

AVERAGE 10 DAYS RIVER DISCHARGE (SELAGAN RIVER)

Period	10 Days River Discharge	Intake Discharge	Surplus Discharge	Remarks
	m ³ /s	m ³ /s	m ³ /s	
Jan. 1	51.67	2.33	49.34	
2	34.31	2.75	31.56	
3	34.59	2.96	31.63	
Feb. 1	35.31	2.04	33.27	
2	22.44	4.64	17.80	
3	25.62	5.73	19.89	
Mar. 1	39.68	3.09	36.59	
2	44.21	2.75	41.46	
3	40.79	3.84	36.95	
Apr. 1	28.06	3.93	24.13	
2	23.48	2.96	20.52	
3	37.14	3.34	33.80	
May 1	25.53	2.29	23.24	
2	21.56	1.11	20.45	
3	18.85	1.99	16.86	
Jun. 1	15.50	2.20	13.30	
2	17.24	1.11	16.13	
3	11.45	0.02	11.43	
Jul. 1	16.61	0.02	16.59	
2	16.47	4.51	11.96	
3	19.48	4.93	14.55	
Aug. 1	16.66	5.19	11.47	
2	9.21	3.93	5.28	Min. dis.
3	12.83	6.45	6.38	
Sep. 1	27.69	4.98	22.71	
2	26.48	3.46	23.02	
3	36.82	0.02	36.80	
Oct. 1	27.23	5.14	22.09	
2	31.21	4.18	27.03	
3	30.57	2.41	28.16	
Nov. 1	32.37	3.09	29.28	
2	24.25	3.76	20.49	
3	36.08	1.15	34.93	
Dec. 1	30.81	0.36	30.45	
2	37.75	0.86	36.89	
3	39.83	1.28	38.55	

4.4.5 Drainage Plan

About 50% of the irrigable area for the Project is distributed in the lower area of which the elevation is less than 5.0 m. Provision of a suitable drainage facility is one of the important factors to improve agricultural productivity and to reduce farming labour force in the low-lying land of the project.

Further, since it is necessary to make the high ground water level at present lower, the drainage net works are planned to lower the ground water level to 1.0 - 1.5 m below the ground.

Muko-Muko, the capital of the Kecamatan Muko-Muko Utara, is located in the upstream about 7 Km far from the mouth of the Selagan river and met the floods in November 1988 and January 1989 recently. In order to reduce the damage due to the floods, it is planned that the mouth of the Hitam river is changed in the downstream from Muko-Muko by a main drainage canal.

Design drainage discharges are obtained dividing each catchment area into rice field and non-rice field.

4.4.6 Alternative Study on Intake Facility

(1) Location of weir

From the view of ground elevation in the planning area and the intake water level, the site of weir is proposed at a certain place of the Selagan river within about 4 Km from the upstream part of the river near Kp. Lubuk Sahung to the downstream part near Kp. Surian Benkal.

As a result of the study by the available topographical maps with a scale of 1/2,000 and field reconnaissance, the following two (2) weir site are compared.

- Downstream site : at the place about 2.3 Km in the upstream from the Kp. Lubuk Sahung bridge (Plan of DPU, Province)
- Upstream site : at the place about 0.8 Km in the upstream from the downstream site (Plan of D.P.M.A)

After the comparative study on the line of existing river, river bed elevation, shape and elevation of the both side levees, location and condition of tributaries, geological condition, backwater level at the time of flood, construction method, etc. between the above two (2) sites, it is judged that the downstream site is advantageous. (refer to the following table)

Division	Downstream	Upstream	Remarks
River bed elevation	22.2 m	21.0 m	From river survey
Width of river	64 m	50 m	
Catchment area	375 Km ²	374 Km ²	By map 1/100,000
Flood discharge	1,000 m ³ /s	997 m ³ /s	1/100 probability
Width of weir	74 m	73 m	
Weir height	3.80 m	5.35 m	
Weir crest elevation	26.00 m	26.35 m	
Length of river bank	205 m	40 m	
Canal length	-	800 m	
Ratio of Construction Cost	1.00	1.23	

The results of the comparative study on the above two plans are as follows.

- a. The weir at the upstream site has smaller width, but has higher height because the river bed elevation is lower than that of downstream caused by the reverse slope of the river.
- b. The ground elevation along the scheduled canal route of upstream plan is about 10 meter higher than the downstream site. From this factor, the canal construction cost becomes expensive.
- c. The size of the weir in the upstream site is higher by 1.55 meter of the weir height.
- d. To keep the unit flood discharge which is the standard, $q = 12.0 - 14.0 \text{ m}^3/\text{s}/\text{m}$, the width of weir in the upstream site becomes almost the same with the width of downstream site.
- e. There is no influence of the back water to the upstream villages in both sites.
- f. From view of technical, economical points and operation & maintenance, the downstream plan is more advantageous for the weir site.

Hence, the downstream site is adopted as the weir site of this project.

