,559
10	1987/88		66	2,955
11	1988/89		66	3,222
12	1989/90		66	3,341
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32	2009/10		66	3,341
33	2010/11		109	3,341
34	2011/12		97	3,341
35	2012/13		117	3,341
36	2013/14		66	3,341
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55	2032/33		66	3,341
Total		7,356	3,477	162,089

Table 5-6-8 Economic Costs and Benefits
(Flood Control & Irrigation Project)

Discharge: 1,000 m^3/s Unit: Million Rp.

	Year	Costs		Benefits
		Construction costs	O.M. & Replacement costs	
1	1978/79	215		
2	1979/80	608		
3	1980/81	2,434		
4	1981/82	2,680	19	446
5	1982/83	2,355	33	764
6	1983/84		69	1,596
7	1984/85		69	2,034
8	1985/86		69	2,460
9	1986/87		69	2,896
10	1987/88		69	3,334
11	1988/89		69	3,628
12	1989/90		69	3,765
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32	2009/10		69	3,765
33	2010/11		112	3,765
34	2011/12		100	3,765
35	2012/13		120	3,765
36	2013/14		69	3,765
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55	2032/33		69	3,765
Total		8,292	3,627	182,818

Table 5-6-9 Economic Costs and Benefits
(Flood Control & Irrigation Project)

Discharge: 1,200 m^3/s Unit: Million Rp.

	Year	Costs		Benefits
		Construction costs	O.M. & Replacement costs	
1	1978/79	245		
2	1979/80	678		
3	1980/81	2,880		
4	1981/82	2,953	19	480
5	1982/83	2,625	33	807
6	1983/84		72	1,650
7	1984/85		72	2,102
8	1985/86		72	2,537
9	1986/87		72	2,984
10	1987/88		72	3,431
11	1988/89		72	3,732
12	1989/90		72	3,873
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32	2009/10		72	3,873
33	2010/11		115	3,873
34	2011/12		103	3,873
35	2012/13		123	3,873
36	2013/14		72	3,873
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55	2032/33		72	3,873
Total		9,381	3,777	188,135

Table 5-7 Results of Benefit-Cost Analysis

Kind of project	Discharge (m^3/s)	IRR/1 (%)	Benefit-cost ratio (B/C) 10%	12%	15%	Net present value (B-C) 10%	12%	15%
								$x10^6$Rp
Flood control	600	12.7	1.25	1.05	0.84	474	88	-251
	800	20.0	1.99	1.67	1.34	2,216	1,396	638
	1,000	18.5	1.84	1.55	1.24	2,453	1,480	586
	1,200	15.4	1.52	1.28	1.02	1,941	960	76
Irrigation		21.8	2.72	2.20	1.67	5,806	3,724	1,841
Flood control & irrigation	600	20.6	2.43	1.97	1.51	7,493	4,715	2,199
	800	26.0	3.25	2.65	2.03	12,641	8,557	4,799
	1,000	26.2	3.29	2.68	2.06	14,371	9,751	5,497
	1,200	24.6	3.01	2.45	1.88	14,213	9,495	5,165

/1 : Internal rate of return.

CHAPTER VI

PROPOSED OVERALL PLAN

In commencing the present study, it was expected that the Overall Project would be composed of such individual projects as sabo project, multipurpose dam project, river-channel improvement project and irrigation/drainage improvement project. With the progress of the study, however, it has become clear that no sabo work is needed at present, no dam is needed for the purpose of supplying irrigation water, and dam plan for flood control falls behind channel-improvement plan in the cost. Accordingly, it has become unnecessary to take the above-mentioned individual projects into consideration.

In stead of the above, it was decided to compare the profitableness of three kinds of projects; a flood-control project by river-channel improvement alone, a project of irrigation/drainage improvement alone, and a project comprizing both of flood control by channel improvement and irrigation/drainage improvement. The results of comparison by benefit-cost analysis are as mentioned in the previous chapter, which will lead to the following conclusion.

In the case of river-channel improvement project and in the case of combined project as well, the cases of 800 m^3/s or 1,000 m^3/s surpass the others, and the case of combined project with design discharge of 800 m^3/s or 1,000 m^3/s is superior to both of irrigation project and river-channel improvement project. Therefore this project must be planned as one project combined with both of river-channel improvement and irrigation/drainage improvement.

In the case of combined project, a project with design discharge of 800 m^3/s compares faborably with that of 1,000 m^3/s. As was studied in Section 3.4 of Chapter III, the return periods of 800 m^3/s and 1,000 m^3/s are 33 years and 133 years respectively. On the other hand, in Indonesia, the return period of 30 years is generally applied at present in planning flood control. In view of this practice as well, it is recommendable to adopt a discharge of 800 m^3/s as the design discharge for flood control.

The proposed overall plan for the Overall Ular River Improvement Project will thus be a combined project of river-channel improvement extending from the rivermouth to the distance-mark No.19 km with the design discharge of 800 m^3/s and irrigation/drainage improvement covering an area of 18,500 ha.

The construction works for river-channel improvement have been described in Section 3.5 together with explanations on the location of works shown in Fig.3-5-1, the proposed basic designs shown in Figs.3-5-6(1) and 3-5-9, and the construction schedule shown in Fig.3-5-10.

The plans for irrigation/drainage improvement have been described in Section 4.3 together with explanations on the location of works shown in Figs.4-10 and 4-11, the proposed irrigation/drainage improvement works shown in Table 4-23 and Table 4-24, and the construction schedule shown in Fig.4-12.

The construction costs of the above-mentioned flood control works and the irrigation/drainage improvement works are shown in Tables 3-5-2(2) and 4-27 respectively at the 1976-prices. Annual allotment of the construction costs required for both of flood control and irrigation/drainage improvement is shown in the following table in Rupiah as of 1976.

(Unit; Million Ripia)

	1978/79	79/80	80/81	81/82	82/83	Total
Flood control works	88	268	1,009	942	863	3,170
Irrigation and drainage	104	293	1,204	1,526	1,268	4,395
Total	192	561	2,212	2,468	2,131	7,565

APPENDICES

CONTENTS OF APPENDICES

APPENDIX H Summary of Discussion on Draft Final Study Report of Overall Ular River Improvement Project.

1. Letter of Submittal of Draft Final Study Report.
2. Notes of Meeting on Submission of Draft Final Study Report of Overall Ular River Improvement Project and First Draft of Scope of Work for Feasibility Study of Ular River Flood Control and Improvement of Irrigation Project.
3. Note of Meeting on Draft Final Study Report and Inception Report for Feasibility Study of Ular River Flood Control and Improvement of Irrigation Project.
4. Record of Meeting in Medan.

APPENDIX A

LIST OF BIBLIOGRAPHY AND DATA

All bibliography and data collected in Indonesia and in Japan and used in the present study are listed in this appendix.

RIVER PLANNING

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3.	The result of leveling in inundated area ..... 4 sheets	-ditto-
4.	Supplemental cross leveling of the river channel ..... 6 sections (2 k, 3 k, 7 k, 8 k, 9 k, 10 k)	-dotto-
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6.	Cross section on existing left dike ..... 7 sections (From -8.0 k)	-ditto-
7.	Cross section on existing right dike ..... 6 sections (From 11.5 k)	-ditto-
8.	Cross section on the bridge (Negeri Dolok) ..... 1 section	-ditto-
9.	Plan ..... 4 sheets	-ditto-
10.	Field notes ..... 8 volumes	-ditto-

APPENDIX B

DISCHARGE DURATION

(1972, 1973, 1974)

DISCHARGE DURATION : AT PULO-TAGOR STATION (1972)

	1	2	3	4	5	6	7	8	9	10	11	12		
1	52.90	50.20	45.90	44.70	69.00	51.50	40.70	32.40	37.20	78.60	49.60	60.40		
2	53.60	49.00	45.90	53.60	70.00	64.50	40.70	30.40	32.80	48.40	55.80	69.00		
3	52.20	53.60	45.90	50.20	56.50	52.20	40.70	29.80	38.10	51.50	48.40	60.00		
4	50.80	48.40	51.50	64.50	53.60	51.50	40.70	38.60	32.80	47.80	55.80	84.60		
5	50.80	48.40	55.10	52.20	49.00	50.20	40.70	29.20	33.80	55.10	49.00	88.90		
6	50.20	50.20	68.10	47.80	47.80	48.40	40.00	29.20	36.30	44.10	56.50	65.40		
7	50.80	52.20	49.60	46.50	46.50	46.50	40.00	29.20	33.50	43.00	62.90	70.90		
8	50.80	52.90	46.50	45.90	46.50	48.40	40.00	29.20	32.10	43.00	51.50	64.50		
9	49.60	52.20	46.50	45.30	49.60	48.40	40.70	29.20	39.00	74.70	52.90	61.20		
10	57.90	100.00	45.90	45.30	47.80	51.50	41.30	29.20	72.80	62.10	49.00	57.90		
11	50.20	51.50	45.90	51.50	79.60	53.60	40.00	26.80	47.80	47.80	103.00	63.70		
12	49.60	55.10	53.60	67.10	84.60	50.80	37.70	26.80	55.80	53.60	54.40	56.50		
13	49.60	72.80	52.90	66.20	52.90	52.20	38.10	28.00	52.90	50.20	51.50	55.80		
14	52.20	50.20	46.50	54.40	57.90	48.40	37.70	29.80	44.70	44.10	100.00	55.10		
15	49.60	49.00	49.60	46.50	51.50	45.90	37.70	31.00	42.40	43.60	60.00	57.90		
16	49.60	51.50	51.50	63.70	50.80	50.80	42.40	35.40	41.90	43.60	50.80	75.60		
17	48.40	47.80	47.10	64.50	49.00	49.60	39.00	35.40	40.70	43.60	49.00	63.70		
18	48.40	47.10	46.50	63.70	52.20	52.90	40.10	31.40	43.00	44.10	47.10	57.90		
19	52.90	48.40	45.90	49.00	79.60	66.20	37.70	29.80	52.90	43.00	63.70	72.80		
20	53.60	46.50	45.30	47.80	53.60	57.90	37.70	29.80	43.60	70.90	65.40	73.70		
21	48.40	50.20	44.10	50.80	60.40	47.80	34.50	30.40	49.60	48.40	123.00	62.90		
22	51.50	49.60	43.60	55.10	51.50	49.60	33.50	43.60	43.60	47.10	77.60	61.20		
23	83.60	46.50	45.90	49.00	50.20	47.80	34.20	32.40	45.90	49.00	60.40	56.50		
24	69.00	50.80	54.40	50.80	50.20	52.20	34.50	36.80	47.10	66.20	56.50	53.60		
25	55.80	48.40	45.30	47.10	50.80	49.60	34.50	34.50	45.30	57.20	55.80	52.90		
26	50.80	50.80	52.90	56.50	57.20	46.50	32.40	34.50	44.10	72.80	112.00	57.90		
27	50.20	47.10	49.60	60.40	52.20	45.30	32.40	37.20	43.00	52.20	60.00	57.20		
28	55.80	45.90	47.80	121.00	57.90	44.70	32.40	52.90	42.40	58.70	55.80	54.40		
29	55.80	46.50	47.10	86.70	55.10	44.70	32.40	34.50	50.20	62.10	86.70	57.90		
30	51.50		46.50	60.00	78.60	44.70	32.40	47.80	44.70	55.80	78.60	52.90		
31	60.00		45.30		55.80		32.80	37.20		69.00		52.20		
SUN.	1656.10	1512.80	1508.20	1707.80	1767.90	1514.30	1159.60	1032.40	1310.00	1671.30	1942.70	1930.10	18713.166	(Annual 1,600x $10^6 m^3$)
MEAN	54.423	52.165	48.652	56.927	57.029	50.477	37.406	33.303	43.667	53.913	64.757	62.261	51.1289	
MAX.	23 83.60	10 100.00	6 68.10	28 121.00	12 84.60	19 66.20	16 42.40	28 52.90	10 72.80	1 78.60	21 123.00	5 88.90	11 21 123.000	
MIN.	17 48.40	28 45.90	22 43.60	1 44.70	7 46.50	28 44.70	26 32.40	11 26.80	8 32.10	7 43.00	18 47.10	31 52.20	8 11 26.8000	
							MAX. 123.00					MIN. 26.80		

DISCHARGE DURATION : AT PULO-TAGOR STATION (1972)

	1			51			101			151			201			251			301			351		
1	123.00	11	21	62.10	10	10	54.40	11	12	51.50	10	3	49.00	5	17	46.50	5	8	40.70	7	2	31.00	8	15
2	121.00	4	28	62.10	10	29	54.40	12	28	51.50	11	8	49.00	10	23	46.50	6	7	40.70	7	2	30.40	8	2
3	112.00	11	26	61.20	12	9	53.60	1	2	51.50	11	13	49.00	11	5	46.50	6	25	40.70	7	4	30.40	8	21
4	103.00	11	11	61.20	12	22	53.60	1	20	50.80	1	4	49.00	11	10	45.90	2	28	40.70	7	5	29.80	8	3
5	100.00	2	10	60.40	4	27	53.60	2	3	50.80	1	5	49.00	11	17	45.90	3	1	40.70	7	9	29.80	8	14
6	100.00	11	14	60.40	5	21	53.60	3	12	50.80	1	7	48.40	1	17	45.90	3	2	40.70	9	17	29.80	8	19
7	88.90	12	5	60.40	11	23	53.60	4	2	50.80	1	8	48.40	1	18	45.90	3	3	40.10	7	18	29.80	8	20
8	86.70	4	29	60.40	12	1	53.60	5	4	50.80	1	26	48.40	1	21	45.90	3	10	40.00	7	6	29.20	8	5
9	86.70	11	29	60.00	1	31	53.60	5	20	50.80	2	24	48.40	2	4	45.90	3	11	40.00	7	7	29.20	8	6
10	84.60	5	12	60.00	4	30	53.60	6	11	50.80	2	26	48.40	2	5	45.90	3	19	40.00	7	8	29.20	8	7
11	84.60	12	4	60.00	11	15	53.60	10	12	50.80	4	21	48.40	2	19	45.90	3	23	40.00	7	11	29.20	8	8
12	83.60	1	23	60.00	11	27	53.60	12	24	50.80	4	24	48.40	2	25	45.90	4	8	39.00	7	17	29.20	8	9
13	79.60	5	11	60.00	12	3	52.90	1	1	50.80	5	16	48.40	6	6	45.90	6	15	39.00	9	9	29.20	8	10
14	79.60	5	19	58.70	10	28	52.90	1	19	50.80	5	25	48.40	6	8	45.90	9	23	38.60	8	4	28.00	8	13
15	78.60	5	30	57.90	1	10	52.90	2	8	50.80	6	12	48.40	6	9	45.30	3	20	38.10	7	13	26.80	8	11
16	78.60	10	1	57.90	5	14	52.90	3	13	50.80	6	16	48.40	6	14	45.30	3	25	38.10	9	3	26.80	8	12
17	78.60	11	30	57.90	5	28	52.90	3	26	50.80	11	16	48.40	10	2	45.30	3	31	37.70	7	12			
18	77.60	11	22	57.90	6	20	52.90	5	13	50.20	1	6	48.40	10	21	45.30	4	9	37.70	7	14			
19	75.60	12	16	57.90	12	10	52.90	6	18	50.20	1	11	48.40	11	3	45.30	4	10	37.70	7	15			
20	74.70	10	9	57.90	12	15	52.90	8	28	50.20	1	27	47.80	2	17	45.30	6	27	37.70	7	19			
21	73.70	12	20	57.90	12	18	52.90	9	13	50.20	2	1	47.80	3	28	45.30	9	25	37.70	7	20			
22	72.80	2	13	57.90	12	29	52.90	9	19	50.20	2	6	47.80	4	6	44.70	4	1	37.20	8	27			
23	72.80	9	10	57.20	5	26	52.90	11	9	50.20	2	14	47.80	4	20	44.70	6	28	37.20	8	31			
24	72.80	10	26	57.20	10	25	52.90	12	25	50.20	2	21	47.80	5	6	44.70	6	29	37.20	9	1			
25	72.80	12	19	57.20	12	27	52.90	12	26	50.20	4	3	47.80	5	10	44.70	6	30	36.80	8	24			
26	70.90	10	20	56.50	4	26	52.90	12	30	50.20	5	23	47.80	6	21	44.70	9	14	36.30	9	6			
27	70.90	12	7	56.50	5	3	52.20	1	3	50.20	5	24	47.80	6	23	44.70	9	30	35.40	8	16			
28	70.00	5	2	56.50	11	6	52.20	1	14	50.20	6	5	47.80	8	30	44.10	3	21	35.40	8	17			
29	69.00	1	24	56.50	11	24	52.20	2	7	50.20	9	29	47.80	9	11	44.10	9	26	34.50	7	21			
30	69.00	5	1	56.50	12	12	52.20	2	9	50.20	10	13	47.80	10	4	44.10	10	6	34.50	7	24			
31	69.00	10	31	56.50	12	23	52.20	4	5	49.60	1	9	47.80	10	11	44.10	10	14	34.50	7	25			
32	69.00	12	2	55.80	1	25	52.20	5	18	49.60	1	12	47.10	2	18	44.10	10	18	34.50	8	25			
33	68.10	3	6	55.80	1	28	52.20	5	27	49.60	1	13	47.10	2	27	43.60	3	22	34.50	8	26			
34	67.10	4	12	55.80	1	29	52.20	6	3	49.60	1	15	47.10	3	17	43.60	8	22	34.50	8	29			
35	66.20	4	13	55.80	5	31	52.20	6	13	49.60	1	16	47.10	3	29	43.60	9	20	34.20	7	23			
36	66.20	6	19	55.80	9	12	52.20	6	24	49.60	2	22	47.10	4	25	43.60	9	22	33.80	9	5			
37	66.20	10	24	55.80	10	30	52.20	10	27	49.60	3	7	47.10	9	24	43.60	10	15	33.50	7	22			
38	65.40	11	20	55.80	11	2	52.20	12	31	49.60	3	15	47.10	10	22	43.60	10	16	33.50	9	7			
39	65.40	12	6	55.80	11	4	51.50	1	22	49.60	3	27	47.10	11	18	43.60	10	17	32.80	7	31			
40	64.50	4	4	55.80	11	25	51.50	1	30	49.60	5	9	46.50	2	20	43.00	9	18	32.80	9	2			
41	64.50	4	17	55.80	11	28	51.50	2	11	49.60	6	17	46.50	2	23	43.00	9	27	32.80	9	4			
42	64.50	6	2	55.80	12	13	51.50	2	16	49.60	6	22	46.50	2	29	43.00	10	7	32.40	7	26			
43	64.50	12	8	55.10	2	12	51.50	3	4	49.60	6	25	46.50	3	8	43.00	10	8	32.40	7	27			
44	63.70	4	16	55.10	3	5	51.50	3	16	49.60	9	21	46.50	3	9	43.00	10	19	32.40	7	28			
45	63.70	4	18	55.10	4	22	51.50	4	11	49.60	11	1	46.50	3	14	42.40	7	16	32.40	7	29			
46	63.70	11	19	55.10	5	29	51.50	5	15	49.00	2	2	46.50	3	18	42.40	9	15	32.40	7	30			
47	63.70	12	11	55.10	10	5	51.50	5	22	49.00	2	15	46.50	3	30	42.40	9	28	32.40	8	1			
48	63.70	12	17	55.10	12	14	51.50	6	1	49.00	4	19	46.50	4	7	41.90	9	16	32.40	8	23			
49	62.90	11	7	54.40	3	24	51.50	6	4	49.00	4	23	46.50	4	15	41.30	7	10	32.10	9	8			
50	62.90	12	21	54.40	4	14	51.50	6	10	49.00	5	5	46.50	5	7	40.70	7	1	31.40	8	18			

DISCHARGE DURATION : AT PULO-TAGOR STATION (1973)

	1	2	3	4	5	6	7	8	9	10	11	12		
1	54.40	41.30	40.10	78.60	51.50	58.70	45.90	50.80	55.80	43.60	81.60	146.00		
2	52.90	41.30	39.00	62.10	49.60	63.70	44.70	52.20	45.30	53.60	75.60	70.00		
3	51.50	41.90	45.30	67.10	48.40	81.60	47.10	51.50	44.70	45.90	56.50	58.70		
4	107.00	41.30	49.00	53.60	50.20	83.60	44.70	50.20	55.80	50.80	53.60	54.40		
5	56.50	40.70	78.60	55.10	51.50	83.60	44.70	49.60	45.90	47.10	50.20	69.00		
6	97.90	40.70	43.00	65.40	49.60	99.20	44.70	45.90	43.60	44.10	49.60	76.60		
7	110.00	40.70	40.70	57.20	73.70	62.10	44.10	45.30	43.60	44.70	48.40	73.70		
8	58.70	40.00	40.10	55.80	52.90	69.00	55.10	49.00	48.40	43.00	53.60	96.70		
9	60.40	67.10	39.00	70.90	49.00	78.60	44.70	47.80	51.50	44.10	49.60	70.90		
10	52.90	52.20	50.20	60.00	46.50	55.80	43.60	44.10	50.20	48.40	62.10	100.00		
11	50.80	44.10	73.70	52.90	48.40	51.50	47.10	43.60	55.80	52.90	68.10	67.10		
12	49.60	40.00	44.70	50.80	45.90	52.20	47.80	43.60	68.10	49.60	57.20	65.40		
13	51.50	36.80	45.30	54.40	44.70	52.20	44.10	44.10	97.90	45.30	52.90	105.00		
14	50.80	38.10	43.00	50.20	45.90	49.00	44.10	47.10	62.10	46.50	54.40	63.70		
15	50.20	38.10	42.40	73.70	49.00	47.80	43.60	54.40	49.00	48.40	49.00	90.00		
16	55.80	37.70	41.30	55.10	47.10	47.10	43.60	47.10	48.40	52.20	47.10	135.00		
17	58.70	37.70	41.30	65.40	49.00	45.90	43.60	49.60	46.50	65.40	54.40	86.70		
18	75.60	50.20	41.30	52.90	51.50	45.90	43.60	46.50	44.70	56.50	50.20	70.90		
19	72.80	38.10	49.60	48.40	49.00	44.70	43.60	44.70	55.10	49.60	66.20	65.40		
20	60.00	35.90	44.10	48.40	49.60	47.80	43.60	43.60	50.80	68.10	70.90	118.00		
21	49.60	43.00	44.70	71.80	47.80	44.70	45.30	44.70	45.30	107.00	97.90	72.80		
22	48.60	37.70	44.70	60.00	52.90	45.90	52.90	43.60	61.20	85.60	79.60	79.60		
23	48.60	35.90	54.40	55.10	55.10	49.60	54.40	43.60	55.10	72.80	57.90	76.60		
24	47.10	35.00	45.30	49.00	57.20	47.10	63.70	43.60	54.40	81.60	52.90	79.60		
25	48.60	36.30	83.60	47.10	62.10	45.90	61.20	43.60	46.50	80.60	51.50	189.00		
26	65.40	36.30	78.60	55.80	55.80	50.20	50.80	43.60	45.30	86.70	52.20	129.00		
27	49.60	49.00	51.50	58.70	48.40	45.90	52.90	58.70	43.60	72.80	50.80	100.00		
28	41.30	43.60	69.00	63.70	47.80	44.70	49.60	44.10	43.60	61.20	55.10	88.90		
29	41.30		58.70	52.20	60.40	47.10	52.90	53.60	43.60	64.50	55.10	114.00		
30	64.50		62.10	55.10	55.80	49.60	54.40	49.60	43.60	77.60	56.50	70.90		
31	43.00		70.90		95.60		58.70	47.10		84.60		60.40		
SUM.	1825.60	1160.70	1595.20	1746.50	1641.90	1690.70	1500.80	1466.50	1545.40	1874.80	1760.70	2744.00	20552.766	(Annual 1,770x $10^6 m^3$)
MEAN	58.890	41.454	51.458	58.217	52.964	56.357	48.413	47.306	51.513	60.477	58.690	88.516	56.3089	
MAX.	7 110.00	9 67.10	25 83.60	1 78.60	31 95.60	6 99.20	24 63.70	27 58.70	13 97.90	21 107.00	21 97.90	25 189.00	12 25 189.000	
MIN.	28 41.30	24 35.00	2 39.00	25 47.10	13 44.70	19 44.70	10 43.60	11 43.60	6 43.60	8 43.00	16 47.10	4 54.40	2 24 35.000	
							MAX. 189.00					MIN. 35.00		

DISCHARGE DURATION : AT PULO-TAGOR STATION (1973)

	1		51		101		151		201		251		301		351	
1	189.00	12 25	72.80	12 21	58.70	6 1	52.90	5 8	49.60	6 23	47.10	8 31	44.10	8 10	40.00	2 12
2	146.00	12 1	71.80	4 21	58.70	7 31	52.90	5 22	49.60	6 30	47.10	10 5	44.10	8 13	39.00	3 2
3	135.00	12 16	70.90	3 31	58.70	8 27	52.90	7 22	49.60	7 28	47.10	11 16	44.10	8 28	39.00	3 9
4	129.00	12 26	70.90	4 9	58.70	12 3	52.90	7 27	49.60	8 5	46.50	5 10	44.10	10 6	38.10	2 14
5	118.00	12 20	70.90	11 20	57.90	11 23	52.90	7 29	49.60	8 17	46.50	8 18	44.10	10 9	38.10	2 15
6	114.00	12 29	70.90	12 9	57.20	4 7	52.90	10 11	49.60	8 30	46.50	9 17	43.60	2 28	38.10	2 19
7	110.00	1 7	70.90	12 18	57.20	5 24	52.90	11 13	49.60	10 12	46.50	9 25	43.60	7 10	37.70	2 16
8	107.00	1 4	70.90	12 30	57.20	11 12	52.90	11 24	49.60	10 19	46.50	10 14	43.60	7 15	37.70	2 17
9	107.00	10 21	70.00	12 2	56.50	1 5	52.20	2 10	49.60	11 6	45.90	5 12	43.60	7 16	37.70	2 22
10	105.00	12 13	69.00	3 28	56.50	10 18	52.20	4 29	49.60	11 9	45.90	5 14	43.60	7 17	36.80	2 13
11	100.00	12 10	69.00	6 8	56.50	11 3	52.20	6 12	49.00	2 27	45.90	6 17	43.60	7 18	36.30	2 25
12	100.00	12 27	69.00	12 5	56.50	11 30	52.20	6 13	49.00	3 4	45.90	6 18	43.60	7 19	36.30	2 26
13	99.20	6 6	68.10	9 12	55.80	1 16	52.20	8 2	49.00	4 24	45.90	6 22	43.60	7 20	35.90	2 20
14	97.90	1 6	68.10	10 20	55.80	4 8	52.20	10 16	49.00	5 9	45.90	6 25	43.60	8 11	35.90	2 23
15	97.90	9 13	68.10	11 11	55.80	4 26	52.20	11 26	49.00	5 15	45.90	6 27	43.60	8 12	35.00	2 24
16	97.90	11 21	67.10	2 9	55.80	5 26	51.50	1 3	49.00	5 17	45.90	7 1	43.60	8 20		
17	96.70	12 8	67.10	4 3	55.80	5 30	51.50	1 13	49.00	5 19	45.90	8 6	43.60	8 22		
18	96.50	5 31	67.10	12 11	55.80	6 10	51.50	3 27	49.00	6 14	45.90	9 5	43.60	8 23		
19	90.00	12 15	66.20	11 19	55.80	9 1	51.50	5 1	49.00	8 8	45.90	10 3	43.60	8 24		
20	88.90	12 28	65.40	1 26	55.80	9 4	51.50	5 5	49.00	9 15	45.30	3 3	43.60	8 24		
21	86.70	10 26	65.40	4 6	55.80	9 11	51.50	5 18	49.00	11 15	45.30	3 13	43.60	8 26		
22	86.70	12 17	65.40	4 17	55.10	4 5	51.50	6 11	48.60	1 22	45.30	3 24	43.60	9 6		
23	85.60	10 22	65.40	10 17	55.10	4 16	51.50	8 3	48.60	1 23	45.30	7 21	43.60	9 7		
24	84.60	10 31	65.40	12 12	55.10	4 23	51.50	9 9	48.60	1 25	45.30	8 7	43.60	9 27		
25	83.60	3 25	65.40	12 19	55.10	4 30	51.50	11 25	48.40	4 19	45.30	9 2	43.60	9 28		
26	83.60	6 4	64.50	1 30	55.10	5 23	50.80	1 11	48.40	4 20	45.30	9 21	43.60	9 29		
27	83.60	6 5	64.50	10 29	55.10	7 8	50.80	1 14	48.40	5 3	45.30	9 26	43.60	9 30		
28	81.60	6 3	63.70	4 28	55.10	9 19	50.80	4 12	48.40	5 11	45.30	10 13	43.60	10 1		
29	81.60	10 24	63.70	6 2	55.10	9 23	50.80	7 26	48.40	5 27	44.70	3 12	43.00	1 31		
30	81.60	11 1	63.70	7 24	55.10	11 28	50.80	8 1	48.40	9 8	44.70	3 21	43.00	2 21		
31	80.60	10 25	63.70	12 14	55.10	11 29	50.80	9 20	48.40	9 16	44.70	3 22	43.00	3 6		
32	79.60	11 22	62.10	3 30	54.40	1 1	50.80	10 4	48.40	10 10	44.70	5 13	43.00	3 14		
33	79.60	12 22	62.10	4 2	54.40	3 23	50.80	11 27	48.40	10 15	44.70	6 19	43.00	10 8		
34	79.60	12 24	62.10	5 25	54.40	4 13	50.20	1 15	48.40	11 7	44.70	6 21	42.40	3 15		
35	78.60	3 5	62.10	6 7	54.40	7 23	50.20	2 18	47.80	5 21	44.70	6 28	41.90	2 3		
36	78.60	3 26	62.10	9 14	54.40	7 30	50.20	3 10	47.80	5 28	44.70	7 2	41.30	1 28		
37	78.60	4 1	62.10	11 10	54.40	8 15	50.20	4 14	47.80	6 15	44.70	7 4	41.30	1 29		
38	78.60	6 9	61.20	7 25	54.40	9 24	50.20	5 4	47.80	6 20	44.70	7 5	41.30	2 1		
39	77.60	10 30	61.20	9 22	54.40	11 14	50.20	6 26	47.80	7 12	44.70	7 6	41.30	2 2		
40	76.60	12 6	61.20	10 28	54.40	11 17	50.20	8 4	47.80	8 9	44.70	7 9	41.30	2 4		
41	76.60	12 23	60.40	1 9	54.40	12 4	50.20	9 10	47.10	1 24	44.70	8 19	41.30	3 16		
42	75.60	1 18	60.40	5 29	53.60	4 4	50.20	11 5	47.10	4 25	44.70	8 21	41.30	3 17		
43	75.60	11 2	60.40	12 31	53.60	8 29	50.20	11 18	47.10	5 16	44.70	9 3	41.30	3 18		
44	73.70	3 11	60.00	1 20	53.60	10 2	49.60	1 12	47.10	6 16	44.70	9 18	40.70	2 5		
45	73.70	4 15	60.00	4 10	53.60	11 4	49.60	1 21	47.10	6 24	44.70	10 7	40.70	2 6		
46	73.70	5 7	60.00	4 22	53.60	11 8	49.60	1 27	47.10	6 29	44.10	2 11	40.70	2 7		
47	73.70	12 7	58.70	1 8	52.90	1 2	49.60	3 19	47.10	7 3	44.10	3 20	40.70	3 7		
48	72.80	1 19	58.70	1 17	52.90	1 10	49.60	5 2	47.10	7 11	44.10	7 7	40.10	3 1		
49	72.80	10 23	58.70	3 29	52.90	4 11	49.60	5 6	47.10	8 14	44.10	7 13	40.10	3 8		
50	72.80	10 27	58.70	4 27	52.90	4 18	49.60	5 20	47.10	8 16	44.10	7 14	40.00	2 8		

DISCHARGE DURATION : AT PULO-TAGOR STATION (1974)

	1	2	3	4	5	6	7	8	9	10	11	12		
1	92.30	48.40	53.60	43.60	48.40	50.80	42.40	55.10	50.20	91.20	54.40	60.40		
2	63.70	49.00	46.50	45.30	44.70	43.60	43.60	44.10	50.20	79.60	58.70	56.50		
3	65.40	49.60	45.30	50.80	44.10	52.20	41.90	67.10	51.50	130.00	60.00	54.40		
4	60.00	61.20	44.10	55.10	57.90	45.30	41.90	45.90	45.90	88.90	55.80	54.40		
5	62.90	54.40	43.00	58.70	45.30	44.70	39.00	44.70	58.70	68.10	53.60	72.80		
6	57.90	54.40	43.00	69.00	41.90	46.50	38.60	43.00	67.10	67.10	52.20	56.50		
7	57.90	49.60	49.60	47.10	47.10	44.70	38.60	42.40	60.00	60.40	54.40	51.50		
8	56.50	51.50	47.10	60.40	43.00	41.30	38.60	45.30	48.40	58.70	54.40	54.40		
9	55.10	129.00	62.90	45.90	42.40	41.90	38.60	57.20	76.60	58.70	52.90	71.80		
10	55.10	54.40	47.80	50.20	42.40	40.70	43.60	45.90	49.00	55.10	62.10			
11	55.10	68.10	62.10	44.70	47.10	40.70	40.10	44.70	62.10	56.50	56.50	43.60		
12	55.10	62.10	51.50	47.80	71.80	40.70	44.70	43.60	56.50	53.60	71.80	43.60		
13	60.00	60.00	45.30	47.10	49.60	40.70	56.50	44.70	53.60	52.90	78.60	43.60		
14	52.20	49.00	44.10	45.30	49.60	40.70	44.10	47.80	52.20	52.90	94.50	44.70		
15	51.50	97.90	47.10	49.00	53.60	39.00	42.40	48.40	72.80	53.60	68.10	43.60		
16	50.20	57.20	45.90	50.80	60.00	40.00	41.30	44.10	55.10	52.90	64.50	45.30		
17	49.60	49.00	45.30	45.30	69.00	40.00	55.80	43.60	54.40	52.90	70.00	44.70		
18	68.10	56.50	45.30	43.00	50.80	40.70	46.50	43.00	80.60	73.70	55.10	43.60		
19	49.00	70.90	45.90	45.30	46.50	40.10	52.20	41.90	68.10	54.40	52.20	43.60		
20	69.00	64.50	52.90	44.10	44.10	40.70	50.80	44.10	85.60	52.20	50.80	42.40		
21	56.50	55.10	45.30	42.40	44.10	40.10	64.50	49.60	72.80	52.90	52.20	46.50		
22	55.10	71.80	44.10	41.90	43.00	57.20	60.40	44.70	62.10	54.40	74.70	45.90		
23	51.50	56.50	43.60	49.60	50.20	57.20	57.20	46.50	57.20	50.80	68.10	45.90		
24	50.20	56.50	41.90	48.40	45.90	47.10	47.10	50.80	75.60	52.20	67.10	47.10		
25	60.40	69.00	40.70	44.70	44.10	57.90	44.70	47.80	66.20	52.90	57.20	44.70		
26	68.10	52.20	70.00	44.70	58.70	49.00	44.70	44.10	68.10	52.20	81.60	43.60		
27	64.50	47.80	54.40	44.70	44.10	44.10	43.00	44.10	57.20	50.80	62.90	43.00		
28	60.40	47.80	45.30	41.90	42.40	43.00	43.00	43.60	56.50	52.20	73.70	43.00		
29	50.80		41.90	55.10	46.50	54.40	44.10	47.80	172.00	56.50	62.10	45.30		
30	55.80		43.60	43.00	44.10	48.40	42.40	44.10	77.60	51.50	65.40	55.10		
31	50.20		43.00		42.40		50.80	43.60		52.20		44.10		
SUM.	1810.10	1693.40	1482.10	1444.90	1504.80	1353.40	1423.10	1443.30	1963.90	1892.00	1885.60	1522.10	19418.676	(Annual 1680x 10^6 m^3)
MEAN	54.390	60.479	47.810	48.163	48.542	45.113	45.906	46.558	65.463	61.032	62.853	49.100	53.2018	
MAX.	1 92.30	9 129.00	26 70.00	6 69.00	12 71.80	25 57.90	21 64.50	3 67.10	29 172.00	3 130.00	14 94.50	5 72.80	9 29 172.000	
MIN.	19 49.00	27 47.80	25 40.70	22 41.90	6 41.90	15 39.00	6 38.60	19 41.90	4 45.90	23 50.80	20 50.80	20 42.40	7 6 38.600	
							MAX. 172.00					MIN. 38.60		

DISCHARGE DURATION : AT PULO-TAGOR STATION (1974)

	1		51		101		151		201		251		301		351	
1	172.00	9 29	64.50	7 21	56.50	9 28	52.20	1 14	49.00	4 15	45.30	4 17	43.60	8 12	40.70	6 13
2	130.00	10 3	64.50	11 16	56.50	10 11	52.20	2 26	49.00	6 26	45.30	4 19	43.60	8 17	40.70	6 14
3	129.00	2 9	63.70	1 2	56.50	10 29	52.20	6 3	49.00	9 10	45.30	5 5	43.60	8 28	40.70	6 18
4	97.90	2 15	62.90	1 5	56.50	11 11	52.20	7 19	48.40	2 1	45.30	6 4	43.60	8 31	40.70	6 20
5	94.50	11 14	62.90	3 9	56.50	12 2	52.20	9 14	48.40	4 24	45.30	8 8	43.60	12 11	40.10	6 19
6	92.30	1 1	62.90	11 27	56.50	12 6	52.20	10 20	48.40	5 1	45.30	12 16	43.60	12 12	40.10	6 21
7	91.20	10 1	62.10	2 12	55.80	1 30	52.20	10 24	48.40	6 30	45.30	12 29	43.60	12 13	40.10	7 11
8	88.90	10 4	62.10	3 11	55.80	7 17	52.20	10 26	48.40	8 15	44.70	4 11	43.60	12 15	40.00	6 16
9	85.60	9 20	62.10	9 11	55.80	11 4	52.20	10 28	48.40	9 8	44.70	4 25	43.60	12 18	40.00	6 17
10	81.60	11 26	62.10	9 22	55.10	1 9	52.20	10 31	47.80	2 27	44.70	4 26	43.60	12 19	39.00	6 15
11	80.60	9 18	62.10	11 10	55.10	1 10	52.20	11 6	47.80	2 28	44.70	4 27	43.60	12 26	39.00	7 5
12	79.60	10 2	62.10	11 29	55.10	1 11	52.20	11 19	47.80	3 10	44.70	5 2	43.00	3 5	38.60	7 6
13	78.60	11 13	61.20	2 4	55.10	1 12	52.20	11 21	47.80	4 12	44.70	6 5	43.00	3 6	38.60	7 7
14	77.60	9 30	60.40	1 25	55.10	1 22	51.50	1 15	47.80	8 14	44.70	6 7	43.00	3 31	38.60	7 8
15	76.60	9 9	60.40	1 28	55.10	2 21	51.50	1 23	47.80	8 25	44.70	7 12	43.00	4 18	38.60	7 9
16	75.60	9 24	60.40	4 8	55.10	4 4	51.50	2 8	47.80	8 29	44.70	7 25	43.00	4 30		
17	74.70	11 22	60.40	7 22	55.10	4 29	51.50	3 12	47.10	3 8	44.70	7 26	43.00	5 8		
18	73.70	10 18	60.40	10 7	55.10	8 1	51.50	9 3	47.10	3 15	44.70	8 5	43.00	5 22		
19	73.70	11 28	60.40	12 1	55.10	9 16	51.50	10 30	47.10	4 7	44.70	8 11	43.00	6 28		
20	72.80	9 15	60.00	1 4	55.10	10 10	51.50	12 7	47.10	4 13	44.70	8 13	43.00	7 27		
21	72.80	9 21	60.00	1 13	55.10	11 18	50.80	1 29	47.10	5 7	44.70	8 22	43.00	7 28		
22	72.80	12 5	60.00	2 13	55.10	12 30	50.80	4 3	47.10	5 11	44.70	12 14	43.00	8 6		
23	71.80	2 22	60.00	5 16	54.40	2 5	50.80	4 16	47.10	6 24	44.70	12 17	43.00	8 18		
24	71.80	5 12	60.00	9 7	54.40	2 6	50.80	5 18	47.10	7 24	44.70	12 25	43.00	12 27		
25	71.80	11 12	60.00	11 3	54.40	2 10	50.80	6 1	47.10	12 24	44.10	3 4	43.00	12 28		
26	71.80	12 9	58.70	4 5	54.40	3 27	50.80	7 20	46.50	3 2	44.10	3 14	42.40	4 21		
27	70.90	2 19	58.70	5 26	54.40	6 29	50.80	7 31	46.50	5 19	44.10	3 22	42.40	5 9		
28	70.00	3 26	58.70	9 5	54.40	9 17	50.80	8 24	46.50	5 29	44.10	4 20	42.40	5 10		
29	70.00	11 17	58.70	10 8	54.40	10 19	50.80	10 23	46.50	6 6	44.10	5 3	42.40	5 28		
30	60.00	1 20	58.70	10 9	54.40	10 22	50.80	10 27	46.50	7 18	44.10	5 20	42.40	5 31		
31	69.00	2 25	58.70	11 2	54.40	11 1	50.80	11 20	46.50	8 23	44.10	5 21	42.40	7 1		
32	69.00	4 6	57.90	1 6	54.40	11 7	50.20	1 16	46.50	12 10	44.10	5 25	42.40	7 15		
33	69.00	5 17	57.90	1 7	54.40	11 8	50.20	1 24	46.50	12 21	44.10	5 27	42.40	7 30		
34	68.10	1 18	57.90	5 4	54.40	12 3	50.20	1 31	45.90	3 16	44.10	5 30	42.40	8 7		
35	68.10	1 26	57.90	6 25	54.40	12 4	50.20	4 10	45.90	3 19	44.10	6 27	42.40	12 20		
36	68.10	2 11	57.20	2 16	54.40	12 8	50.20	5 23	45.90	4 9	44.10	7 14	41.90	3 24		
37	68.10	9 19	57.20	6 22	53.60	3 1	50.20	9 1	45.90	5 24	44.10	7 29	41.90	3 29		
38	68.10	9 26	57.20	6 23	53.60	5 15	50.20	9 2	45.90	8 4	44.10	8 2	41.90	4 22		
39	68.10	10 5	57.20	7 23	53.60	9 13	49.60	1 17	45.90	8 10	44.10	8 16	41.90	4 28		
40	68.10	11 15	57.20	8 9	53.60	10 12	49.60	2 3	45.90	9 4	44.10	8 20	41.90	5 6		
41	68.10	11 23	57.20	9 23	53.60	10 15	49.60	2 7	45.90	12 22	44.10	8 26	41.90	6 9		
42	67.10	8 3	57.20	9 27	53.60	11 5	49.60	3 7	45.90	12 23	44.10	8 27	41.90	7 3		
43	67.10	9 6	57.20	11 25	52.90	3 20	49.60	4 23	45.30	3 3	44.10	8 30	41.90	7 4		
44	67.10	10 6	56.50	1 8	52.90	10 13	49.60	5 13	45.30	3 13	44.10	12 31	41.90	8 19		
45	67.10	11 24	56.50	1 21	52.90	10 14	49.60	5 14	45.30	3 17	43.60	3 23	41.30	6 8		
46	66.20	9 25	56.50	2 18	52.90	10 16	49.60	8 21	45.30	3 18	43.60	3 30	41.30	7 16		
47	65.40	1 3	56.50	2 23	52.90	10 17	49.00	1 19	45.30	3 21	43.60	4 1	40.70	3 25		
48	65.40	11 30	56.50	2 24	52.90	10 21	49.00	2 2	45.30	3 28	43.60	6 2	40.70	6 10		
49	64.50	1 27	56.50	7 13	52.90	10 25	49.00	2 14	45.30	4 2	43.60	7 2	40.70	6 11		
50	64.50	2 20	56.50	9 12	52.90	11 9	49.00	2 17	45.30	4 14	43.60	7 10	40.70	6 12		

APPENDIX C

CONTENTS

APPENDIX C

TERMS OF REFERENCE FOR OVERALL ULAR RIVER IMPROVEMENT PROJECT (INCLUDING FLOOD CONTROL, RECLAMATION OF DOWNSTREAM PLAIN AND POSSIBLE IRRIGATION PROJECT)

I. BACKGROUND INFORMATION.

1. General.

Indonesia is an archipelago composed of about 3,000 islands which are located between the Pacific Ocean and the Indonesian Ocean. It has an area of about 1.9 million km2 and population of about 130 million with growth rate of 2.4 to 2.5 % per annum.

Sumatra Island, the second biggest island in Indonesia, has an area of about 470,000 km^2, population of about 20 million and consists of 8 provinces.