(2) Small-scale hydro-power generation

The discharge of the Selagan river is affluent in comparison

with the intake discharge for irrigation and the proposed weir has the energy of head of about 4.0 m. Therefore, it is possible to produce small-scale hydroelectric power.

The maximum discharge for the small-scale hydro-power generation is estimated at 10.72 m³/s, taking the minimum ten days discharge of the river to be 17.33 m³/s, which appears in the second period in August out of each mean ten days discharge of the river from 1981 to 1988, and the maximum diversion requirement at the weir to be 3.93 m³/s.

Under the above condition, estimating the effective head at 3.5 m, the maximum generated output of 290 Kw can be obtained. It means that the electricity can be supplied to about 9,000 households assuming the distribution of electricity for one household to be 100 w/h and taking the electric supply ratio in Bengkulu province to be 32.26%.

The economical comparative study between the diesel generation and the small-scale hydro-power generation shows that the initial cost of the diesel generation is lower than that of the small-scale hydro-power generation, but the former is about 26% higher in running cost in comparison with the later.

4.5 PROPOSED PROJECT WORKS

4.5.1 General

In order to achieve the projected agricultural development in success, the construction of following infrastructures and further improvement of supporting services are required:

- a) Construction of irrigation network consisting of a weir, linking, main and secondary canals,
- b) Construction of drainage network of secondary drain,
- c) Construction of road network which includes main, secondary and connecting roads,
- d) Construction of tertiary network consisting of tertiary and quaternary canals, tertiary and quaternary drains and farm road,
- e) Reclamation of new farm lands,
- f) Construction of O & M facilities and provision of O & M equipment, and
- g) Further improvement of the present agriculture supporting services.

The irrigation water is diverted by gravity method from the weir and conveyed through the link canal of 4.58 Km on the right side of the Selagan river, and then diverted to two (2) main canals for the right side and the left side of the Selagan river. The left main canal crosses the Selagan river by a siphon structures.

4.5.2 Weir

The result of the design is summarized as follows:

Water source	: Selagan river
Location of intake facility	: about 2.3 Km upstream from Kp. Lubuk Sahung
Catchment area	: 375 Km ²
Elevation of river bed	: 22.20 m
Elevation of crest	: 26.00 m
Height of weir	: 3.80 m
Height of weir body	: 6.30 m
Width of weir	: 74.0 m
Intake water level	: 25.90 m
Flood discharge	: 1,000 m ³ /s (1/100 year probability)
Flood water level	: 30.05 m (1/100 year probability)
- ditto -	: 30.85 (1/1,000 year probability)
Elevation of river bank	: 31.55 m
Freeboard	: 1.50 m (1/100 year probability)
- ditto -	: 0.70 m (1/1,000 year probability)

Type of weir	: Fixed type
Flood way	: Fixed type (68.0 m)
Scouring sluice	: Undersluice (2m x 2 spans)
Intake	: Sluice gate (2.9m x 3 spans)
Design intake discharge	: 6.45 m ³ /s
Fish way	: Ladder type, 2.0m x 21.24m
Small-scale hydro-power	: 290 KW, effective head, 3.5m
Construction method	: Temporary diversion

4.5.3 Irrigation Canal System

Irrigation canal system up to the tertiary box with tertiary blocks in the Project area includes a link canal, main canals and secondary canals.

(1) Link canal

A link canal with a length of 4.58 Km is constructed between the weir and a diversion structure to lead the intake discharge of 6.45 m³/s in peak time to Right Side and Left Side Main Canals.

The canal has a trapezoidal section with an inside slope of 1 : 2.0 and has 4.6 m bottom width and 1.49 m water depth. The canal is principally unlined and the longitudinal gradient of the canal base is 1/5,522.

(2) Main canals

The Right Side Main Canal of 10.51 Km is constructed for the irrigation area of 1,722 ha on the right side of the Selagan river. This canal is designed for the discharge of 3.16 m³/s at its head.

The Left Side Main Canal runs for 13.95 Km to irrigate 2,409 ha on the left side of the Selagan river and the design discharge at the head of the canal is 4.42 m³/s.

The above main canals are principally unlined.

(3) Secondary canals

These canals are branched off from the above mentioned main canals to distribute water to these secondary units of which the covering areas are more than 150 ha. Ten (10) secondary canals with a total length of about 39.8 Km are planned in the Project area. These canals are basically unlined and trapezoidal.