Its climate is tropical, mean temperature is about 27° C varying between 26°C and 29° C according to location. The rainy season continues from September to January and the dry season from April to June.

This island has abundant mineral resources such as petroleun, bauxite and tin, and besides large potential resources of tropical agriculture such as forestry, plantation, rice and fishery.

North Sumatra Province itself has more than 200,000 ha plantation and 500,000 ha paddy field. The major production of this Province are palm-oil, rubber, tobacco followed by rice. The water resources in this Province are not developed yet, the lowland area still has poor drainage, river training and improvement has been done only for some rivers. Therefore flood damage still occurs annually resulting in decrease of production. The Ular river is one among those rivers.

2. General Aspect of the Ular River Basin.

The Ular river Basin stretches from Bukit Barisan near Toba Lake as its origin to the Strait of Malacca pouring into the sea at the southern part of Medan City, the capital of North Sumatra Province.

The catchment area is about 1,000 km^2 and the river length is about 115 km. According to river gradient, the river course is divided into 4 parts; mean gradient of 1/250 on the upstream stretch, 1/25 on the middle upstream, 1/150 on the middle downstream and 1/800 on the downstream. The tributaries run down with a steep slope from the plateau

in broom shape to Galang Barat, where the Buaya River meets the Karai River and forms the Ular River. Further it runs down to the north direction for about 30 km and finally flows into the Strait of Malacca.

40 % of the plateau area of this basin is still covered by forest, but the remaining area is natural devastation area. However the lower plain area is almost cultivated by plantation, rice field and other vegetation. The other area is occupied by people or forms swampy zone.

From the geological condition, the upstream area is formed by andestic or liparitic effusive rocks accompanied with pretaertiary sedimentary rock and the downstream plain area is composed of alluvium.

The present condition of hydrological measurement is as follows. Six recording rain-gage stations have been established spreading in the catchment area and 3 recording water-level gage stations have been set up respectively at a place near Serbajadi Bridge, Perbaungan highway bridge and at the estuary. Since 1972, the recording by those instruments are under the control of the Ular River Project.

The mean annual rainfall depth is about 2,300 mm showing greater depth in the flat land. The rainy season continues from September to January and the dry season continues from April to June. In the rainy season, squally rainfall continues every day raising the water level of the river gradually, and sometimes heavy rainfall visiting there causes flood.

The mean highest high water level of the sea is 2,732 m and the lowest is 0.808 m in 1969, where the zero of the datum level of tide is of Belawan Harbor. The bed material is almost constant along the river course from the river mouth to Serbajadi Bridge. The size is about 1 mm at 65% grain size.

3. Present Condition of Flood Control Scheme.

In 1971, a Technical Assistance was given by the Japanese Government for conducting a feasibility study on an urgent flood control plan for the Ular River. Flood discharge for the plan was estimated at 600 m^3/s based on the maximum carrying capacity of the existing bridges, a highway and a railway bridge, on the basis of the river-channel improvement together with strengthening by revetment.

The proposed urgent flood control works were specified as follows; excavation, dredging and regulation of low water channel, strengthening and improvement of dikes in selected places, setting back of dikes in critical sections, revetment work for protection of dikes and other structures at critical points and last but not least clearance of high water channel area from vegetation. All proposed works were located on the stretch upstream of the highway bridge up to Pulau Gambar.

Since 1973, the execution of the urgent flood control plan had been carried out under the Japanese Loan. The loan amounting to US$ 1,300,000 was used for the financing of consulting engineering services including detail design and supervision and for the purchase of construction equipment. At the present time, the progress of the works is about fifty persent time, the progress of the works is about fifty percent and the remaining works will be completed by the beginning of the next year.

The highway and railway bridges are also being reconstructed by the Directorate General of Nina Marga and the Railways State Company respectively.

II. OBJECTIVE.

The purpose of the service is to assist the Directorate General of Water Resources Development, Ministry of Public Works and Electric Power by conducting a study and investigation to provide an overall Ular River improvement project which includes flood control of the river, reclamation of downstream plain area, improvement of drainage system and possible improvement/extension of irrigated paddy field.

This overall plan prepared by Consultant will provide the Directorate General of Water Resources Development with Detailed project proposal suitable or submission to and appraisal by International Financing Agencies.

Therefore it is essential that this services will be provided by an experienced Engineering Consultant in river basin development plan project.

III. SCOPE OF SERVICES.

1. A detailed inventory of avaiable water supply at point of interest on the Ular River and analysis and interpretations of seasonal and annual variation as required in project study.

2. A detailed inventory of the available land affected by the Ular River for extension of irrigated paddy field, plantation and reclamation land considering that the purposed and selected area have to be free from flood damage and have suitable drainage system.

3. A detailed inventory of sediment load, both suspended load and bed load of stream in river course and its origin with present development and water use.

4. A detailed inventory of potential dam site or retarding area for regulation of flood together with estimated sediment which would be trapped by these structures.

5. Identification of land to be reclamed and for extension of irrigated rice field and determination of the method for development and utilization of those areas.

6. Identification of area having poor drainage and determination of need for improvement and drainage system to be used.

7. Optimum utilization studies of available water for irrigation, plantation water supply, flood control and other purposes. All water studies will include comparative studies for controlling, handling and operation.

8. Preliminary analysis of economic feasibility of those plans. Cost and benefit must be determined in sufficient detail to identify project having reasonable likelihood of being formed in economically feasible in more detailed study.

9. A review of estimated economic benefit of the plan including income of farmer and high yield arising from improvement of drainage, flood protection and other benefit from further development.

10. A recommendation for the establishment of flood forecasting system in this river basin, if necessary, to make a proposal for rearrangement or addition of the hydrological observation network.

11. One important aspect of the consultant task will also be the transfer of knowledge and experience to the counterpart in all fields related to the consultant task.

IV. TIME REQUIRED.

Number of man-months required for conducting engineering services is estimated at about 60 man-months for field office and home office services, and additional 4 man-months for training counterparts at the Consultant's home office.

The services are expected to be commenced at the middle of this year (1975) and be done approximately in one year. The first ten year will be used for field office services and the following two months for finalizing the services at the Consultant's home office during which some counterparts will join to the Consultant to participate in completion of the final report for training.

Reports to be submitted to the Director General of Water Resources Development for discussion are as follows.

1. Inception report in the second month.
2. Interim report in the sixth month.
3. Draft final report in the nineth month.

The final report must be submitted to the Director General of Water Resources Development at least two months after the end of home office services.

V. EXPERTISE.

Expertise required for the proposed services will include mainly the following.

1. River planning engineer, as team leader, should be civil engineer with high skill and experience in conducting study for planning of water resources development project, particularly in the basin development plan.

2. Flood control engineer should be a river engineer with hight experience in flood regulation system, flood design structure, hydraulic structure and design of river structure.

3. Irrigation and drainage engineer should be a civil engineer with experience in planning and designing of irrigation network and structural drainage network systems and reclamation.

4. Hydrologist should be an expert with experience in hydrological data collection and analysing, hydrological network and flood warning system and calculation of flood discharge for design.

5. Agriculturist should be an expert with experience in soil science, planning of cropping pattern, and establishment of agriculture production.

6. Economist should be an expert with experience in the cost and benefit calculation in the river basin development project or similar project.

7. Surveyor should be an expert with experience in the interpretation of photogrammetric map, leveling and other surveying work in irrigation and drainage area.

8. Geologist should be an expert with experience in geological interpretation for the proposed structures.

9. Specialist consultant should be an expert in river planning engineering and experienced in river basin development plan particuraly in flood control planning. He will be recruited if necessary.

VI. COST ESTIMATION.

The total cost estimate for the services is about US$1,000,000 which will consist of US$750,000 in foreign currency expected from

Technical Assistance and Rp. 100,000,000 in local currency provided by the Indonesian Government.

Foreign currency will be provided for:

1. Consulting engineering services.
2. Purchase of hydrological, surveying, soil test and drawing equipment.
3. Training of the counterparts in the Consultant's home office.

Rupiah currency will be provided for:

1. Field office and other facilities.
2. Counterparting cost.
3. Additional works for supporting the services.

VII. ASSIGNMENT SCHEDULE.

Expertise	1 2 3 4 5 6 7 8 9 10 11 12	Remarks
River Planning Eng. (Team Leader)	———————————————	12MM
Flood Con. Eng.	———————————————	11MM
Irrigation Eng.	———————————————	7MM
Hydrologist	————	5MM
Agriculturist	————————	5MM
Economist		6MM
Surveyor	———————————	6MM
Geologist	————————	4MM
Spec. Const.	———	4MM
Total:		60MM

APPENDIX D

CONTENTS

SUMMARY OF DISCUSSION

The Japanese Preliminary Survey Team and The Directorate of Rivers, Directorate General of Water Resources Development, Ministry of Public Works and Electric Power, exchanged views concerning the study for OVERALL ULAR RIVER IMPROVEMENT PROJECT on the 9th, 27th, and 29th of March 1976, and identified in respect to basic matters as written herewith:

1. Both sides principally agreed to conduct the next study based on the draft of Scope of Work attached herewith, and the Final Scope of Work will be determined later.

2. The term requested the Government of Indonesia to conduct the survey and collect the data and information listed in attached paper before the arrival of the main survey team.

3. The team was strongly requested by the Directorate of Rivers:

   * To conduct the feasibility study of the highest priority project as soon as identified in the overall plan study.
   * To take into consideration the establishment of model run-off basin in the study.
   * To take the aerophotograph and make photomap necessary for the project.
   * To consider the economic interrelation of the project with Asahan project and Medan industrial development.
   * To conduct all the survey and study until the compilation of the final draft report in Indonesia so as to make the transfer of knowledge more effective.

Attachments are as follows:

1. Draft Scope of Work on Overall Ular River Improvement Project in the Republic of Indonesia.

2. Itinerary of the Japanese Preliminary Survey Team.

3. Meetings.

4. Request of the Japanese Preliminary Survey Team for Overall Ular River Improvement Project.

5. List of Attendants.

Jakarta, March 29, 1976.

Yukito IMANAGA
Team Leader of the Japanese
Preliminary Survey Team on
OVERALL ULAR RIVER IMPROVEMENT
PROJECT.

Ir. Y. SUDARYOKO
Director of Rivers.

DRAFT SCOPE OF WORK
ON OVERALL ULAR RIVER IMPROVEMENT PROJECT
IN THE REPUBLIC OF INDONESIA

INTRODUCTION.

In response to the request made by the Government of Indonesia for technical cooperation in conducting the study for Overall Ular River Improvement Project, the Government of Japan agreed to offer the service of Japanese Expert Team for the study to be carried out in the project site and the transfer of knowledge to the Counterparts of the Indonesian Government c/q Directorate General of Water Resources Development, Ministry of Public Works and Electric Power in the course of the works and entrusted its implementation to the Japan International Cooperation Agency (JICA).

The present documents sets forth the scope of work in regard to the above mentioned works to be conducted in close cooperation with the Government of Indonesia.

I. Objective of the Study.

The objectives of the study are: to conduct survey and study in order to provide an Overall Plan of Ular River Improvement Project which include flood control of the river, reclamation of downstream plain area, improvement of drainage system, possible improvement, and extention of irrigated paddy field and to indicate sequence of priority of projects to be undertaken.

The Survey area is the Whole Ular River basin from Bukit Barisan near the lake Toba as its originate to the strait of Malacca.

II. Scope of Work.

The activities undertaken in the survey and study are divided into two main programs namely: Main works program, Transfer of knowledge program.

1. Main works program is specified as follows:

1.1. Surveying.

a. Terrestrial survey.
b. Aerophotographic survey.

1.2. Collection of relevant data and information.

a. Hydrology and hydraulics.
b. Meteorology.
c. Geology.
d. Agriculture and agro-economy.
e. Regional economy.
f. Topographic maps.
g. Others.

1.3. Estimation of hydrological and hydraulic quantities.

a. River water discharge.
b. Analysis of runoff mechanism and high water discharge.
c. Rainfall and evaporation.
d. Design year for irrigation planning.
e. Sediment and siltation.
f. Study on the hydrological observation network.

1.4. Geological survey.

a. Geological survey for necessary sites (dam, sabo works, etc.).

1.5. Soil investigation.

a. Surface soil survey for embankment.
b. Soil survey for irrigation area.

1.6. Construction material study.

a. Study on construction materials for embankment.
b. Study on availability of other construction materials.

1.7. Flood control study.

a. Survey and study of inundated area and flood damage.
b. Study on river channel improvement plan of Ular River.
c. Formulation of the basic layout of flood control structures (dam, retading area, etc.).
d. Optimum utilization studies of available water considering flood control, irrigation and other purpose.

1.8. Erosion and sand control study.

a. Study on land erosion around the catchment area.
b. Study on torrent condition.
c. Study on runoff sediment discharge.
d. Formulation of the basic layout erosion control facilities.

1.9. Irrigation study.

a. Study on the existing irrigation system and facilities.
b. Determination of irrigable area.
c. Determination of cropping pattern.
d. Estimation of irrigation water requirement.
e. Formulation of the basic layout for improvement and extension of irrigation system and facilities.

1.10. Drainage study.

a. Study on the existing drainage system and facilities.
b. Study on damage by inundation.
c. Study on reclamation of agricultural land.
d. Formulation of the basic layout of drainage canal system and basic design of the standard structure.

1.11. Economic analysis and evaluation.

a. Data collection of standard unit price for estimating the construction costs and benefits and their analysis.
b. Study on the value of general property, public facilities and agricultural products.
c. Estimation of construction costs and benefits of each project.
d. Economic evaluation of the project.

2. Transfer of knowledge program is as follows:

2.1. Training the counterparts of the Indonesian Government.

2.2. Transfer of knowledge and technical know-how to the Indonesian counterparts in the course of the main works.

III. Report.

1. Inception report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Inception Report (in English) at the beginning of the field survey.

2. Interim report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Interim Report (in English) within ... months after the commencement of the field survey. The Government of Indonesia will provide the JICA with its comments within ..... days after the receipt of the Interim Report.

3. Draft final report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Draft Final Report (in English) within ..... months after the receipt of the comments of the Interim Report. The Government of Indonesia will provide the JICA with its comments within ..... days after the receipt of the Draft Final Report.

4. Final report.

The JICA will prepare and submit to the Government of Indonesia 30 copies of Final Report within ..... days after the receipt of the comments on the Draft Final Report.

IV. Undertaking of the Government of the Republic of Indonesia.

For the purpose of the study, the Government of Indonesia will cooperate to the extent possible by:

1. Providing the study team with the data and information concerned for its use in connection with the study.

2. Carrying out such works as terrestrial survey, geological survey, material and soil test, hydrological observation.

3. Assuring the security of the Japanese team members to the extent possible.

4. Exempting from taxes and duties for machinery equipment and materials necessary for the study.

5. Assigning counterpart personnel (officials/engineers) to the team during the survey period.

6. Providing the Japanese study team with suitable office space and office equipment necessary for the study.

7. Making arrangements for accommodations and field office required for the study work, when necessary.

8. Providing the Japanese team members with medical services, when necessary.

9. Providing 7 vehicles with drivers (four wheel drives Jeep).

10. Allowing to take all data and materials concerned out of the Republic of Indonesia to Japan by the Japanese study team according to the security regulation.

11. Providing any other available facilities that may be required for the execution of the study.

V. Undertakings of the Government of Japan.

For the purpose of the study, the Government of Japan will assist to the extent possible:

1. Sending the Japanese expert team for about ..... months to conduct the survey and study mentioned in article I.

2. Transfering the knowledge to the counterparts of the Indonesia Government during the period of the study.

3. Arranging the equipment necessary for the efficient conduct of the study.

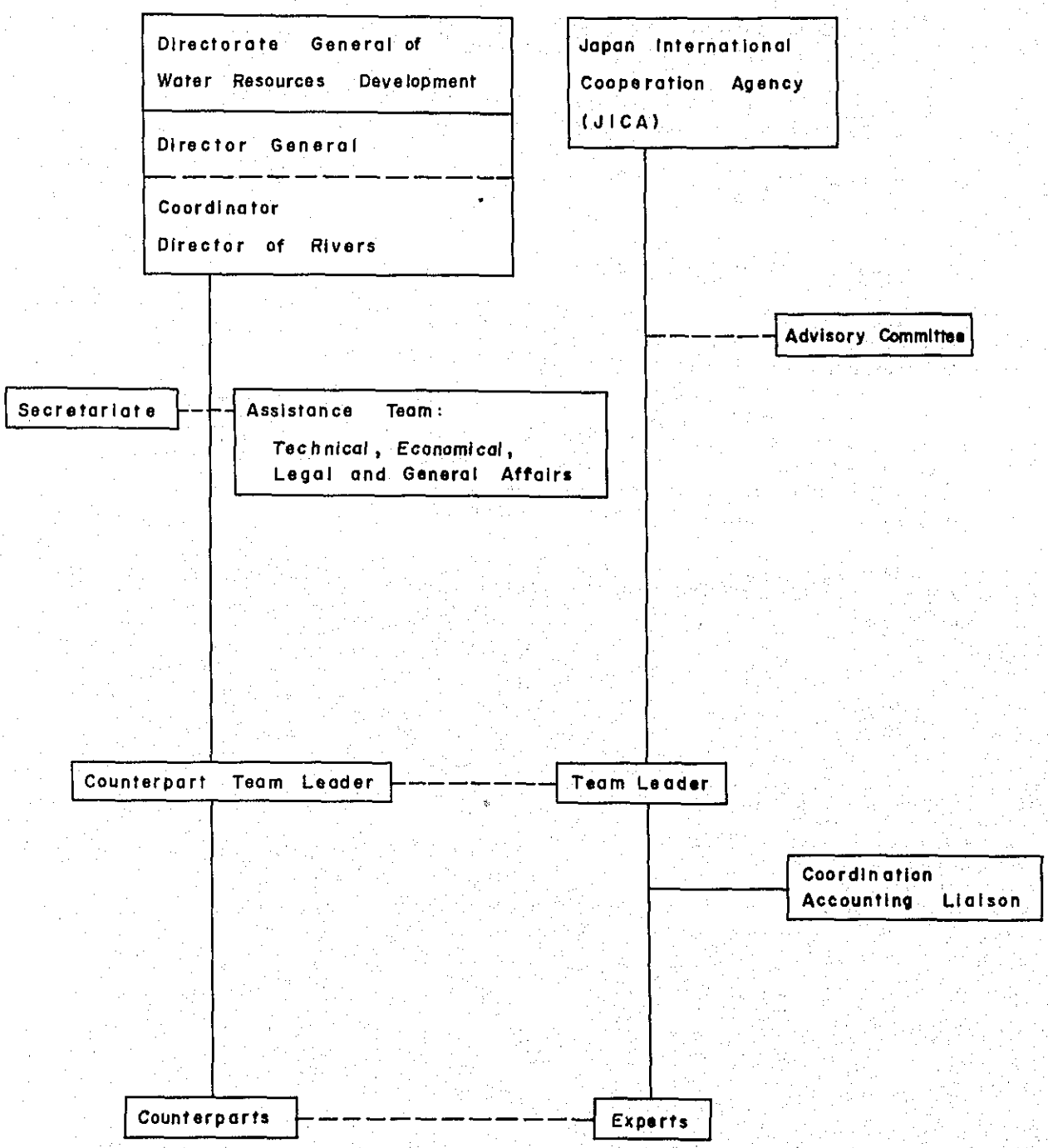
VI. Organization of the Project.

The Government of Japan and the Government of Indonesia, through their respective executive authorities shall jointly be responsible for the execution of the project described in Article II above.

The Government of Indonesia puts in charge for the implementation of the project the Director General of Water Resources Development, Ministry of Public Works and Electric Power as the Indonesian executive authority while the Government of Japan puts in charge the President of JICA at the Japanese executive authority.

For the execution of the survey and study, the Government of Japan and the Government of Indonesia will establish the organization as shown in Annex ...

Organization Chart



ITINERARY OF THE JAPANESE PRELIMINARY SURVEY TEAM

Date	Itinerary
7, March 1976 (SUN)	Tokyo ——————— Jakarta.
8, (MON)	Courtesy call to Japanese Embassy and JICA.
9, (TUS)	Meeting with D.P.U.T.L.
10, (WED)	Jakarta ——————— Medan.
11, (THU)	Courtesy call to Japanese Consulate in Medan. Meeting with Project Office.
12, (FRI)	Meeting and data collection in Project Office and Job site office.
13, (SAT)	Reconnaissance survey of the upper stream area
14, (SUN)	Ditto ——————— Medan.
15, (MON)	Survey on the basin by plane.
16, (TUS)	Survey on the retarding area. Hearing and data collection in BAPEDA, Dinas Pertanian.
17, (WED)	Survey of the upper reach of Buaya River on dam site. Survey on existing intakes.
18, (THU)	Survey in the basin of Denai River. Field survey on irrigation. Data collection in Deli Serdang regional office and agricultural office.
19, (FRI)	Survey on down stream area, estuary condition, irrigation facilities and reclamation area.
20, (SAT)	Survey on the lower reach of Buaya River. Hearing of PNP condition from BKU and agricultural.

Date	Itinerary
20, March 1976 (SAT)	Extension Office. Survey on drainage condition.
21, (SUN)	Internal meeting.
22, (MON)	Survey on the basin by plane. Final meeting with the Project Office.
23, (TUS)	Medan (13.15)————Jakarta (15.15)
24, (WED)	Jakarta————Bandung.
25, (THU)	Report making and data collection in Bandung.
26, (FRI)	Bandung————Jakarta
27, (SAT)	Internal meeting (9.00 a.m.)
28, (SUN)	
29, (MON)	Final meeting with D.P.U.T.L.
30, (TUS)	Courtesy call to Japanese Embassy and JICA.
31, (WED)	Jakarta————Tokyo.

MEETINGS

Meeting held at Jakarta, Bandung and Medan.

1) Design Section, Directorate of Irrigation in Bandung DGWRD.
2) Directorate of Hydraulic Laboratory DGWRD.
3) Geological Survey Institute.
4) Directorate General of Water Resources Development.
5) Directorate of Rivers DGWRD.
6) B.K.U. in Medan.
7) Ular River Project Office in D.P.U.
8) Dinar Pertanian.
9) Planning Board of Regional Development.
10) Deli Serdang Region's Office.
11) Provincial Agriculture Extension Office.
12) Agricultural Department Office of Deli Serdang Region.

REQUEST OF THE JAPANESE PRELIMINARY SURVEY TEAM FOR OVERALL ULAR RIVER IMPROVEMENT PROJECT.

1. To make sure path and roads in the basin necessary for the investigation to be able to guide the team easily.

2. To reconnoitre the location of the eroded valley.

3. To inventory the existing irrigation and drainage system, irrigation and drainage area.

4. To collect data and information on the damage.
(inundation area, agricultural products reduction due to inundation and its total amount of damage).

5. To collect and compile the recent data on water level, water discharge and rainfall in the Ular River basin.

6. To carry out the profile and cross section survey interval 100 m from the estuary to the Serbajadi bridge.

7. To investigate and observe the amount of inflow water at the intakes (Timbang Deli, Perbaungan, Sumber Rejo intake).

8. To observe the water requirement in depth at the paddy field.

9. To observe the water discharge of existing main drainage canal (river).

10. To collect the questionnaires handed to B.K.U.

11. To collect the questionnaires handed to the secretary of Deli - Serdang Region's Office.

    As soon as the questionnaires are filled up, they should be collected by D.P.U. and sent to Japan (Mr. Maruta) immediately by air mail.

12. The team expected D.P.U. will carry out continuously more detailed property investigation including the amount of agricultural products in the Ular River basin.

13. To take the aerophotograph in scale of 1 : 25,000 covering the whole basin and make the photomap in scale of 1 : 10,000 with contour line.

LIST OF ATTENDANTS

Name of Partners	
I. Indonesian Side:	
1. Ir. Y. Sudaryoko.	Directorate of Rivers.
2. Ir. Sarbini.	- " -
3. Drs. P. Tambunan.	Directorate of Planning.
4. Drs. M. Attamimi.	- " -
5. Ir. Soekrisno Rammelan.	Directorate of Rivers.
6. Ir. Sunarto.	Directorate of Irrigation.
7. Ir. Sugito.	Bureau of Planning.
8. Ir. Soemarso.	Directorate of Rivers.
9. Ir. M. Yusuf Gayo.	- " -
10. Ir. Oloan P. Hutagalung.	- " -
11. Ir. B. Simanungkalit.	Ular River Project.
12. Ir. Dartawan.	- " -
13. Azis Boeking MSc.	Directorate of Planning.
14. Waluyo Sabarno.	Directorate of River.
15. Sutrisno BA.	- " -
16. Wardji BA.	- " -
17. Mr. T. Tomaru.	Embassy of Japan.
18. Mr. M. Nakahiro.	Colombo Plan Expert.
19. Mr. S. Nagao.	- " -
20. Mr. T. Hayashi.	- " -
21. Mr. M. Watanabe.	- " -
II. Japanese Side:	
1. Mr. Yukito Imanaga.	Expert Team.
2. Mr. Katsuji Komiyama.	- " -
3. Mr. Tetsuji Maruta.	- " -
4. Mr. Michinobu Tsunematsu.	- " -
5. Mr. Sikatsugu Muraoka.	- " -
6. Mr. Kiichiro Tanaka.	- " -
7. Mr. Yuji Okazaki.	- " -

APPENDIX E

CONTENTS

APPENDIX E

SCOPE OF WORK
ON OVERALL ULAR RIVER IMPROVEMENT PROJECT IN
THE REPUBLIC OF INDONESIA

INTRODUCTION.

In response to the request made by the Government of Indonesia for technical cooperation in conducting the study for the Overall Ular River Improvement Project, the Government of Japan agreed to offer the service of Japanese Expert Team for the study to be carried out in the project site and the transfer of knowledge to the Counterparts of the Indonesian Government c/q Directorate General of Water Resources Development, Ministry of Public Works and Electric Power in the course of the works and the Japan International Cooperation Agency (JICA) will conduct the study. The present document sets forth the scope of work in regard to the above-mentioned works to be conducted in close cooperation with the Government of Indonesia.

I. OBJECTIVE OF THE STUDY.

The objectives of the study are; to conduct survey and study in order to provide an Overall Plan of Ular River Improvement Project which includes flood control of the river, reclamation of downstream plain area, improvement of drainage system, and possible improvement and extension of irrigated paddy field and to indicate sequence of priority of projects to be undertaken. The survey area is the whole Ular River basin from Bukit Barisan near Lake Toba as its origin to the Strait of Malacca.

II. SCOPE OF WORK.

The activities undertaken in the survey and study are divided into two main programs, namely; Main-works program and Transfer of knowledge program.

1. Main works program is specified as follows:

1.1. Surveying.

a. Terrestrial survey.

b. Aerial photographic survey.

1.2. Collection of relevant data and information.

a. Hydrology and hydraulics.

b. Meteorology.

c. Geology.

d. Agriculture and agroeconomy.

e. Regional economy.

f. Topographic maps.

g. Others.

1.3. Estimation of hydrological and hydraulic quantities.

a. River water discharge.

b. Analysis of runoff mechanism and high-water discharge.

c. Rainfall and evaporation.

d. Design year for irrigation planning.

e. Sediment and siltation.

f. Study on the hydrological observation network.

1.4. Geological survey.

a. Geological survey for necessary sites (dam saboworks, etc.).

1.5. Soil investigation.

a. Surface soil survey for embankment.

b. Soil survey for irrigation area.

1.6. Construction material study.

a. Study on construction materials for embankment.

b. Study on availability of other construction materials.

1.7. Flood control study.

a. Survey and study of inundated area and flood damage.

b. Study on river channel improvement plan of the Ular River.

c. Formulation of the basic layout of flood control structures (dam, retarding area, etc.).

d. Optimum utilization studies of available water considering flood control, irrigation and other purposes.

1.8. Erosion and sand control study.

a. Study on land erosion over the catchment area.

b. Study on torrent condition.

c. Study on sediment discharge.

d. Formulation of the basic layout of erosion control.

1.9. Irrigation study.

a. Study on the existing irrigation system and facilities.

b. Determination of irrigable area.

c. Determination of cropping pattern.

d. Estimation of irrigation water requirement.

e. Formulation of the basic layout for improvement and extension of irrigation system and facilities.

1.10. Drainage study.

a. Study on existing drainage system and facilities.

b. Study on damage by inundation.

c. Study on reclamation of agricultural land.

d. Formulation of the basic layout of drainage canal system and basic design of the standard structure.

1.11. Economic analysis and evaluation.

a. Data collection of standard unit price for estimating the construction costs and benefits and their analysis.

b. Study on the value of general property, public facilities and agricultural products.

c. Estimation of construction costs and benefits of each project.

d. Economic evaluation of the project.

2. Transfer knowledge program is as follows;

2.1. On-the-job training of Indonesian counterparts.

2.2. Transfer of knowledge and technical know-how to the Indonesian counterparts in the course of the main works in Japan.

III. REPORT.

1. Inception report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Inception Report (in English) at the beginning of the field survey.

2. Interim report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Interim Report (in English) within 6 months after the commencement of the field survey. The Government of Indonesia will provide the JICA with its comments within 30 days after the receipt of the Interim Report.

3. Draft final report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Draft Final Report (in English) within 4 months after the receipt of the comments of the Interim Report. The Government of Indonesia will provide the JICA with its comments within 30 days after the receipt of the Draft Final Report.

4. Final report.

The JICA will prepare and submit to the Government of Indonesia 30 copies of Final Report within 60 days after the receipt of the comments on the Draft Final Report.

IV. UNDERTAKINGS OF THE GOVERNMENT OF THE REPUBLIC OF INDONESIA.

For the purpose of the study, the Government of Indonesia will cooperate to the possible extent by:

1. Providing the team with the necessary facilities for taking aerial photographs.

2. Providing the team with the data and information concerned for its use in connection with the study.

3. Carrying out such works as terrestrial survey, geological survey, material and soil test, hydrological observation.

4. Assuring the security of the team to the possible extent.

5. Exempting from taxes and duties for machinery equipment and materials necessary for the study.

6. Assigning counterpart personnel (officials/engineers) to the team during the study period.

7. Providing the team with suitable office space and office equipment necessary for the study.

8. Making arrangements for accomodations and field office required for the study work, when necessary.

9. Providing 7 vehicles with drivers (four-wheel-drive Jeep).

10. Allowing to take all data and materials concerned including photofilms out of the Republic of Indonesia to Japan by the Japanese study team according to the security regulation.

11. Providing any other available facilities that may be required for the execution of the study.

V. UNDERTAKINGS OF THE GOVERNMENT OF JAPAN.

For the purpose of the study, the Government of Japan will assist to the possible extent by:

1. Taking aerial photographs and mapping, details are shown in ANNEX 1.

2. Sending the Japanese expert team to conduct the survey including ground control survey.

3. Transferring the knowledge to the Indonesian counterparts during the period of the study.

4. Arranging the equipment necessary for efficient conduct of the study.

VI. ORGANIZATION FOR THE STUDY.

The Government of Japan and the Government of Indonesia, through their respective executive authorities shall jointly responsible for the execution of the study.

The Government of Indonesia puts in charge for the implementation of the study the Director General of Water Resources Development, Ministry of Public Works and Electric Power as the Indonesian executive authority while the Government of Japan puts in charge the President of the JICA as the Japanese executive authority.

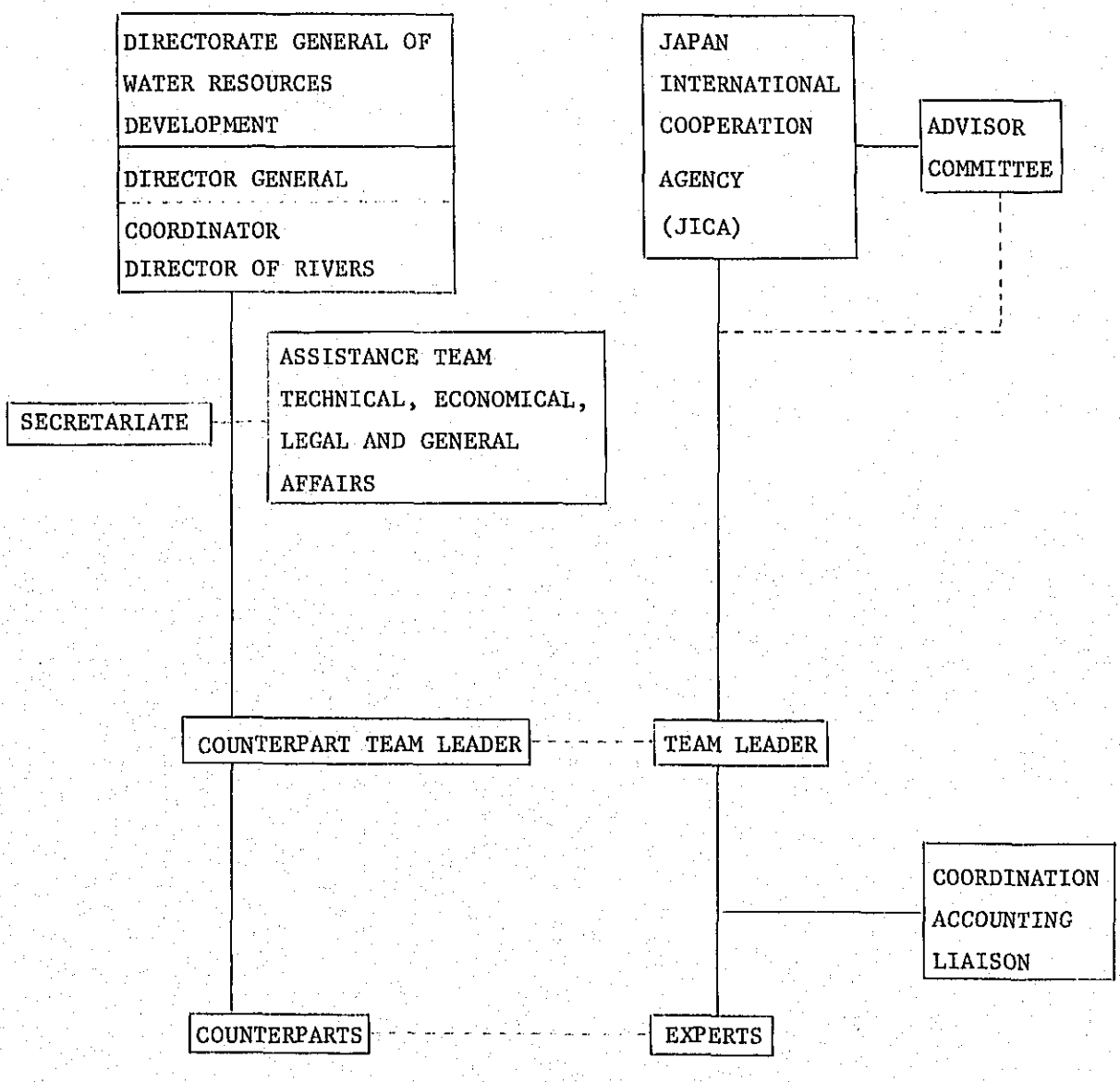
For the execution of the study, the Government of Japan and the Government of Indonesia will establish the organization as shown in ANNEX 2.

STUDY SCHEDULE

	1976									1977								
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1 Preparation in Japan	—																	
2 Aerophotograph taking and Ground control survey		—	—															
3 Map preparation in Japan			—	—														
4 Field survey in Indonesia				—	—	—												
5 Review, compilation and analysis of survey data in Japan						—	—	—										
6 Submission of the interim report									—									
7 Submission of the draft final report														—				
8 Submission of the final report																	—	

ANNEX 2

ORGANIZATION CHART



APPENDIX F

INCEPTION REPORT

ON

MASTER PLAN STUDY* FOR

OVERALL ULAR RIVER IMPROVEMENT PROJECT

(Submitted on November 5, 1976)

(* This was afterwards changed to OVERALL PLAN STUDY and hereinafter shall be read as "overall plan study".)

CONTENTS

Our ref. ULAR-MPS-76001 Jakarta, November 5, 1976.

Ir. Suyono Sosrodarsono

Director General of Water
Resources Development,
Ministry of Public Works
and Electric Power

Dear Sir:

INCEPTION REPORT OF MASTER PLAN STUDY
FOR OVERALL ULAR RIVER IMPROVEMENT PROJECT

We have the pleasure of submitting the Inception Report together with 20 (twenty) copies of it in accordance with Item 1, Chapter III of the Scope of Work which was approved by the letter 4321/Set.Kab/LN/P/9/1976 sent to Mr. Shigeru Tamesue, First Secretary, Embassy of Japan, Jakarta by Mr. Gempo Sujono, Head of the Bureau of International Cooperation, Cabinet Secretariate, the Government of Indonesia on September 6, 1976 after the Draft of Scope of Work had been sent to Mr. Gempo Sujono by Mr. Ken Uesugi, First Secretary, Embassy of Japan, Jakarta on July 29, 1976. The Draft Scope of Work was prepared based on the Summary of Discussion signed by Mr. Yukito Imanaga, Leader of the Japanese Preliminary Survey Team on the Project and Ir. Y. Sudaryoko, Director of Rivers on March 29, 1976 after the preliminary survey was conducted in March 1976.

After the Japanese Master Plan Study Team arrived at Jakarta on October 26, 1976 discussions were made in Jakarta and also in Medan on the Draft Inception Report which was prepared by the Study Team, and the Draft Inception Report was agreed by the Government of Indonesia with the Note of Understanding attached herewith.

The study has already been commenced with cooperation of the Indonesian Counterpart Team in accordance with the schedule described in the Inception Report.

We hope the study will be performed successfully on schedule.

Sincerely yours,

Dr. Seiichi Sato

Leader of the Japanese Master
Plan Study Team for the Overall
Ular River Improvement Project

REPUBLIC OF INDONESIA

MINISTRY OF PUBLIC WORKS AND ELECTRIC POWER

INCEPTION REPORT

ON

MASTER PLAN STUDY FOR OVERALL ULAR RIVER IMPROVEMENT PROJECT

OCTOBER 1976

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

This report has been prepared for carrying out the study of the master plan for the Overall Ular River Improvement Project in accordance with the Scope of Work which was submitted to the Government of Indonesia by the Japan International Cooperation Agency.

The Project aims at the implementation of the flood control works of the Ular River and, at the same time, the improvement works of the irrigation and drainage systems and extension works of irrigated paddy field which may be contemplated in relation to the flood control.

The objective of the present study is to formulate a master plan for the above-mentioned Project and to indicate the priority order of the individual projects to be included in the Master Plan. The study will be completed in two years of 1976 and 1977.

October 1976

Dr. Seiichi Sato

Leader of the Japanese Master Plan Study Team for the Overall Ular River Improvement Project

CONTENTS

(2) Planning of dam
(3) Study of retarding effect
(4) Planning of river channel
(5) Study of land erosion and sand control
(6) Planning of irrigation
(7) Planning of drainage
(8) Estimation of construction costs
(9) Estimation of benefits
(10) Economic evaluation

VI TRANSFER OF KNOWLEDGE

(1) Transfer of knowledge in the field
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VII. WORK SCHEDULE

VIII. ORGANIZATION FOR THE STUDY

IX. REPORTING

(1) Inception report
(2) Interim report
(3) Draft final report
(4) Final report

X. ARRANGEMENT OF THE EQUIPMENT FOR THE STUDY

XI. ARRANGEMENT BY THE GOVERNMENT OF INDONESIA

I. BACKGROUND OF THE STUDY.

The Ular River originates in the Bukit Barisan mountains, that is, the somma of Lake Toba runs almost to the north and pours into the Malacca Strait at a point about 30 km in the southeast of Medan, the capital of North Sumatra Province. The river has a catchment area of about 1,000 km^2 and a length of about 115 km. The hilly land of the upper basin is formed of andestic or liparitic effusive rocks accompanied with pre-tertiary sedimentary rocks. The downstream plain is composed of alluvium.

The river basin stretches over both Kabupaten of Deli/Serdang and Simalungun. The flat area surrounding the lower reaches has well-developed plantations of palmoil, rubber, tobacco, etc. and well-cultivated paddy field. This area is among the best agricultural production zones in Indonesia. Furthermore, the national railway and the national highway run through this area.

The climate of this area belongs to the tropical one, the mean annual rainfall is about 1,800 mm in the downstream area and that in the mountainous area is about twice as much as the former. Water level of the river usually continues to be high in the rainy season from September to January and high run-off discharges due to squally rainfall are frequently superposed on it. Almost in every rainy season, flooding has repeatedly occured due to breaches of the dikes, and caused great damages to farm land, the railway, the highway and other public facilities as well as inhibitants.

With the view to preventing these disasters emergently, a flood control project was planned over a stretch of 11 km upstream from the Perbaungan highway bridge in view of the fact that very frequent breaches of the dikes occured on this stretch. This project was started in 1971 as Ular River Urgent Flood Control Project with the aid of a loan from the Overseas Economic Cooperation Fund, Japan, estimating the temporary design discharge at 600 m^3/s. The emergency works were finished in March, 1976 and are producing the expected effect in their own way.

However, in view of the fact that the above-mentioned works are the emergent ones, the Government of Indonesia has intended to formulate a master plan which contains not only flood-control measures but also improvement and development of the irrigation and drainage in the downstream plain area, and requested to the Government of Japan to extend a technical aid in conducting the study for making the Overall Ular River Improvement Plan. In response to the request, the Japan International Cooperation Agency dispatched a Preliminary Study Team to Indonesia in March 1976, and it was decided to carry out the present study in cooperation with the Indonesian counterparting.

II. OBJECTIVE OF THE STUDY.

The present study aims at the formulation of a master plan for the Overall Ular River Improvement Project which will be composed of the flood control project in consideration of sand control and the irrigation project related to the former. The master plan will contain the following.

a. Plan for flood control in consideration of the regulation of flood discharge and sand efflux by means of dam and the improvement of river channel considering a retarding effect, if any.

b. Plan for improvement of irrigation and drainage.

c. Plan for extension of paddy field.

d. Study of possible exploitation of water utilization by dam.

Based on the master plan, the priority order of the individual projects shall be studied from the viewpoint of engineering and economy. The area for the study shall cover a region from the river-head to the rivermouth including the area to be affected by the flooding of the Ular River.

III. PLAN OF APPROACH.

The activities to be taken in the present study shall be divided into two parts: (1) main works for carrying out the study and (2) transfer of knowledge to the counterparts during the study.

1. Main works.

(1) General.

As a first step, some candidate plans for flood control will be formulated paying attention to the maximum discharge in the past and taking into consideration the construction costs of the flood control works. Next, a master plan for the Overall River Improvement Project which will consist of the flood control works and the related irrigation and drainage works will be formulated in consideration of benefit-cost evaluation. Finally, the priority order of the individual projects included in the master plan will be studied from the viewpoint of engineering as well as economy.

Those studies will be made both in the field and in the Study Team's Home Office on the basis of the aerial photographs to be newly taken on a scale of 1/25,000, the topographic maps covering an area of 100 km^2 including the confluence of the Denai and the Buaya and the cross-sectional and longitudinal profiles of the Ular River.

Those profiles will be prepared by the Government of Indonesia, and the photographs and the maps will be prepared by the JICA before the commencement of the present study.

(2) Collection of data.

The following data will be prepared by the JICA prior to the commencement of the study. Other necessary data will be collected in the field. All the data will be evaluated by the Study Team before using.

a. Data collected by the Preliminary Study Team.

b. Aerial photographs of the whole river basin which are taken on a scale of 1/25,000.

c. 1/10,000 topographic maps covering an area of 100 km^2 including the confluence of the Denai and the Buaya.

d. Results of the longitudinal leveling of the river and the leveling on the roads. The pegs set at intervals of 2 km for carrying out the leveling will be remained on the sites and the locations of them will be marked on the aerial photographs mentioned above.

e. Data on the relation between the tidal level and elevation of the bench marks included in the data mentioned in the above items c and d.

(3) Surveying and measurement.

Field surveying and measurement necessary for the study will be carried out by the Government of Indonesia and the arrangement of equipment will be made by the JICA as described in Chapter X. The study Team will work out the plans for the surveying and measurement.

(4) Flood control plan.

a. The basic point of location where the basic flood hydrograph is to be set for planning the flood control will be settled near the Serbajadi Bridge located approximately 35 km upstream from the rivermouth. Flood hydrographs at the basic point of location will be studied based on the existing data on hydrology.

b. The basic flood discharge will be allocated to dam and river channel in case that dam is effective for flood control and irrigation.

c. Dam, if effective, will primarily be planned in consideration of regulation of flood and checking or regulation of sand efflux, and based on this plan, exploitation of water to be utilized for irrigation will further be studied. For the purpose of regulation of flood, it will be most effective if the dam sites are located as much downstream as possible. Therefore, dam sites will be searched by giving priority to an area near the confluence of the Denai and the Buaya.

d. An area prospective for the retardation of flood will be searched in the field study and the effect will be studied if a candidate area has been found.

e. The improvement of the river channel will be planned within the range of stretch from the river mouth to near the Serbajadi Bridge.

(5) Irrigation and drainage plan.

Based on the established plan for flood control, related plans for improvement of irrigation and drainage and extension of paddy field will be formulated.

(6) Water requirement study.

Water requirement for irrigation will be studied. As for the other water utilization, potenciality of exploitation by dam will be studied.

(7) Benefits.

The benefits of the present project will be divided into two parts; benefits due to prevention of flood disaster and benefits due to related projects.

The former benefits are those which will be brought by the effect of flood-disaster prevention by means of one or combined works of dam, sand control and river channel improvement taking account of retardation of flood. The latter benefits are those which will be brought by the improvement of irrigation and drainage and the extension of paddy field on the basis of the implementation of flood control works.

(8) Economic evaluation.

Economic present costs and economic present benefits will be calculated for each alternative plan in order to compare the economic relative merits of them. The economic evaluation will be made on the basis of the study of the net present values, the benefit-cost ratios and the internal rates of return.

2. Transfer of knowledge.

Knowledge will be transfered to the Indonesian counterparts through the actual study work to be done in cooperation with both the teams in the Study Team's home office as well as in the field.

IV. STUDY IN THE FIELD.

(1) Reconnaissance.

Reconnaissance and hearing at site will be made as much as possible to grasp the actual circumstances.

(2) Collection of data.

Necessary data will be collected in Jakarta, Bogor and Bandung as well as in the field.

(3) Hydrologic measurement.

The following supplementary measurement will be carried out at need.

i) Measurement of discharge and suspended load.

ii) Sampling of bed materials and mechanical analysis of them.

iii) Surveying necessary for the above measurements.

(4) Survey of the past floods.

Survey will be conducted of the causes, the inundation depth and the damages due to the major floods in the past, and leveling at major points in the inundated area will also be carried out.

(5) Survey of the flood control facilities.

Survey will be conducted of the structure and location of the existing facilities for flood control.

(6) Field survey of suitable sites for dams.

In order to select suitable site for dams, general reconnaissance and geological survey will be carried out. If boring for selected dam sites is urgently required, the boring test will be carried out by the Government of Indonesia. For the selected dam sites, cross-section surveying will be conducted. Along with the selection of the dam sites, reconnaissance for borrow area avaiable for the construction will be carried out.

(7) Survey of water requirement for irrigation.

The survey of the existing conditions of cropping pattern, irrigation area and water management, and the measurements of existing canal discharge and plot water requirement in depth at the main parts will be carried out in order to assume the water requirement for irrigation.

(8) Field survey of retarding area.

There is an area which seems to have a retarding effect for flood discharge. Survey will be conducted of the topography, the river channel and the land utilization in this area.

(9) Field survey of land erosion.

Field inspection of land erosion will be conducted as far as possible with a view to grasping the topography, the covering of vegetation and the geology of the upper basin which is regarded as the source of supply of sand.

(10) Field survey for irrigation plan.

Survey will be conducted of the topography, climate, hydrology, irrigation system and soil in the project area in order to study the improvement of irrigation and the extension of paddy field. Leveling at major points will be carried out.

(11) Field survey for drainage plan.

Survey will be conducted of the existing drainage systems and facilities, and necessary data for planning will be collected.

(12) Field survey for benefit estimation.

Survey will be conducted of the population, the general economy, the general properties, the agricultural products, the public facilities, the traffic of highway and railway in the project area, and the damages due to floods.

(13) Field survey for the estimation of the construction costs.

Survey will be conducted of the unit costs of the individual construction works and necessary unit prices.

V. STUDY IN THE HOME OFFICE.

(1) Determination of the basic flood hydrograph and the allocation of discharge.

a. Run-off analysis.

The mechanism of run-off will be studied by use of the record at the recording rainfall gaging stations (about 6 stations) installed in the basin, the record at the recording gaging stations installed on the Ular River and the stage-discharge curves.

b. Study of the basic flood hydrograph and the allocation of discharge.

The flood hydrograph at the basic point for design will be studied based upon the record of the peak discharge and hydrograph observed at the point. Some flood hydrographs will be taken as the candidate basic flood hydrographs and the allocation of discharge

to dam and river channel will be studied for each flood hydrograph taking into consideration the construction costs of the flood control works.

(2) Planning of dam.

After the selection of dam site, a dam plan will be studied for the purpose of flood control and irrigation on the basis of the field study and rough reservoir operation.

(3) Study of retarding effect.

The retarding effect of the candicate area chosen by the aerial-photograph study and the field inspection will be studied within the framework of the river channel design.

(4) Planning of river channel.

The carrying capacity of the existing river channel will first be studied and then channel improvement plans will be worked out based on the discharge allocated to the channel.

(5) Study of land erosion and sand control.

Study will be made on the amount of sediment transportation at the upper end of the expected reservoir or at the point of Serbajadi Bridge.

(6) Planning of irrigation.

On the premise that the river improvement works are implemented, plans for the improvement of irrigation and the extension of paddy field will be studied together with a study of the future farm management system to be proposed.

(7) Planning of drainage.

Drainage plans in the project area will be studied based on the study of the existing drainage systems and facilities on the premise of the implementation of the river improvement works.

(8) Estimation of construction costs.

The construction costs and the maintenance costs will be estimated of the individual projects worked out by the studies mentioned above.

(9) Estimation of benefits.

The project benefits will be estimated based on the following.

a. Effect of reduction in flood damages due to the flood control works.

This will be estimated in consideration of damaged area, degree of inundation, and products and properties contained in that area.

b. Increase in agricultural products due to the improvement works of irrigation and drainage and the extension of paddy field.

c. Other benefits. Benefits other than those mentioned in the items a and b will be incorporated in the project benefits, if they are countable in monetary term.

(10) Economic evaluation.

Economic evaluation of the candidate master plans will be made by examining the net present value, the benefit-cost ratio and the internal rate of return on the basis of the economic present costs and the economic present benefits.

(11) Determination of the master plan and study of the priority order of the individual projects.

A master plan will be chosen from among the candidate master plans based upon the results of the above-mentioned economic evaluation. Economic and engeneering judgement will be made regarding to the priority order of the individual projects included in the master plan. The study works will be conducted as shown in ANNEX attached herewith.

VI. TRANSFER OF KNOWLEDGE.

1. Transfer of knowledge in the field.

The Indonesia counterparts will join the Japanese Study Team in making the necessary studies in the field and knowledge will be transfered to them through the actual study work.

2. Transfer of knowledge in the Study Team's Home Office.

The Indonesian counterparts will join the Japanese Study Team in formulating the project plan in the Team's Home Office and knowledge will be transfered through the actual study work. For this purpose, the JICA will arrange a special budget for the counterparting in Japan.

VII. WORK SCHEDULE.

The Ular River master plan study will be carried out based on the work schedule shown in Fig.1.

The two months beginning around the end of October will be spent for the study in Indonesia. At the beginning of this period, the Inception Report will be discussed in Jakarta and submitted to the Government of Indonesia.

In the field, data collection and basic studies will be carried out after the reconnaissance for about one week. In the Study Team's home office, two months and a half will be spent for making the plan for the project and the Interim Report will be prepared in Japan.

The Interim Report will be submitted to the Government of Indonesia in March 1977 and discussions will be made during about 10 days. After having received the comments on the Interim Report, the Draft Final Report will be prepared in Japan in the following four months and submitted to the Government of Indonesia for discussion. After having received the comments on the report, the Final Report will be prepared in Japan and sent to the Government of Indonesia in December 1977. The reporting schedule is described in Chapter IX of this report.

VIII. ORGANIZATION FOR THE STUDY.

For carrying out the study, the JICA and the Government of Indonesia will establish the organization shown in Fig.2 in accordance with the Scope of Work submitted to the Government of Indonesia.

The Study Team consists of the members mentioned below.

Team leader	Dr. Seiichi Sato
Co-leader	Mr. Kiyomi Kasama
River engineer	Mr. Shoji Kawabata
Hydrologist	Mr. Noboru Jitsuhiro
Sabo engineer	Mr. Masahiro Kimura
Dam engineer	Mr. Jiro Shimoyama
Geologist	Mr. Hisashi Sasaki
Irrigation and drainage engineer	Mr. Takeshi Nomoto
Agronomist	Mr. Kenjiro Onaka
Agroeconomist	Mr. Masashi Shono
Surveyor	Mr. Masaru Yonai
Project economist	Dr. Kinichi Ohno
Measurement and Liaison	Mr. Yoshiaki Ishizuka

IV. REPORTING.

(1) Inception Report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Inception Report (in English) upon discussion with the

Government of Indonesia at the commencement of the field study.

(2) Interim Report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Interim Report (in English) together with the economic and technical priority order of the individual projects within 6 months after the commencement of the field study. The Government of Indonesia will provide its comments to the JICA within 30 days after the receipt of the Interim Report.

(3) Draft Final Report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Draft Final Report (in English) within 4 months after the receipt of the comments on the Interim Report. The Government of Indonesia will provide its comments to the JICA within 30 days after the receipt of the Draft Final Report.

NOTE OF UNDERSTANDING
ON THE MASTER PLAN STUDY FOR
THE OVERALL ULAR RIVER IMPROVEMENT PROJECT

Held on : Thursday, October 28, 1976.
Time : 09:00-13:00 WIST.
Place : Meeting Room, Directorate of Rivers.

Attendants:

Indonesia	Japan
Ir. Sarbini	Mr. Tadahiko Nakao
Ir. Soekrisno Rammelan	Mr. Yukito Imanaga
Mr. Azis Bockings Msc.	Mr. Kiichiro Tanaka
Ir. Soemarso M.	Mr. Takanori Jibiki
Ir. M. Y. Gayo	Dr. Seiichi Sato
Drs. Ch. Nasri	Mr. Kiyomi Kasama
Ir. Dartawan S.	Mr. Shoji Kawabata
Mr. Sutrisno BA	Mr. Noboru Jitsuhiro
Mr. Wardji BA	Mr. Takeshi Nomoto
Drs. Wimpi Suhandi	Dr. Kinichi Ohno
Ir. Oloan Hutagalung	Mr. Masahiro Kimura
Mr. Waluyo Sabarno BA	Mr. Kenjiro Onaka
Mr. Sei Nagao	Mr. Yoshiaki Ishizuka

General explanation was given by Dr. Seiichi Sato, Leader of the Japanese Study Team, on the Draft Inception Report on the Master Plan Study for the Overall Ular River Improvement Project and the Government of Indonesia has agreed with minor changes in the Draft Inception Report and with the following understanding.

Chapter II. Objective of the Study. Page 2.

1. In connection with the study of erosion control, necessity of reforestation in the riverhead will be suggested by the Study Team if the Team has recognized based on his visual inspection.

2. In connection with the items b and c on page 2, the Study Team will pay attention to the influence of salinity.

Page 3.

1. Two sets of copies of aerial-photograph of the whole Ular River basin will be left in Medan after finishing the field study.

2. As for the establishment of the bench marks, the Study Team will suggest on the selection of locations for them and will prepare technical specifications.

3. The Study Team will suggest on the future network of raingage stations and water gage stations in the Ular River basin.

Chapter X. Arrangement of Equipment for the Field Study. Page 10.

The Study Team has brought the equipment stated in the list attached herewith. The total items are 35, a part of which will be left in Indonesia after the study has been finished. The list of the equipment to be left in Indonesia is given in the Attachment I.

Chapter XI. Arrangement by the Government of Indonesia. Page 11.

1. As for the office space, I (one) meeting room and 1 (one) another room in Kampung Baru Medan and also the Perbaungan Office will be provided for the Study Team's exclusive use.

2. As for the vehicles, the Government of Indonesia has already prepared 5 (five) vehicles and the two more cars will be provided within two weeks after the Study Team has arrived at the Project site.

3. Laboratory tests are needed of approximately 30 samples of riverbed materials, approximately 20 samples of embankment foundations and approximately 30 samples of suspended load.

4. The Government of Indonesia will provide a boring machine with a capacity of 50 meters.

Counterpart.

The Government of Indonesia will provide the Japanese Study Team with the Counterpart Team as shown in the Attachment II.

Agencies to be contacted in Indonesia.

The agencies which the Study Team intends to contact for collecting data are stated in the Attachment III. The Government of Indonesia will prepare official letters with guides in Jakarta and Medan.

Transfer of Knowledge.

1. Four engineers including one surveying engineer if necessary will be sent to Japan in this fiscal year for one-month period.

2. The Government of Indonesia strongly requested that the Government of Japan will accept the Indonesian Counterparts in Japan in the 1977 fiscal year.

Data for Feasibility Study.

Data required for conducting the feasibility study will be mentioned in the Interm Report.

Record of Meeting in Medan.

The record of meeting held in Medan between the Japanese Study Team and the Indonesian Team is attached herewith.

Jakarta, November 5, 1976.

Dr. SEIICHI SATO	IR. SARBINI RONODIBROTO
Leader of the Japanese Study Team for the Overall Ular River Improvement Project.	Acting Director of Rivers.

List of Equipment arranged by JICA for the Study Field

ITEMS	SPECIFICATION	QUANTITY	REMARK
(1) Electro-optical distance meter	SOKKISHA: SDM 1-C	1 set	
(2) Transit with tripod	SOKKISHA: TM-10C	1 set	
(3) Level with tripod	SOKKISHA: B-2	1 set	
(4) Level with tripod	ZUIHO: Z-TL Tilting	1 set	
(5) Hand level		2 pcs.	
(6) Binocular	NIKON J-B7	1 pc.	
(7) Mirror stereoscope	TOPCON III type		
	TOPCON II type	2 pcs.	
(8) Pocket streoscope		2 pcs.	
(9) Handy talky for surveying	HITACHI CH-1330	2 pcs.	
(10) Calculator	pocket type	10 pcs.	
(11) Current meter	CM - IB type		
	ASAHISOKKI: Price type	2 sets	
(12) Silt sampler		1 set	
(13) Stop watch		2 pcs.	
(14) Hand auger	S-15-1A	1 set	
(15) PH meter	HM - 1F	1 set	
(16) Pedometer		1 pc.	
(17) Altimeter	tomen 3B-21	1 pc.	
(18) Planimeter		4 pcs.	
(19) Curvimeter		3 pcs.	
(20) Sieve	SS - 85	1 set	
(21) Leveling staff	MIKASA: 3m, two folding	2 pcs.	Expandable
(22) Leveling staff	5m, telescopic	5 pcs.	"
(23) Esron tape	50m	4 pcs.	
(24) Esron tape	30m	1 pc.	
(25) Esron rope	100m	2 pcs.	
(26) Esron rope	50m	1 pc.	
(27) Pole	2m	6 pcs.	
(28) Boring spade	S - F - 54	1 set	
(29) Standard soil color chart	S - F - 462	1 set	
(30) Soil tester	S - F - 300	1 set	
(31) Auger boring past - hall	SS - 24 with one rod	1 pc.	
(32) Screw point for swedish sounding test	SS - 156	2 pcs.	
(33) Beaker	1000 cc with cap	5 pcs.	
(34) Volumetric Cylinder	1000 cc	2 pcs.	
(35) Evaporation dish	ϕ 10 cm	10 pcs.	

ATTACHMENT I

List of Equipment which will be left in Indonesia after the Study Team finished

ITEMS	SPECIFICATION	QUANTITY	REMARK
(9) Handy talky for surveying	HITACH CH-1330	2 pcs.	
(12) Silt sampler		1 set	
(20) Sieve	SS - 85	1 set	
(21) Leveling staff	MIKASA: 3m, two folding	2 pcs.	Expandable
(22) Leveling staff	5m, telescopic	5 pcs.	"
(23) Esron tape	50 m	4 pcs.	
(24) Esron tape	30 m	1 pc.	
(25) Esron rope	100 m	2 pcs.	
(26) Esron rope	50 m	1 pc.	
(27) Pole	2 m	6 pcs.	
(28) Boring spade	S - F - 54	1 set	
(29) Standard soil color chart	S - F - 462	1 set	
(30) Soil tester	S - F - 300	1 set	
(31) Auger boring past - hall	SS - 24 with one rod	1 pc.	
(32) Screw point for swedish sounding test	SS - 156	2 pcs.	
(33) Beaker	100 cc with cap	5 pcs.	
(34) Volumetric cylinder	1000 cc	2 pcs.	
(35) Evaporation dish	ϕ 10 cm	10 pcs.	

ATTACHMENT II

List of the Japanese Study Team and the Indonesian Counterpart Team

Japanese Study Team

Team Leader	Dr. Seiichi Sato
Co-leader	Mr. Kiyomi Kasama
River Engineer	Mr. Shoji Kawabata
Hydrologist	Mr. Noboru Jitsuhiro
Sabo Engineer	Mr. Masahiro Kimura
Dam Engineer	Mr. Jiro Shimoyama
Geologist	Mr. Hisashi Sasaki
Irrigation and Drainage Engineer	Mr. Takeshi Nomoto
Agronomist	Mr. Kenjiro Onaka
Agroeconomist	Mr. Masashi Shono
Surveying Engineer	Mr. Masaru Yonai
Project Economist	Dr. Kinichi Ohno
Measurement and Liaison	Mr. Yoshiaki Ishizuka

Indonesian Counterpart Team

Team Leader	Ir. Machmudin Makdurah
Deputy I Team Leader	Ir. Kasim Siregar
Deputy II Team Leader River Engineer	Ir. B. Simanungkalit
Assistant River Engineer	Mr. B. Tampubolon BIE
Hydrologist	Drs. Soedirman
Assistant Hydrologist	Ir. Aisyah Nasution
Dam/Sabo Engineer	Ir. Dartawan
Geologist	Ir. Sudaryanto
Irrigation and Drainage Engineer	Mr. O. Lumban Gaol BIE
Agronomist	Ir. N. Ginting
Agroeconomist	Ir. Sardjono Adji
Surveying Engineer	Mr. Sahar BE
Project Economist	Drs. Dj. Siahaan
General Affairs	Mr. P. Simatupang
Measurement I	Ir. Widiyastuty D.
Measurement II	Mr. L. Pardosi BIE

ATTACHMENT III

AGENCIES TO BE CONTACTED IN INDONESIA

1. Dapartamen Pertambangan, Direktorat Jenderal Pertambangan Diroktorat Geologi.
2. Department Dalam Negeri, Direktorat Jenderal Agraria, Direktorat Tata Guna Tanah.
3. Lembaga Meteorologi dan Geofisika.
4. Direktorat Penyelidikan Masalah Air.
5. PNP Office in Medan.
6. Some agencies which deal with statistical record of damages to Agriculture, traffic, public facilities and general properties.
7. Agency which deals with statistical record of export and import.
8. Agency which deals with excise taxes.
9. Agency which deals with import and export tax.
10. Agency which deals with statistical record of highway traffic and railway traffic in North/Sumatra.
11. Maps of the government-owned land for the Ular River and Irrigation and drainage canals.
12. Agency which deals with tidal record of Belawan Harbour.
13. Agency which deals with statistical record of Agricultural production.
14. Agency which deals with statistical record of population by desa , kecamatan and kabupaten in the Ular River Basin.
15. Agency which deals with statistical data on economic indices.
16. Agency for agricultural requisites supply.
17. DOLOG.
18. Bank Rakyat Indonesia.
19. Agency for transmigration.

RECORD OF MEETING
ON
MASTER PLAN STUDY
FOR
OVERALL ULAR RIVER IMPROVEMENT PROJECT

Held on : Monday, November 1, 1976.
Time : 12:00 - 15:00 WIST.
Place : Metting Room, Kampung Baru Office, Medan.

Attendants:

Indonesia	Japan
Ir. Machmudin Makdurah	Mr. Yukito Imanaga
Ir. Kasim Siregar	Mr. Katsuji Komiyama
Ir. Soekrisno Rammelan	Mr. Kiichiro Tanaka
Ir. M. Y. Gayo	Mr. Takanori Jibiki
Ir. B. Simanungkalit	Dr. Seiichi Sato
Ir. Dartawan	Mr. Kiyomi Kasama
Mr. O. Lumban Gaol BIE	Mr. Shoji Kawabata
Mr. B. Tampubolan BIE	Mr. Noboru Jitsuhiro
Ir. Sardjono Adji	Mr. Takeshi Nomoto
Ir. N. Ginting	Dr. Kinichi Ohno
Drs. Soedirman	Mr. Masahiro Kimura
Mr. Sahar BE	Mr. Kenjiro Onaka
Drs. Dj. Siahaan	Mr. Masaru Yonai
Mr. P. Simatupang	Mr. Masashi Shono
Ir. Widyastuty D.	Mr. Yoshiaki Ishizuka
Mr. L. Pardosi BIE	
Drs. Sri Wianto	
Ir. Dj. Pinem	
Mr. Masayuki Watanabe	

General explanation was given by Dr. Seiichi Sato, Leader of the Japanese Study Team, on the Draft Inception Report and the Draft Note of Understanding for the Master Plan Study for the Overall Ular River Improvement Project. As a result of discussion, the following was concluded.

1. Accomodation is available for two persons in the Perbaungan Office.

2. Six Surveying teams with four levels and four staffs have already been prepared in accordance with the item (9) of Chapter XI of the Draft Inception Report, and the surveyers of the teams are as follows.

   Mr. M. Pakpahan
   Mr. P. Naingolan
   Mr. H. Hutabarat
   Mr. A. Siahaan
   Mr. B. Sembiring
   Mr. Husin

3. Two measurement teams have already been prepared in accordance with the item (10) of Chapter XI of the Draft Inception Report, and the chiefs of the teams are as follows.

   Ir. Widiyastuty D.
   Mr. L. Pardosi BIE

4. Transportation measure has already been prepared for the six surveying teams and the two measurement teams mentioned above.

5. Two boats (sampan) with engines four or five persons each will be provided within one week in accordance with the item (12) of Chapter XI of the Draft Inception Report.

6. Three pieces of metal crowns (bits) are now available, and additional ones will be available if necessary.

7. Boring works of four holes are desirable for geological survey at the candidate dam sites, but they will be combined with test pits as circumstances demand.

8. Careful attention shall be paid in making a study of plans including land acquisition and removement of people in the project area, if any.

9. The working hour is as follows.

Monday to Thursday:		8:00 a.m. to 4:00 p.m. including one hour of lunch break from 12:00 to 1:00 p.m.
Friday	:	8:00 a.m. to 12:00 p.m. and 2:00 p.m. to 4:00 p.m.
Saturday	:	8:00 a.m. to 12:00.

Medan, November 3, 1976.

Dr. Seiichi Sato	Ir. Machumdin Makdurah
Leader of the Japanese Study Team for the Overall Ular River Improvement Project.	Leader of the Indonesian Counterpart Team for the Overall Ular River Improvement Project.

Jakarta, December 11, 1976.

Our Ref. No. : DS.1761/I/K/F6

Dr. Seiichi Sato
Leader of the Japanese
Master Plan Study Team for
the Overall Ular River
Improvement Project.

Re.: Request of Leaving the Equipment in Indonesia for Overall Ular River Improvement Project.

We would like to request you to leave the following equipment in Indonesia among the list of equipment stipulated in Chapter X "Arrangement of the Equipment for the Field Study" of the Inception Report on Master Plan Study for the Overall Ular River Improvement Project" on November, 1976. The leaving time will be after finishing the Study.

Items		Specification	Quantity
(9)	Handy talky for surveying	HITACHI CH-1330	2 pcs.
(12)	Silt sampler		1 set
(20)	Sieve	SS-85	1 set
(21)	Leveling staff	MIKASA : 3m two folding	2 pcs.
(22)	Leveling staff	5m telescopic	5 pcs.
(23)	Esron tape	50 m	4 pcs.
(24)	Esron tape	30 m	1 pc.
(25)	Esron rope	100 m	2 pcs.
(26)	Esron rope	50 m	1 pc.
(27)	Pole	2 m	6 pcs.
(28)	Boring spade	S-F-54	1 set
(29)	Standard soil colour chart	S-F-462	1 set
(30)	Soil tester	S-F-300	1 set
(31)	Auger boring post hall	SS-24 with one rod	1 pc.
(32)	Screw point for swedish sounding test	SS-56	2 pcs.
(33)	Beaker	100 cc with cup	5 pcs.
(34)	Volumetric cylinder	1000 cc	2 pcs.
(35)	Evaporation dish	ϕ 10 cm	10 pcs.

Your kind attention to this matter will be highly appreciated.

Ir. Sarbini Ronodibroto
Director of Rivers
Directorate General of
Water Resources Development,
Ministry of Public Works
and Electric Power.

Copy to : i. Project Manager of
Ular River Project.

ii. Nikken Consultants,
Medan.

iii. File.

YOUR REF. NO.
OUR REF. NO. : NUET-76001

Tokyo, December 21, 1976.

Ir. Sarbini Ronodibroto
Director of Rivers
Directorate General of Water
Resources Development
Ministry of Public Works and
Electric Power

Dear Sir: Letter of Request for Leaving the Equipment in Indonesia for Ular River Improvement Project.

I have received your letter DS.1761/I/K/76 dated December 11, 1976 requesting us to leave the equipment listed in ATTACHMENT I of Note of Understanding on the Master Plan Study for the Overall Ular River Improvement Project attached to the Inception Report on Master Plan Study for Overall Ular River Improvement Project. I am pleased to inform you that I accept your request.

Sincerely yours,

Dr. Seiichi Sato
Leader of the Japanese Master
Plan Study Team for the Overall
Ular River Improvement Project

SS/ta

Copy to : i. Project Manager of Ular River Project.
ii. Japan International Cooperation Agency.
iii. Mr. Kojima, Nikken liaison officer, Jakarta
iv. File, Tokyo.

Jakarta, February 3, 1977.

Our Ref. No.: DS.140/4/K/77.

Dr. Seiichi Sato
Leader of the Japanese
Master Plan Study Team for
the Overall Ular River
Improvement Project
NIKKEN CONSULTANTS, INC.
5-2-4, Higashi Gotanda
Shinagawa-ku, Tokyo

Subject: Acceptance for Leaving the Equipment in Indonesia for Ular River Improvement Project.

Dear Dr. Seiichi Sato:

It is a great pleasure to receive your letter No. NUET-76001 dated December 21, 1976 in which you informed us that you have accepted to our request on the approval of the above subject.

In this opportunity allow me on behalf of the Government of the Republic of Indonesia to express our thankfulness to your good understanding and kind cooperation.

Sincerely yours,

Ir. Y. SUDARYOKO
Director of Rivers

Copy to :
i. Project Manager of Ular River Project.
ii. Japan International Cooperation Agency.
iii. Mr. Kojima, Nikken liaison officer, Jakarta
iv. File

Perbaungan, 20th Dec., 1976.

Our Ref. No.: 441/XII/FC/76.

Mr. Kiyomi Kasama
Co-leader of the Japanese
Master Plan Study Team for
the Overall Ular River
Improvement Project.

Dear Sir: Receipt of the Equipment for the Overall Ular River Improvement Project.

We, the Indonesian Counterpart Team for the Overall Ular River Improvement Project duly received the following equipments stipulated in the "Note of Understanding on the Master Plan Study for the Overall Ular River Improvement Project" dated November 5, 1976.

Items		Specifications	Quantities
(9)	Handy talky for surveying	HITACHI CH-1330	2 pcs.
(12)	Silt sampler		1 set
(20)	Sieve	SS-85	1 set
(21)	Leveling staff	MIKASA: 3m two folding	2 pcs.
(22)	Leveling staff	5m telescopic	
(23)	Esron tape		
(24)	Esron tape		
(25)	Esron rope		
(26)	Esron rope	50 m	
(27)	Pole	2 m	6 pcs.
(28)	Boring spade	S-F-54	1 set
(29)	Standard soil colour chart	S-F-462	1 set
(30)	Soil tester	S-F-300	1 set
(31)	Auger boring post hall	SS-24 with one rod	1 pc.
(32)	Screw point for swedish sounding test	SS-56	2 pcs.
(33)	Beaker	100 cc with cup	5 pcs.
(34)	Volumetric cylinder	1000 cc	2 pcs.
(35)	Evaporation dish	ϕ 10 cm	10 pcs.

Your kind attention to this matter will be highly appreciated.

Sincerely yours,

Ir. Machmuddin Makdurah
Leader of the Indonesian Counterpart Team for the Overall Ular River Improvement Project.

Perbaungan, Dec. 20, 1976.

Our Ref. No.: 442/XIII/FC/76.

Mr. Kiyomi Kasama
Co-leader of the Japanese
Master Plan Study Team for
the Overall Ular River
Improvement Project.

Dear Sir: Receipt of the Aerial-photograph for the Overall Ular River Improvement Project.

We, the Indonesian Counterpart Team for the Overall Ular River Improvement Project duly received the one set of aerial-photograph for the Overall Ular River Improvement Project.

Your kind attention to this matter will be highly appreciated.

Sincerely yours,

Ir. Machmudin Makdurah
Leader of the Indonesian
Counterpart Team for the
Overall Ular River
Improvement Project.

Tokyo, January 19, 1977.

Our Ref. No.: NUET-77001

Ir. Sarbini Ronodibroto
Acting Director of Rivers
Directorate General of Water
Resources Development
Ministry of Public Works and
Electric Power

Dear Sir: LOCATION OF RAIN-GAGE STATIONS AND WATER GAGE STATIONS IN THE ULAR RIVER BASIN

We have the pleasure in suggesting to you the conception in locating the additional recording rain-gage and water-level gage stations over the Ular River basin in accordance with Chapter II - Page - 3 of the NOTE OF UNDERSTANDING ON THE MASTER PLAN STUDY FOR THE OVERALL ULAR RIVER IMPROVEMENT PROJECT dated Jakarta, November 5, 1976, as mentioned in detail in the ANNEX "SUGGESTION ON LOCATION OF RAIN-GAGE AND WATER-GAGE STATIONS".

Thanking for your kind attention, we are,

Sincerely yours,

Dr. Seiichi Sato
Leader of the Japanese Study
Team for the Overall Ular
River Improvement Project.

SS/ta

Copy to :
i. Ir. Machmudin Makdurah
Leader of the Indonesian
Counterpart Team for the
Overall Ular River
Improvement Project.
ii. Ir. Kasim Siregar,
Deputy I Team Leader.
iii. Ir. B. Simanungkalit,
Deputy II Team Leader.
iv. File.

SUGGESTION ON LOCATION OF RAIN-GAGE AND WATER-GAGE STATIONS

The Japanese Study Team for

the Overall Ular River Improvement Project

1. Recording rain-gage stations.

At present, 7 recording rain-gage stations and 14 ordinary rain-gage stations have been established and being managed by the Ular River Project Office and the DPMA in and around the Ular River basin. They are as follows.

Recording gages	Ordinary gages
1. Perbaungan	1. Paku
2. Kotarih	2. Silinda
3. Gunung-Meriah	3. Rumah-Deleng
4. Sarang-Padang	4. Bandar-Negeri
5. Tiga-Runggu	5. Tiga-Juhar
6. Negeri-Dolok	6. Marubun-Lokung
7. Silinda (DPMA)	7. Negeri-Kashihan
	8. Bah-Bah
	9. Sarang-Ganjang
	10. Siporkas
	11. Sanggai-Sanggai
	12. Pematang-Raya
	13. Huta-Raja
	14. Seribu-Dolok

The Ular River Project Office has a plan to add 12 new recording rain-gage stations for the purpose of improving runoff analysis of the Ular River basin.

As the areal range of rainfall in this district is considerably small, the distribution density of rain-gage stations must be thick as far as possible covering the river basin and an area surrounding it as well. At this stage, however, only twelve stations are to be added to the seven existing ones. In view of this matter, the twelve new stations were located so that the total nineteen stations may cover the whole

catchment area as uniformly as possible and be easy to access for measurement and maintenance. The suggested locations of the twelve stations are shown below, detail of which is indicated in the attached map.

Suggested stations	Remarks
1. Paku	Near ordinary gage station.
2. Bandar-Pinang	Near PNP gage station.
3. Kota-Rihasilau	
4. Tiga-Juhar	Near ordinary gage station.
5. Marubun-Lokung	"
6. Bah-Bah	"
7. Sarang-Ganjang	"
8. Siporkas	"
9. Sanggai-Sanggai	"
10. Pematang-Raya	"
11. Huta-Raja	"
12. Seribu-Dolok	"

2. Recording water-level gage stations.

At present, 3 recording gage stations and 2 staff gage stations are established on the Ular River and managed by the Ular River Project Office and the DPMA. They are as follows.

Recording gages	Staff gages
1. Bandar-Tiga	1. Serbajadi bridge (DPMA)
2. Perbaungan	2. Ular bridge
3. Denai-Lama	

Among the above-mentioned stations, discharge is measured by the Ular River Project Office at the Bandar-Tiga and the Ular Bridge stations and by the DPMA at Pulo-Tagor near Serbajadi Bridge.

Ideally considering, the following nine recording water-level gage stations are desirable for the improvement of runoff analysis.

1) Balapulung on Buaya river (near bridge)
2) Sipinggan " (no bridge)
3) Mabar " (near bridge)
4) Paku bridge " (")
5) Negeri Dolok on Karai river (")
6) Bandar-Pinang " (")
7) Serbajadi bridge on Ular River (")
8) Esperance " (no bridge)

However, as the Ular River Project Office has at this stage a plan to establish four additional stations of recording water-level gage, we suggest the following four locations in consideration of suitability for establishing discharge-rating curve and measurement of discharge at flood time. The locations of these stations are also indicated in the attached map.

1) Paku bridge on Buaya River (near bridge)
2) Negeri-Dolok on Karai River (")
3) Bandar-Pinang on Karai River (")
4) Serbajadi bridge on Ular River (")

3. Matters that demand special attention.

As the above-mentioned rain-gage and water-level gage stations will play an important role for supplying hydrological data extending over a long period of time, special attention concerning the following matters must be paid in building the stations.

(1) Rain-gage stations.

i. Rainfall depth to be measured must not be affected by topographic conditions, vegetations and artificial structures.

ii. The station must not be inundated by heavy storm.

iii. The spot of the station must be easy for measuring, maintaining and stationing the staffs therefor.

(2) Water-level gage stations.

i. The stream flow must not be disturbed by building the station.

ii. The cross-section of the channel for measurement must be stable enough for long-term measurement.

iii. The spot of the station must not be dangerous for measurement at flood time.

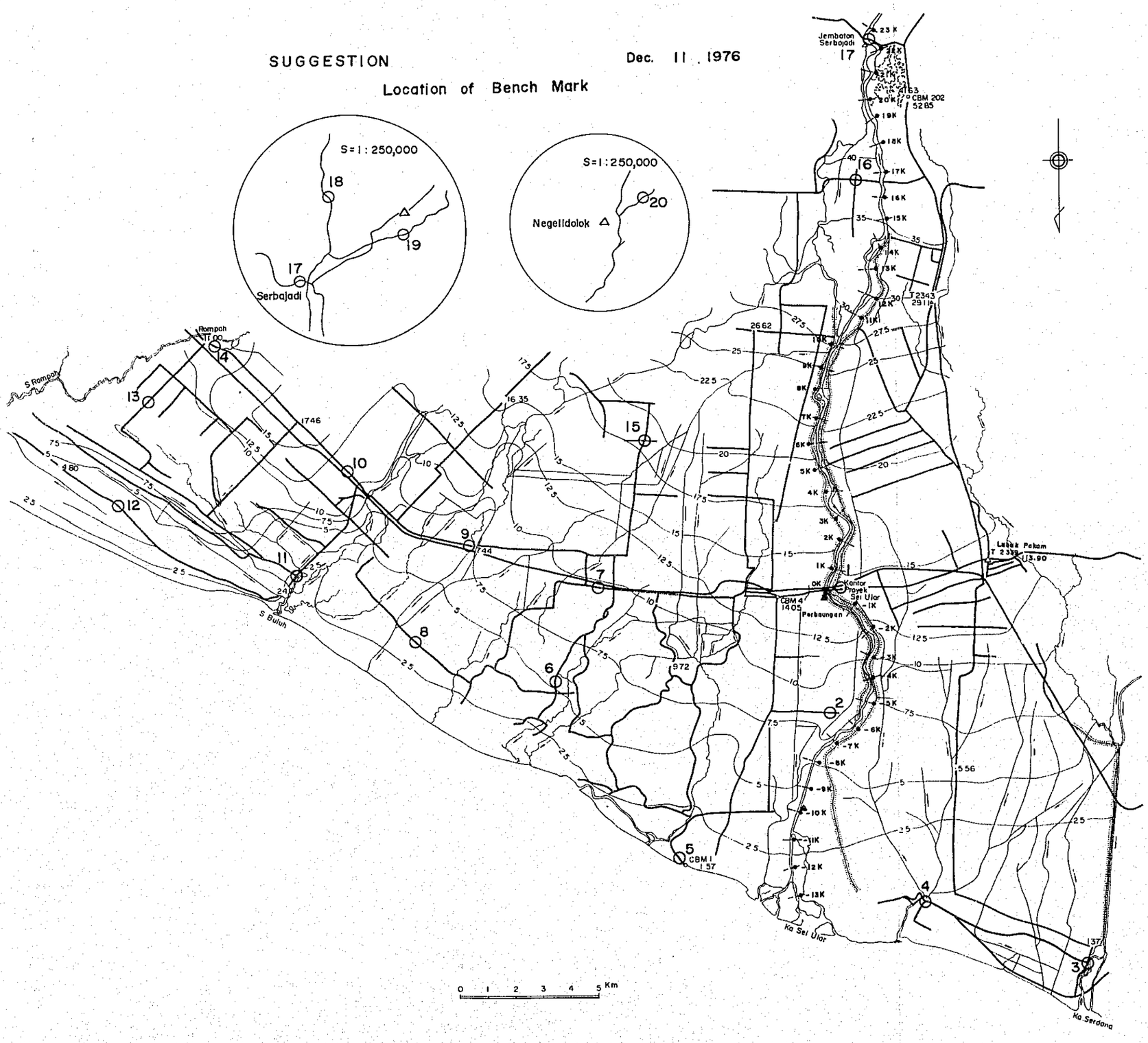
iv. The spot of the station must be easy for measuring, maintaining and stationing the staffs therefor.

: enclosed figure.

SUGGESTION

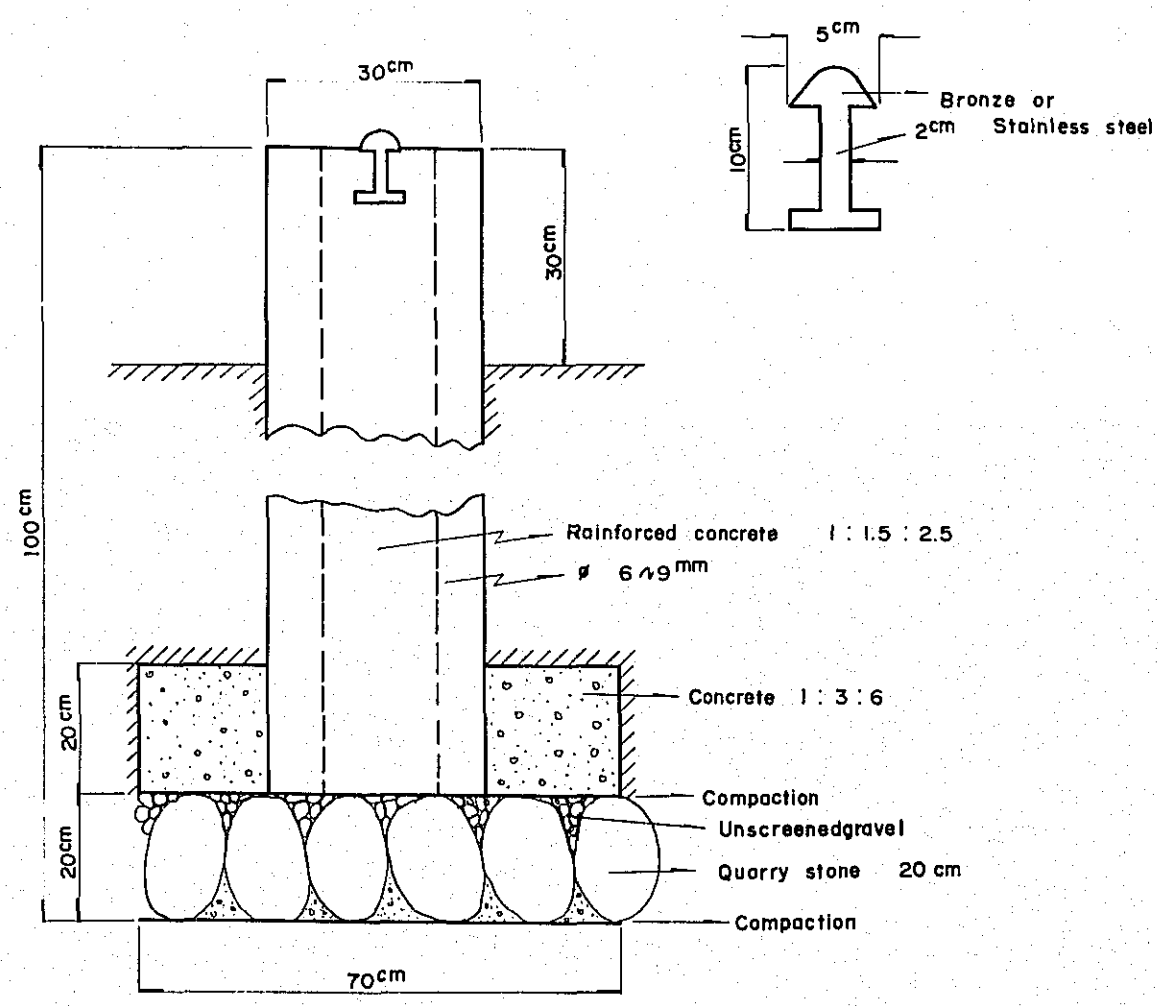
Dec. 11 , 1976

Location of Bench Mark



SUGGESTION Dec. 11, 1976

Specification of Bench Mark



APPENDIX G

SUMMARY OF DISCUSSION

ON

INTERM REPORT OF THE MASTER PLAN* STUDY

(* This was afterwards changed to OVERALL PLAN; hereinafter read as "overall plan".)

CONTENTS

Jakarta, March 16, 1977.

Ir. Suyono Sosrodarsono
Director General of
Water Resources Development
Ministry of Public Works
and Electric Power.

Dear Sir: Submission of Interim Report on Master Plan Study for Overall Ular River Improvement Project

We have the pleasure of submitting twenty (20) copies of Interim Report on Master Plan Study for Overall Ular River Improvement Project in accordance with Inception Report, November 1976.

We should be pleased if you would kindly extend your comments with 45 days.

Thanking for your kind attention, we are

Sincerely yours

K. Kasama
Co-leader of the Master Plan
Study Team for Overall Ular
River Improvement Project.

Copy to:
i. Ir. Y. Sudaryoko
Director of Rivers.
ii. Mr. T. Nakao
Secretary of the Embassy
of Japan, Jakarta.
iii. Mr. S. Tsurumi
Resident Repressentative
of JICA, Jakarta.
iv. File

SUMMARY OF DISCUSSION
ON INTERIM REPORT OF THE MASTER PLAN STUDY FOR THE OVERALL ULAR RIVER IMPROVEMENT PROJECT

The Japanese Master Plan Study Team and the Directorate General of Water Resources Development, Ministry of Public Works and Electric Power discussed the Interim Report of the Master Plan Study for Overall Ular River Improvement Project on the 17th, 18th and 19th of March 1977 and identified basic matters as written herewith:

I. Comments and questions from the Directorate General of Water Resources Development.

Five main comments and questions concerning the following items were raised by the staff of the DGWRD.

Main idea and concept.

Data and analysis.

Construction plan.

Cost analysis.

Economic analysis.

These questions are summarized as follows.

1.1. Main idea and concept.

1.1.1. At this opportunity the Study Team was requested to explain the basic idea and concept of the Master Plan and its recommended individual project.

1.1.2. The Study Team was also requested to explain the basic concept of the calculation of I.R.R.

1.1.3. Question concerning the necessity of dam construction for flood control was raised in the meeting.

1.2. Data and analysis.

1.2.1. The Study Team was requested to explain the hydrological evaluation for its selection of the design discharge 800 m^3/s.

1.2.2. Question concerning the relation among land erosion and bank erosion problem in the upper basin, vegetation cover, and sediment transport in the river channel was raised in the meeting.

1.2.3. The three-days' investigation of tide is considered very limited. It is suggested that more data from the Naval Institute of Hydrology should be considered to be included in the next study.

1.3. Construction plan.

1.3.1. Questions concerning river improvement were raised in the meeting as follows:

a. Additional alternative evaluation of Pulau Gambar lower area.

b. Explanation concerning the reason why dam construction was not recommended for flood control protection in the area.

c. Influence to the railroad bridge due to the increase in the design discharge from 600 m^3/s (selected in the urgent flood control study) to 800 m^3/s.

1.3.2. The Study Team was requested to explain how technically it will be done to increase the irrigation area from 7,000 ha of the existing irrigated area to 18,500 ha.

1.3.3. A question concerning drainage was raised to answer the problems related to:

a. Inundated area in the Project area.

b. Salinity and ground water table.

1.4. Cost analysis.

The Study Team was requested to give additional explanation concerning the unit cost (in 1976) applied to this study.

1.5. Economic analysis.

1.5.1. Question concerning the basic cost calculation for the estimation of I.R.R. was raised especially in relation to the construction cost of the Urgent Flood Control Project.

1.5.2. The Study Team was requested to give additional explanation concerning the selection of 4.5 ton/ha as an average yield of paddy for the 18,500 ha in this study.

1.6. Others.

The Study Team was requested to explain on the estimation of period required for conducting the Feasibility Study as the continuation of this study.

II. Conclusion.

2.1. Both sides principally agreed to finalize the study. Additional comments, if any, shall be provided by the DGWRD to the JICA within 45 days after receiving the Interim Report.

2.2. The main target of the Master Plan for the Overall Ular River Improvement Project is as follows:

2.2.1. Flood control will protect an area of about 25,000 ha in the downstream region of the Ular River.

2.2.2. The improvement of drainage systems put emphasis on the area along the coast line will be included in the project.

2.2.3. The project area for the irrigation plan is delineated to be 18,500 ha in total. Out of 18,500 ha, 7,000 ha with irrigation systems will be improved and extension of irrigation system will carried out in the remaining rainfed area of 11,500 ha to increase rice production.

2.3. Among the alternative plans, the combined plan with flood control and drainage and irrigation, having the I.R.R. of about 25.7% with the design river discharge of 800 m^3/s, indicates that the project is very attractive. It is recommended to carry out a Feasibility Study.

2.4. The summary of discussion is written as follows:

2.4.1. In the final report, the data list with their sources, the Inception Report, the Scope of Work and the Terms of Reference shall be attached.

2.4.2. The vegetation in the upper Ular watershed is comparatively good. There is no land sliding nor sliding with collapse in the upper watershed and the surface erosion is scarce. From this point of view, there is scarce need to build sabo facilities at present. It is desirable, however, to carry out further study in future for clarifying sediment transportation, because it is comparatively large. Besides, the present intensity of reforestation and green movement under the IMPRESS program is desired to continue.

2.4.3. Five recording rain-gages have been installed. Unfortunately, however, the covering area by them is not enough yet for study of discharge hydrograph.

2.4.4. The Master Plan indicates that flood control by dam construction is unfavorable economically at present based on the studies of six cases.

2.4.5. Permeability test was not included in the boring test because the investigation was only for determination geological lithology.

2.4.6. The 3-days' investigation of tide level around the Ular River mouth is considerably very limited. It is suggested to the team to get more data from the Naval Institute of Hydrology in Jakarta in his next study.

2.4.7. The downstream area of 40 ha of Pulau Gambar is planned as open-dike-system improvement. However, Pulau Gambar area has been developed as paddy field. Therefore, such alternative plan as flap-gate-system will be studied in the next study. Further, necessity of strengthening of the dike between No.10 km and No.13 km will be studied together with above mentioned alternative.

2.4.8. The railway bridge is under rebuilding for flood discharge of 600 m^3/s, and for proposed flood discharge of 800 m^3/s, the Master Plan includes a countermeasure against rise of water level by the bridge. It is desirable, however, to expand the total span of the railway bridge longer than the highway bridge. The implementation of the work depends upon the progress by the authority concerned and its construction cost is not included in the economic calculation.

2.4.9. For the purpose of the next Feasibility Study, the Master Plan Study Team prepares a plan of work items for data collection as Attachment 1 of this summary of discussion.

2.4.10. The annual quantity of river flow is estimated at:

1972 ..... 1.600×10^6 m^3

1973 ..... 1.770×10^6 m^3

1974 ..... 1.680×10^6 m^3

2.4.11. The existing irrigation and drainage systems include 13 intake facilities, main irrigation canal of about 50 km, secondary canal of about 90 km and drainage canal of about 57 km respectively.

2.4.12. The irrigation water necessary for the project on the basis of the proposed cropping pattern is estimated at 25.2 m^3/s at maximum. It can be sufficiently provided from the Ular River of which the minimum ten-day discharge is 40.3 m^3/s of the drought year, 1972.

2.4.13. For the purpose of smooth supply of irrigation water, 6 intake facilities as well as the main irrigation canals 40 km long shall be newly constructed and other canals 40 km long will be rehabilitated.

2.4.14. The increasing of capacity of the intakes will be expected by lowering and widening of the intake sill.

2.4.15. Taking into consideration the intrusion of sea water and the complexity of topography, the area with the width of 1 km along the coastal line is excluded from the project area.

2.4.16. With respect to drainage plan, drainage canal of 20 km will be newly constructed and natural river of 40 km shall be improved. These facilities play an important role in control of surface drainage and partially of lowering of ground water table. In addition, they will give good influence to the drainage condition in the plantation area.

2.4.17. Excess water of irrigation will be smoothly drained out into the drainage systems due to the steep topography of the project area.

2.4.18. Pulau Gambar of 1,200 ha has comparatively good condition in drainage. However, the drainage canal will be constructed along the new dike at the same time as the construction of dike for the protection of Pulau Gambar area.

2.4.19. The I.R.R.'s of the projects with the design flood discharge of 800 m^3/s and the irrigation project area as follows:

I.R.R. of the project with flood control only:	20.0%
I.R.R. of the project with irrigation and drainage improvement:	21.5%
I.R.R. of the project with flood control and irrigation combined:	25.7%

It is recommended from the above that the project should be carried out as one project consisting of flood control and irrigation.

2.4.20. The economic evaluation was made mainly based on the damage estimation of the past four comparatively big floods which occured in 1954, 1969, January 1973, and December 1973.

2.4.21. For economic calculation, the cost and the benefit of the Urgent Flood Control Project were taken into consideration. The economic evaluation in the Master Plan Study was made on the basic of the present situation of the project area.

Attachments are as follows:

1. Work items for data collection for the Feasibility Study stage.
2. Discussion schedule of the Japanese Master Plan Study Team.
3. List of attendants.

Figures:

1. Overall Ular River Improvement Project.
2. Plan of drainage system.
3. Plan of irrigation system.

Jakarta, March 23rd, 1977.

MR. KIYOMI KASAMA
Leader of the Japanese
Master Plan Study Team for
the Overall Ular River
Improvement Project.

IR. SARBINI RONODIBROTO
o.b.o. Director of Rivers.

ATTACHMENT 1

WORK ITEMS FOR DATA COLLECTION FOR THE FEASIBILITY STUDY STAGE

I. Profile leveling and cross-section leveling for the proposed river channel improvement.

Profile leveling: The distance will be about 70 km in total on both sides from the estuary to the distance-mark No.20 km.

Cross leveling : At intervals of 250 m, from the estuary to No.20 km, and the standard width of each section will be 450 m.

Note : Stake points for cross-section leveling must be kept to remain in the site and on the drawing.

II. Profile leveling, cross-section leveling and others for the proposed irrigation and drainage works.

Profile : about 150 km.

Cross-section : about 750 sections at intervals of 200 m.

Plan surveying : 9 intakes.

Soil survey.

Sediment survey of irrigation water including laboratory test.

Water quality.

III. Soil-mechanics survey.

Machine boring and soil laboratory test. : 2 places in the estuary and 1 place in the downstream of Pulau Gambar canal.

Swedish sounding test. : about 60 points.

IV. Agroeconomical data.

V. Economical data.

VI. To conduct the Feasibility Study, a total of about 10 months is estimated.

ATTACHMENT 2

DISCUSSION SCHEDULE OF THE MASTER PLAN STUDY TEAM IN INDONESIA (1977)

March	15 (Tue)	Arrived in Jakarta.
	16 (Wed)	Meeting with the Embassy of Japan and the JICA-Jakarta.
	17 (Thu)	Courtesy call to the Director General (9:30 a.m. to 10:00 a.m.). Meeting for discussion on the Master Plan (basic data, data, and data analysis).
	18 (Fri)	Meeting for discussion on the Master Plan (plan, construction plan, and cost analysis).
	19 (Sat)	Meeting for discussion on the Master Plan (draft final).
	20 (Sun)	Left for Medan.
	21 (Mon)	Meeting in Medan.
	22 (Tue)	Meeting in Medan. Left for Jakarata.
	23 (Wed)	Conclusion.
	24 (Thu)	Left for Tokyo.

ATTACHMENT 3

LIST OF ATTENDANTS

Indonesia	Japan
Ir. Sarbini R.	Mr. T. Nakao
Ir. Kusdaryono	Mr. Y. Imanaga
Ir. Mardjono	Mr. T. Maruta
Ir. Soekrisno Rammelan	Mr. S. Muraoka
Ir. M. Y. Gayo	Mr. T. Jibiki
Ir. Soemekto	Mr. K. Kasama
Ir. B. Simanungkalit	Mr. S. Kawabata
Ir. Dartawan	Dr. K. Ohno
Ir. C. L. Sumartono	Mr. T. Nomoto
Ir. Djoko S. Sardjono	Mr. K. Onaka
Drs. Nasri	
Ir. Toto Sutisno	
Ir. Widyastuti D.	
Mr. Aziz Bockings MSc.	
Mr. Sutrisno BA.	
Mr. Amancik	
Mr. M. Nakahiro	
Mr. T. Kon	

RECORD OF MEETING IN MEDAN ON INTERIM REPORT OF THE MASTER PLAN STUDY FOR THE OVERALL ULAR RIVER IMPROVEMENT PROJECT

Held on : March 21, 1977.

Place : Meeting Room, Kampung Baru Office, Medan.

Attendants

Indonesia	Japan
Planning Board of North Sumatra Province	Study Team
Prof. Dr. S. Hadibroto M.A.	Mr. Yukito Imanaga
Ir. Rasmi Ginting	Mr. Tetsuji Maruta
Ir. Gabriel Sinaga	Mr. Shikatsugu Muraoka
Mr. P. Hutasoit	Mr. Takanori Jibiki
Ular River Project	Mr. Kiyomo Kasama
Ir. Machmudin Makdurah	Mr. Shoji Kawabata
Ir. Kasim Siregar	Dr. Kinichi Ohno
Ir. B. Simanungkalit	Mr. Takeshi Nomoto
Ir. Dartawan	Mr. Kenjiro Onaka
Mr. O. Lumban Gaol BIE	
Ir. N. Ginting	
Ir. Aisyah Nasution	
Ir. Widyastuti D.	
Mr. B. Tampubolon BIE	
Directorate of Rivers	
Ir. Kusdaryono	
Ir. Soekrisno Rammelan	
Ir. M. Y. Gayo	

Brief explanation of the Master Plan for the Overall Ular River Improvement Project was presented by the Study Team to the Dinas Pekerjaan Umum Propinisi Sumatera Utara. The results of discussion are as follows.

1. Considering the high IRR of the Project, the Overall Ular River Improvement Project is one of the high priority among those in North Sumatra Province.

2. The amount of construction cost economic cost of the 1976-price of the Project is estimated as follows:

Irrigation sector	:	Rp. 4,395,000,000.-
Flood control sector	:	Rp. 3,170,000,000.-
Total	:	Rp. 7,565,000,000.-

3. Without any resoirvor, natural river flow can supply the water requirement for irrigation of 18,500 ha of rice field.

4. Even though a new main irrigation canal of 8 km for Rampah commading area runs through plantation area, the steep slope of the plantation area will release the area from rise of ground water table.

5. The project area of 18,500 ha has been being used as paddy field. The average size of rice field of landowner is estimated at about 0.96 ha. Farmaers in the project area who are familiar with paddy cultivation have sufficient intensives to produce paddy.

6. At full stage of the Project, the annual operation and maintenance costs are estimated at about Rp. 60,000,000.- for irrigation and drainage sector and about Rp. 10,000,000.- for flood control sector respectively.

7. Land acquisition for both of flood control and irrigation is estimated at about 475 ha and 120 ha respectively.

8. Expected schedule of starting of activity for the next study is;

   Feasibility study in July 1977.

   Design early in 1979.

9. There is a possibility to carry out the Feasibility Study of the Overall Ular River Improvement Project under the Technical Assistance Program of the Japanese Government after receiving the formal request of the Government of Indonesia.

10. The land acquisition problem should be carefully handled in relation to the successful implementation of the Project.

Medan, March 22, 1977.

Mr. Kiyomi Kasama
Co-Team Leader of the Japanese Master Plan Study Team for the Overall Ular River Improvement Project.

Ir. Machmuddin Makdurah
Team Leader of the Indonesian Counterpart Team for the Overall Ular River Improvement Project.

Jakarta, May 4, 1977.

Our Ref. No.: DS.525/27/K/77

JICA - TOKYO
PO Box 216, MITSUI BUILDING
2-1 Nishi Shinjuku
Shinjuku-ku, Tokyo
160, Japan

Att.: Mr. Kiyomi Kasama

Re.: Additional Comments on the Summary of Discussion on the Interim Report of the Master Plan Study for the Overall Ular River Improvement Project.

Dear Sir,

Referring to the Summary of Discussion of above mentioned subject, and in conformity with page 4, Conclusion 2.1., I would like to submit some additional comments as follows:

1. Considering the big debit of the Ular River, it is recommended to study the possibility of extending the irrigation areas beyond those mentioned in the report.
2. It is recommended to consider other uses and advantages of the Ular river water besides the use for irrigation, such as for drinking water, industrial water supply, and hydro electric power.
3. Though dams seem not to be feasible for irrigation and flood control it is necessary to proceed with the study on the feasibility of conducting dams for hydro electric power. All data concerning this study can be forwarded to the State Electricity Company (PLN) to get further consideration relating to present electrical network development in North Sumatera.
4. It is recommended to study more accurately the cause of the change of river-bed at the steep part of the upper course. Also recommended to study the river-bed starting from the lower course along 50 km which has a very small gradient.
5. Sand transportation of approximately 800,000 m^3/year is considered to have a very big influence, therefore it is necessary to be studied as accurately as possible in the planning of Sabo Dams.
6. It is recommended to make a study on the water sources areas which rivulets running into the Ular river current.
7. Also recommended to observe the kinds of plants growing at the hilly slope of the upper course for they have a great influence to erosion.

8. It is needed to pay attention to the areas between km 18,7 and km 21,9 where the river water often overflows causing damages.

9. Deposit problem at the intake at km 35 needs special attention.

In completion to the above matters, please find the enclosed copy of Summary of Discussion concerned signed on March 23rd, 1977.

Yours faithfully,

IR. Y. SUDARYOKO
o.b.o. Director General of
Water Resources Development

Copy to: i. Mr. T. Nakao,
Embassy of Japan,
Indonesia

ii. Secretary to Directorate
General of Water Resources
Development, Ministry of
P.W.E.P.

iii. File.

APPENDIX H

SUMMARY OF DISCUSSION ON DRAFT FINAL STUDY REPORT OF OVERALL ULAR RIVER IMPROVEMENT PROJECT

CONTENTS

Our Ref. No.: NUET-77002 Tokyo, August 18, 1977

Ir. Suyono Sosrodarsono

Director General of Water
Resources Development,
Ministry of Public Works
and Electric Power

Dear Sir:

Re Submission of Draft Final Study Report of Overall Plan Study for Overall Ular River Improvement Project

We have the pleasure of submitting twenty copies of the Draft Final Report of Overall Plan Study for Overall Ular River Improvement Project in accordance with Item (2), Chapter IX of the Inception Report. The Draft Final Report was prepared taking into consideration the comments provided by the Government of Indonesia on the Interim Report.

Yours faithfully,

Dr. Seiichi Sato

Leader of the Japanese Master Plan Study Team for the Overall Ular River Improvement Project

SS/yw

C.C.: i. Ir. Y. Sudaryoko, Director of Rivers.

ii. Ir. Soekrisono Rammelan, Project Officer of Foreign Aid Administration, Directorate of Rivers.

iii. Ir. Machmuddin Makdurah, Leader of the Indonesian Counterpart Team for the Overall Ular River Improvement Project.

iv. Ir. Kasim Siregar, Deputy I Team Leader.

v. Ir. Simanungkalit, Deputy II Team Leader.

vi. File.

NOTES OF MEETING
ON
SUBMISSION OF DRAFT FINAL STUDY REPORT OF
OVERALL ULAR RIVER IMPROVEMENT PROJECT
AND
FIRST DRAFT OF SCOPE OF WORK FOR
FEASIBILITY STUDY OF ULAR RIVER FLOOD CONTROL
AND IMPROVEMENT OF IRRIGATION PROJECT

Held on : Wednesday, August 24, 1977
Time : 10.00 - 12.00
Place : Meeting Room Directorate of Rivers.

On the arrival of the Feasibility Study Team for the Ular River Flood Control and Improvement of Irrigation Project, meetings were held on 18th, 19th and 24th of August 1977 between the Directorate of Rivers and the Japanese Feasibility Study Team.

The records of the meeting on 18th and 19th of August 1977 were attached as Attachment B and Attachment C respectively, while the conclusion of the meeting on 24th August 1977 is recorded as follows:

1. Mr. K. Kasama as Co-Leader of the Team gave an explanation regarding the Draft of Final Study Report of Overall Ular River Improvement Project and presented the Notes of meeting on 18th and 19th August 1977.

2. The Notes of Meeting mentioned above are accepted by both sides with minor correction.

3. It was desired by the Directorate of Rivers to consider the extension of the Project area by including other basins outside the Ular Irrigation Project.

   This matter was already included in the Draft Final Report.

4. The influence distance of tidal water at downstream after the use of river water for irrigation will be studied in more detail in the Feasibility Study.

5. Feasibility Study and Counterpart Team as attached on page 5 and page 7 of the Record of Meeting in Medan on 19th August 1977 will be adjusted according to the organization chart proposed by the Government of Indonesia.

6. The meaning of the verb "arrange" used in par. VII point 3 on page 13 and Table 3 on page 18 of First Draft of Scope of Work must be understood as "make available" and changed accordingly.

7. In par. VI point 9 on page 12 of First Draft of Scope of Work, the figures "8" and "9" were corrected to "7" and "8" respectively.

8. Both sides agreed that access roads, farm roads and inspection roads should be included in the basic design of irrigation and river improvement works.

9. The list of attendance of the meeting is attached to this Notes.

Jakarta, 24th August 1977.

JAPANESE FEASIBILITY STUDY TEAM

KIYOMI KASAMA

DIRECTOR OF RIVERS.

IR. Y. SUDARYOKO

Attachment A

LIST OF ATTENDANCE

Held on : Wednesday 24th August 1977
Time : 10.00 - 12.00
Place : Meeting Room, Directorate of Rivers.

INDONESIA

Mr. Y. Sudaryoko
Mr. Sarbini
Mr. Kusdaryono
Mr. Soekrisno Rammelan
Mr. Suraji
Mr. M. Nainggolan ME
Mr. Kasri Kansrah
Mr. Bambang Prayitno
Mr. Ch. Nasri
Mr. Waluyo Sabarno
Mr. M. Nakahiro
Mr. Fujie

JAPAN

Mr. T. Nakao
Mr. K. Kasama

IRSR/WS/W

Attachment B

RECORD OF MEETING
OF
PREPARATION OF THE FEASIBILITY STUDY
ON
OVERALL ULAR RIVER IMPROVEMENT PROJECT

Held on : Thursday, August 18, 1977
Time : 09.00 - 11.30
Place : Meeting Room, Directorate of Rivers.

Attendance :

Directorate of Rivers	Japanese Feasibility Study Team.
Mr. Kusdaryono	Mr. K. Kasama
Mr. Waluyo Sabarno	Mr. M. Yonai
	Mr. T. Imai
Colombo Plan Expert.	Mr. Y. Suzuki
Mr. M. Nakahiro	Mr. M. Nakagami
	Mr. K. Nakajima

On the occasion of the arrival of the Feasibility Study Team for Overall Ular River Improvement Project, a meeting was held between the Directorate of Rivers and the Japanese Feasibility Study Team, which concluded some notes of record as follows :

1. The arrival of Mr. Kiyomi Kasama has two assignments :

1.1. Submission of the Draft Final Report on Master Plan of Overall Ular River Improvement Project.

1.2. To act as the Team Leader of the Feasibility Study Team for Overall Ular River Improvement Project in carrying out its preliminary activities i.e. : preparing and collecting the basic data on surveying and soil mechanics.

2. On the Draft Final Study Report on Master Plan of Overall Ular River Improvement Project, an explanation was given that :

2.1. The Reports submitted constitute the Draft Final Report as the perfection of the Interim Report and has included the comments forwarded by the Government of Indonesia.

2.2. Comments if any can be given to the said Draft Final Report, and will be discussed at the time of the arrival of JICA's Team, which is expected in November 1977, at the same moment as the arrival of the Main Team of the Feasibility Study Team for Overall Ular River Improvement Project.

2.3. On the matter of erosion problem proposed by the Government of Indonesia mentioned in the Terms of Reference, no study will be carried out in the Feasibility Study. In the Draft Final Study Report on Master Plan of Overall Ular River Improvement Project, this is stated as a recommendation; therefore the matter of erosion problem will be done in the future as a particular study.

2.4. On the resettlement study which was proposed by the Government of Indonesia to be included in the Feasibility Study, the JICA's Team will only be able to assist in giving its advise to the Team of the Local Government during conducting the said resettlement study. The study of this problem shall cover the necessary study for land acquisition and compensation, and other necessary matters needed within the framework of the relocation of the people.

2.5. Since the study of flood forecasting and flood warning system will need a long period and consist of a more wide scope of study, the present feasibility study will cover the study of network of hydrological observation stations including radio telephone communication stations for establishment of flood forecasting and warning system.

2.6. As far as the utilization of the term "Master Plan" is concerned, this means entirely a plan covering all kinds of aspects, on water resources problems; therefore in order to avoid any misunderstanding within the study already done so far, the title should be named "Overall Ular River Improvement Project (Including Flood Control, Reclamation of Downstream Plain and Possible Irrigation Project) in accordance with the Terms of Reference proposed by the Government of Indonesia.

3. Further discussion will be held in Medan and the final discussion will be held in Jakarta on August 24, 1977.

Jakarta, August 18, 1977

JAPANESE FEASIBILITY STUDY TEAM.

KIYOMI KASAMA

Co-Leader of the Study Team.

DIRECTORATE OF RIVERS.

IR. KUSDARYONO

Chief of Sub Directorate of
Construction Services
Division I.

Attachment C

RECORD OF MEETING
IN MEDAN
CONCERNING THE STUDY FOR
OVERALL ULAR RIVER IMPROVEMENT PROJECT
AND FEASIBILITY STUDY OF ULAR RIVER FLOOD
CONTROL AND IMPROVEMENT OF IRRIGATION PROJECT

Held on : Friday, August 19, 1977
Time : 09.15 - 12.00
Place : Meeting Room, Ular River Project in Medan

Attendants:

Indonesia	Japan
Ular River Project	Study Team
Ir. Machmuddin Makdurah	Mr. K. Kasama
Ir. B. Harahap	Mr. M. Yonai
Mr. M. Nainggolan M.E.	Mr. M. Nakagami
Drs. Dj. Siahaan	Mr. Y. Imai
Mr. P. Simatupang	Mr. Y. Suzuki
Mr. L. Pardosi BIE	Mr. K. Nakajima
Mr. Sahar B.E.	
Ir. STP Tambunar	
Ir. Dartawan S.	
Ir. N. Bangun	
Directorate of Rivers, Jakarta	
Ir. Kusdaryono	
Mr. Waluyo Sabarno	

On the occasion of commencement of surveying and soil-mechanical investigation in the feasibility study of Ular River Flood Control and Improvement of Irrigation Project, a meeting was held for the following items.

(1) Submission of Draft Study Report on the Master Plan of Overall Ular River Improvement Project.

(2) First draft of Scope of Work for Feasibility Study of Ular River Flood Control and Improvement of Irrigation Project.

Note of Meeting was recorded as follows:

1. Draft Study Report on Master Plan of Overall Ular River Improvement Project.

   i. Draft Study Report was submitted on this occasion. Some change and supplement to the Interim Report were already included considering the comments prepared by the Government of Indonesia.

   ii. The title of study should be corrected to "Report on Overall Ular River Improvement Project" in accordance with the Terms of Reference prepared by the Government of Indonesia and the Scope of Work prepared for the Project.

   iii. Explanation and discussion will be made later between the Government of Indonesia and the Study Team. This is tentatively scheduled in November 1977.

2. First Draft of Scope of Work for Feasibility Study of Ular River Flood Control and Improvement of Irrigation Project.

   i. Explanation about the meeting held in Jakarta on August 18, 1977 for Feasibility Study was made by Ir. Kusdaryono.

   ii. The title of Scope of Work will be corrected to "Scope of Work for Feasibility Study of Ular River Flood Control and Improvement of Irrigation Project" in accordance with the Terms of Reference prepared by the Government of Indonesia.

   iii. As for erosion control study in upper part of the Ular River basin, it was understood that a study of mechanism of sand production in the headwaters and the quantity of production was recommended as an additional study as mentioned in the Study Report of Overall Ular River Improvement Project. Therefore, it is understood that the feasibility Study will not cover the erosion constrol study.
   However, it was explained by the Machmuddin Makdurah that North Sumatra Province will make study of reforestation and greening next year because Simalungung area is still critical from the viewpoint of erosion control.

   iv. As for resettlement study, understandings are as below:

   -Transmigration study is not needed for the Project.

   -Inventory and study for the existing population that will be affected by the Project are required in the Feasibility Study.

   -Feasibility Study Team may assist the study for resettlement/ relocation which will be carried out by agencies concerned.

   -The project-cost shall cover land acquisition, compensation cost and other expenses relating to the relocation of people concerned.

   v. As for the study of flood forecasting and warning system in Ular River Project, understandings are as follows:

-Improvement of the existing radio/VHF station is needed.

-Study of network of hydrological observation stations for establishment of flood forecasting and warning system and for additional data collection in future will be made in the Feasibility Study.

-Cost of hydrological observation stations and communication stations related to the above study will be estimated.

vi. In the transfer of knowledge program, overseas training in Japan in the course of the study is requested.

vii. As for UNDERTAKING OF THE GOVERNMENT OF THE REPUBLIC OF INDONESIA, the following items were concluded:

-7(seven) vehicles will be provided for exclusive use by the Team. (4 vehicles will be provided from August 1977 and 3 vehicles will be provided in addition to the 4 vehicles mentioned above for the full Team).

-5(five) typists and 3(three) tracers will be provided during the last 1.5 months of the study period in the site.

viii. As for UNDERTAKING OF THE GOVERNMENT OF JAPAN, the following items were concluded.

-The request of transfer of knowledge in Japan will be transfered to the JICA.

-The equipment and materials shown in Table 3 in the first draft of Scope of Work are arranged for efficient conduct of the survey and study.

ix. The first group of the experts for mapping & surveying and soil-mechanics survey arrived here on August 15, 1977 and they commenced the services in Medan on August 18, 1977. The second group of the experts together with the advisors are scheduled to arrive at the beginning of November 1977 as shown in the attachment. However, the exact date of arrival of the second group will be decided later in the final draft of Scope of Work.

x. The Indonesian counterpart team has been organized as shown in the attachment.

xi. The first draft of Scope of Work is attached herewith.

Medan, August 22, 1977

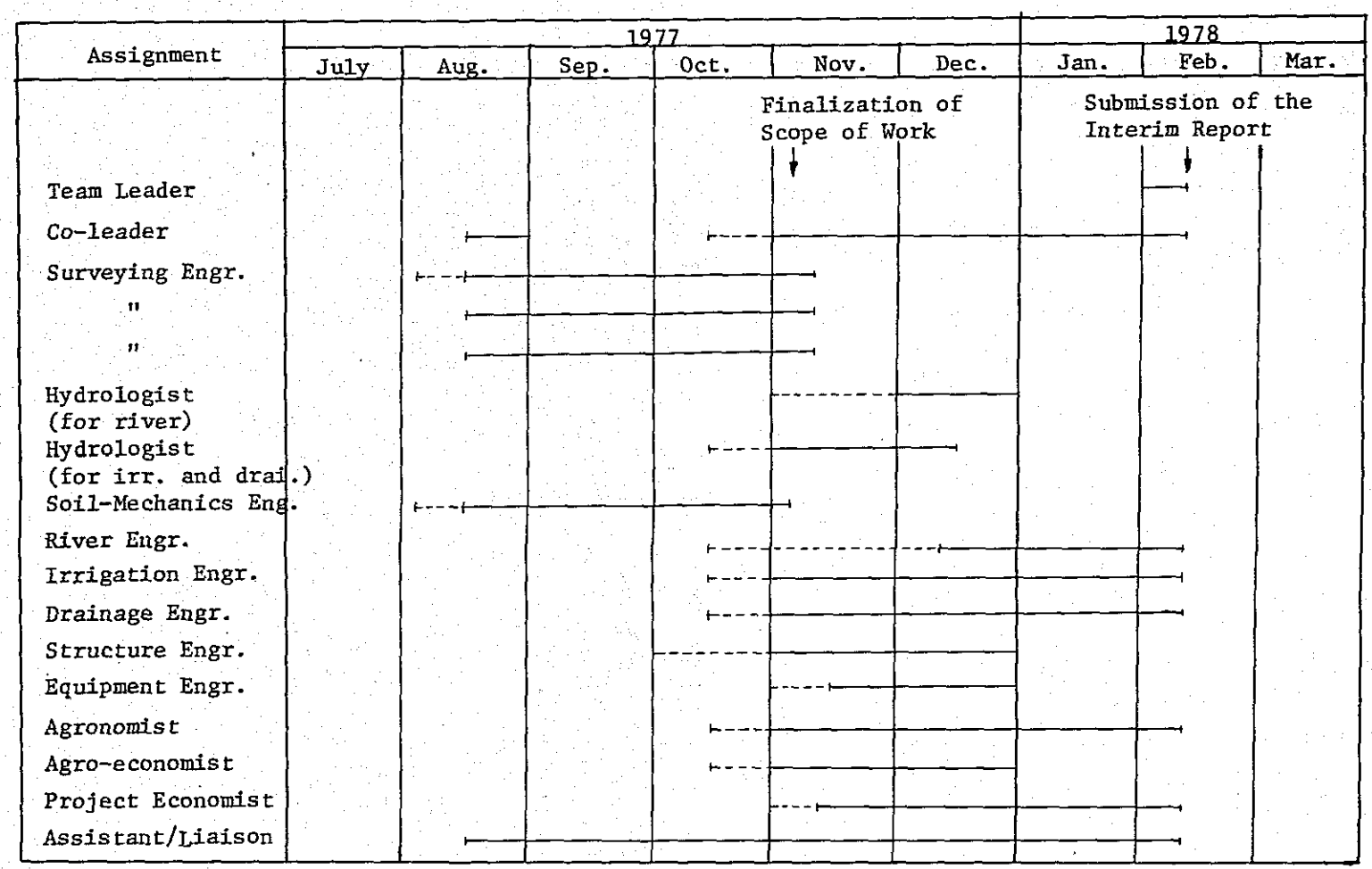
K. Kasama
Co-leader of the
Japanese Study Team

Ir. Machmudin Makdurah
Project Manager of Ular
River Improvement Project

MEMBER LIST
OF
FEASIBILITY STUDY TEAM
OF
ULAR RIVER FLOOD CONTROL
AND IMPROVEMENT OF IRRIGATION PROJECT

Chief Advisor	Mr. Shohei Inoue
Advisor	Mr. Yoichi Takeuchi
Advisor	Mr. Tetsuji Maruta
Advisor	Mr. Kiichiro Tanaka
Advisor	Mr. Shitatsugu Muraoka
Advisor	Mr. Yusuke Suematsu
Advisor	Mr. Takanori Jibiki
Team Leader	Dr. Seiichi Sato
Co-leader	Mr. Kiyomi Kasama
Surveying Engineer	Mr. Masaru Yonai
Surveying Engineer	Mr. Tokio Imai
Surveying Engineer	Mr. Yasuharu Suzuki
Hydrologist (for River)	Mr. Toshikatsu Imai
Hydrologist (for Irr. and Drai.)	Mr. Shinroku Ohtsuki
Soil Mechanic Engineer	Mr. Masahiko Nakagami
River Engineer	Mr. Shigeaki Hisajima
Irrigation Engineer	Mr. Takeshi Kawaguchi
Drainage Engineer	Mr. Masayuki Kodama
Structure Engineer	Mr. Akira Takubo
Equipment Engineer	Mr. Kiyohito Yamazaki
Agronomist	Mr. Kenjiro Onaka
Agro-economist	Mr. Masashi Shono
Project Economist	Dr. Kinichi Ohno
Assistant/Liaison Officer	Mr. Kaoru Nakajima

Assignment Schedule For Feasiblity Study



LIST OF COUNTERPART TEAM

ULAR RIVER PROJECT

Project Manager	Ir. Machmudin Makdurah
Team Leader	Ir. B. Harahap
Co-Leader	M. Nainggolan M.E.
Secretary	Drs. Dj. Siahaan
Liaison Officer	P. Simatupang
Surveying	L. Pardosi B.I.E.
Surveying	Sahar B.E.
Surveying	Ir. Rizal
Hydrologist for FC & IRR., Dr.	Ir. Widiastuti
Hydrologist for flood force & W system	Ir. Aisyah Nastion
Soil-mechanic Eng.	Ir. STP. Tambunan
River Eng.	Ir. Dartawan S.
Irr. Drainage	M. Nainggolan M.E.
Irr. Drainage	B. Tampubolon B.I.E.
Strc/Hdr. Eng.	L. Sibarani B.I.E.
Equipment Eng.	Ir. N. Bangun
Agronomist Agriculture Eng.	Ir. N. Ginting
Agro Economist Agr. Eng.	Ir. Amiruddin Ritonga
Project Economist	Drs. Dj. Siahaan

NOTE OF MEETING
ON
DRAFT FINAL STUDY REPORT
FOR
OVERALL ULAR RIVER IMPROVEMENT PROJECT
AND
INCEPTION REPORT
FOR
FEASIBILITY STUDY OF ULAR RIVER FLOOD CONTROL AND IMPROVEMENT OF IRRIGATION PROJECT

Held on	: Friday, November 11, 1977
Time	: 9:30 - 12:00
Place	: Meeting Room, Directorate of Rivers, Directorate General of Water Resources Development, Jakarta
Attendances	: Attachment A.

On the arrival of the Advisory Group for the Feasibility Study Team, JICA, for the Ular River Flood Control and Improvement of Irrigation Project, meetings were held on 8th and 11th November 1977 at Medan and Jakarta, respectively between the Directorate of Rivers and the Feasibility Study Team, JICA for the following items :

(1) Draft Final Report on the Overall Ular River Improvement Project which was submitted on 18th of August 1977.

(2) Draft Inception Report for the Feasibility Study for the Ular River Flood Control and Improvement of Irrigation Project.

The record of the meeting on 8th of November 1977 in Medan was attached as reference shown in Attachment B, while the conclusion of the meeting on 11th of November 1977 is recorded as follows :

1. Ir. Y. Sudaryoko, Director of Rivers, Directorate General of Water Resources Development gave the following explanations :

   a. The Draft Final Report submitted on 18th of August 1977 by the Study Team, JICA, has been agreed by the Government of Indonesia and the Study Team is expected to proceed to prepare the Final Report. However, a word of "a master plan" should be changed into "an overall plan" based on the Notes of Meeting on 24th August 1977.

   b. The scope of work submitted by the Government of Japan through the Embassy of Japan, Jakarta, by No. 106/TH dated October 6, 1977 has been accepted by the Government of Indonesia and the Study Team is

expected to proceed to execute the feasibility study with some considerations.
A word of "a master plan" in the Scope of Work submitted from Embassy of Japan, Jakarta by No. 106/TH/77 dated October 6, 1977 should be read as "an overall plan".

2. The Study Team, JICA agreed as follows :

   a. The Final Report will be prepared in Japan based on the Draft Final Report which was submitted on 18th of August 1977 and the matter as stated in paragraph 1. a mentioned above.

   b. The Feasibility Study will be conducted based on the considerations agreed by both the Government of Indonesia and the Study Team, JICA, as mentioned in the next paragraph.

3. Considerations for the Feasibility Study.

   a. In the Overall Ular River Improvement Project, the flood control scheme is the most important aspect; therefore the study will be conducted considering the principle mentioned above.

   b. For the study of improvement of irrigation system, the following items will be considered.

      i. to review the existing irrigation system.

      ii. to improve the existing irrigation system.

      iii. to extend the existing irrigation system.

   c. On the flood control scheme, an artificial retarding basin will be studied as an alternative for natural retarding basin reported in the draft final report. A review of the carrying capacity of the river channel upstream of the Perbaungan Highway Bridge will be made in order to make sure that the carrying capacity is relevant to the design discharge of 600 m^3/sec.

   d. In the course of the feasibility study on the improvement of the existing irrigation scheme, the following studies will be made as alternatives :

      i. the overall plan as formulated in the draft final report.

      ii. the plan formulated in consideration of reducing reconstruction of the existing intakes.

      iii. An alternative, in which all necessary irrigation water will be provided by one new weir located upstream of the Serbajadi Bridge, was requested by the Directorate of Rivers. However it was concluded that the weir plan could not be conducted in the present feasibility study due to shortage of fundamental data, but discussion concerning this matter will be made in the course of the study.

   e. For the drainage scheme to be included in the Feasibility study, only the surface drainage will be taken into consideration.

4. In the course of the study, meetings will be held once a month at Medan with representatives from the Directorate of Rivers, DGWRD, Jakarta.

5. It is acceptable that three counterparts will be dispatched for two months each, for the purpose of transfer of knowledge in Japan.

6. The following equipment and materials will be left after completion of the study in the field.

   a. one set of the item No.2 shown in page 20 of the Inception Report.
   b. one set of the item No.4 - " -
   c. five sets of the item No.5 - " -
   d. ten pcs. of the item No.6 - " -
   e. one set of the item No.14 - " -
   f. one set of the item No.15 - " -
   g. one set of the item No.17 - " -
   h. four pcs. of the item No.18 - " -
   i. six pcs. of the item No.19 - " -
   j. eight pcs. of the item No.21 - " -
   k. six pcs. of the item No.22 - " -
   l. all of the items No.23 to No.28 - " -

7. Three survey parties were requested for supplemental surveying for about two months in the field.

8. 20 copies of Inception Report will be submitted on 14th of November 1977.

Jakarta, November 14, 1977

K. Kasama

Co-Leader of the
Feasibility Study Team,
J I C A.

Ir. Y. Sudaryoko

Director of Rivers,
Directorate General of Water Resources Development, Ministry of Public Works and Electric Power.

Attachment A

LIST OF ATTENDANCE

Held on : Friday, 11th November 1977.
Time : 9.30 - 12.30
Place : Metting Room, Directorate of Rivers, Jakarata

INDONESIA	JAPAN
Mr. Y. Sudaryoko	Mr. S. Inoue
Mr. Sarbini Ronodibroto	Mr. Y. Takeuchi
Mr. Mardjono Notodihardjo	Mr. K. Tanaka
Mr. Kusdaryono	Mr. Y. Suematsu
Mr. Soekrisno Rammelan	Mr. K. Kasama
Mr. Suradji	Mr. K. Ohno
Mr. Raaydi	Mr. T. Kawaguchi
Mr. M. Nainggolan	Mr. K. Onaka
Mr. Dj. Siahaan	Mr. K. Nakajima
Mr. Bambang Prayitno	
Mr. Nakahiro	
Mr. Watanabe	
Mr. Kasri Kansrah	
Mr. Waluyo Sabarno	

Attachment B

RECORD OF MEETING

IN MEDAN

Concerning Draft Study Report on Overall Ular River Improvement Project and Scope of Work for Feasibility Study of Ular River Flood Control and Improvement of Irrigation Project.

Held on : Tuesday, November 8, 1977.

Time : 9.00 - 12.00.

Place : Meeting room of DPU, Medan.

Attendance List is attached herewith.

On the arrival of Advisory Group for the JICA Study Team, a meeting was held concerning the following items.

(1) Draft Study Report on Overall Ular River Improvement Project.

(2) Draft of Scope of Work for Feasibility Study for Ular River Flood Control and Improvement of Irrigation Project.

Note of meeting is as follows.

I. Draft Study Report.

1.1. The Project Manager of Ular River Improvement Project gave an explanation and requested as follows.

1.1.1. The Project Manager principally agreed to the study result of flood control scheme.

1.1.2. For irrigation scheme, the Project Manager strongly requested 2 (two) items mentioned below.

(a) Reduction of reconstruction of intakes.

(1) The existing whole intakes along the lower reaches of the Ular river except Pulau Gambar, Singosari and Wonosari will be left as they are, due to social conditions.

(2) Singosari & Wonosari which are proposed as Singosari intake will newly be constructed.

(3) Extension of irrigable area in Swadaya, Buluh, Perbaungan irrigation systems will depend upon the capacity of the existing intakes and improvement of the existing and necessary irrigation canals will be rehabilitated based on the above-mentioned matter.

(4) The remaining area which is not covered by item 3 except Singosari area on the right side of the Ular river will be irrigated from Pulau Gambar intake. Pulau Gambar intake will be reconstructed for the above-mentioned purpose.

(5) Extension of irrigable area on Timbang Deli, Sumber Rejo and Ramonia intakes depends upon the capacity of the existing intakes and improvement of the existing and necessary irrigation canals will be rehabilitated. The existing aqueduct in Sumber Rejo area should be left as it is.

(6) If the existing capacities of Timbang Deli and Sumber Rejo intakes are not enough for proposed irrigable area in Timbang Deli and Sumber Rejo area, reconstruction of the above-mentioned intakes and necessary canals will be considered.

(b) Sediment problem.

(1) Sedimentation in the existing irrigation system is important problem for the Project.

1.2. The JICA Team gave explanations as follows.

1.2.1. Preparation of the final study report will be proceeded based on the Draft Study Report.

1.2.2. The requested items as shown in 1.1.2. will be studied in more detail during the Feasibility Study period.

II. Scope of Work.

2.1. The study for the items as mentioned in paragraph 1.1.2. will be carried out in more detail during the Feasibility Study period. The irrigation Plan mentioned in paragraph 1.1.2. leads the final concepts for the Feasibility Study.

2.2. If the alignment of proposed irrigation canal is in plantation area, it should be considered to use lining canal in order to reduce the seepage.

2.3. Sediment control devices will be studied in more detail during the Feasibility Study. The approach of study would be as follows.

(a) Approaching velocity shall be reduced by means of some energy dissipation devices at the head of approaching canal.

(b) Counter measure against sediment which deposits in canal would be solved by settling basin with gravity flushing canal if possible.

(c) If it is not possible, maintenance of the settling basin will be considered by use of man-power or some equipment.

2.4. Improvement of drainage in the plantation area will not be included in the Project. It is desirable to give general descriptions for about improvement of drainage in consideration of lowering of ground water table.

2.5. In order to get electric conductivity and pH, field test should be conducted.

2.6. An artificial retarding basin in Pulau Gambar area will be considered as an alternative for flood control device.

Mr. K. Kasama	Mr. Machmudin Makdurah
Co-Leader of the Feasibility Study Team, JICA	Project Manager of Ular River Improvement Project

Attachment

LIST OF ATTENDANCE

Held on : Tuesday 8th November 1977.
Time : 9.00 - 12.00.
Place : Meeting Room DPUP - Medan.

INDONESIA

Mr. Machmudin Makdurah
Mr. B. Harahap
Mr. M. Nainggolan
Mr. Nakahiro
Mr. Waluyo Sabarno
Mr. B. W. Limbong
Mr. Dartawan S.
Mr. J. Banjarnahor
Mr. Dj. Siahaan
Mr. N. Ginting
Mr. N. Bangun
Mr. B. Tampubolon
Mr. Sahar
Mr. L. Sibarani
Mr. L. Pardosi
Mrs. Aisyah Nasution

JAPAN

Mr. S. Inoue
(Chairman of Advisory Committee)
Mr. Y. Takeuchi
(Advisory Committee)
Mr. K. Tanaka
(Advisory Committee)
Mr.. Y. Suematsu
(Advisory Committee)
Mr. K. Kasama
Mr. K. Onaka
Mr. T. Kawaguchi
Mr. M. Shono
Mr. A. Takubo
Mr. M. Yonai
Mr. K. Nakajima
Mr. S. Ohtsuki
Mr. M. Kodama