The numbers of the related structures for the link canal are tabulated below:

Related Structure	Numbers
Diversion	1
Turnout	3
Check	1
Spillway/waste way	1
Crossdrain	6
Bridge	3

The total lengths of the main and secondary canals and the numbers of their related structures are listed below:

Main Canal	Right Side	Left Side	Total
Canal Length (Km)	10.51	13.95	24.46
Related Structures (nos.)			
Diversion	1	2	3
Turnout	12	19	31
Check	4	5	9
Spillway/waste way	1	3	4
Siphon	1	2	3
Crossdrain	12	9	21
Bridge	7	8	15

Secondary Canal	Right Side	Left Side	Total
Canal Length (Km)	18.08	21.72	39.80
Related Structures (nos.)			
Diversion	2	2	4
Turnout	31	35	66
Check	8	12	20
Stop log	2	-	2
Spillway/waste way	4	6	10
Siphon	1	-	1
Drop	7	14	21
Crossdrain	14	6	20
Bridge	12	16	28

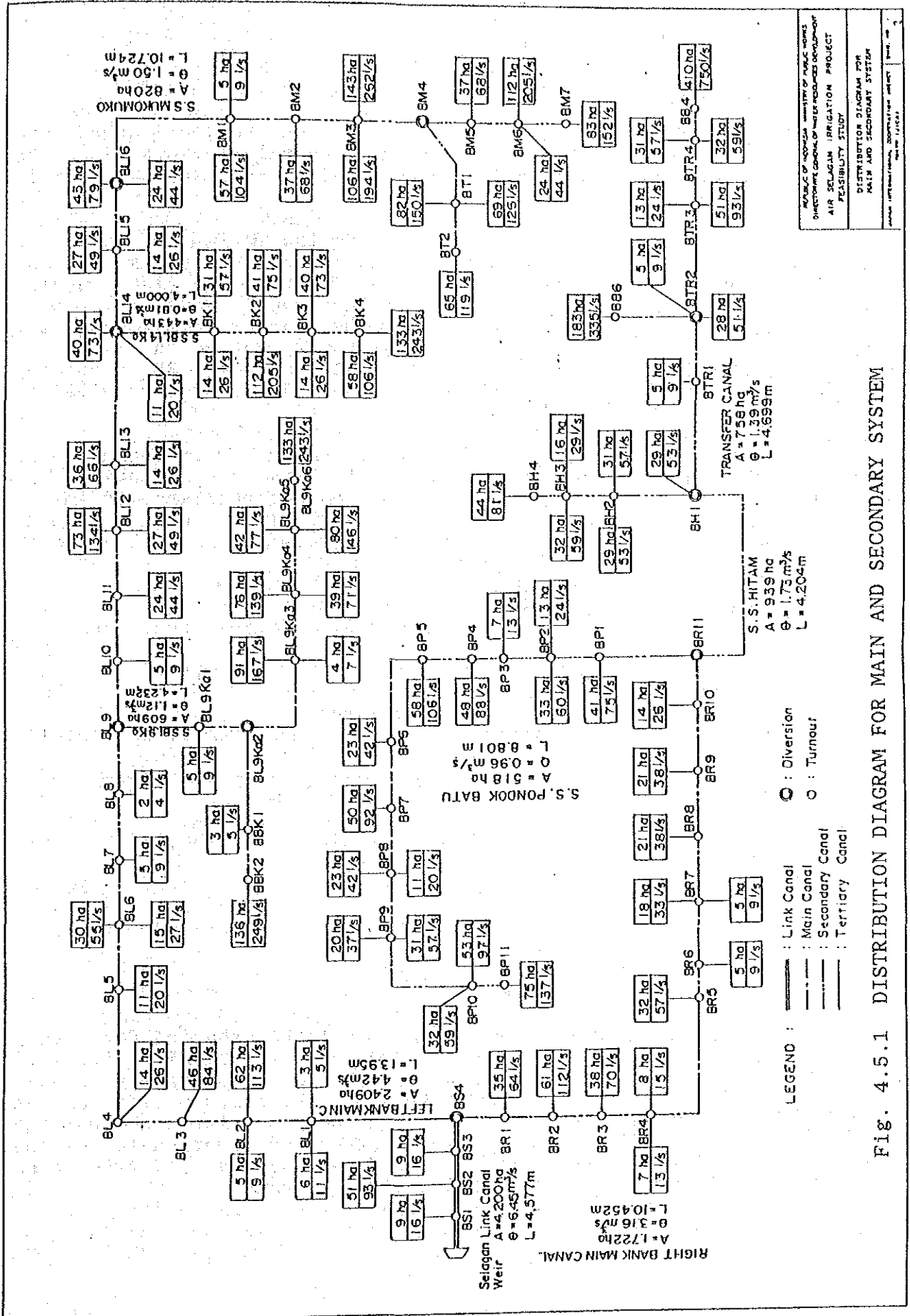


Fig. 4.5.1 DISTRIBUTION DIAGRAM FOR MAIN AND SECONDARY SYSTEM

4.5.4 Drainage Canal Networks

The drainage canal networks in the Project area are generally divided into the drainage canal network in the irrigation areas and ones in the plantation areas for oil palm in the low land.

The location of drainage canal in the irrigation area is dominated by natural streams and rivers crisscrossing in the development area. These drainage canal except for small drains in the tertiary blocks of which the covering area are less than 150 ha and will be designed to collect water from quaternary drains and tertiary drains and transport collected water to streams or rivers. For the whole irrigation areas, 32 secondary drainage canals with a total length of 71.20 Km will be excavated.

The drainage canals in the plantation area are planned to be connected with the Selagan river and the Hitam river, taking the topographical conditions into account and their alignments to be at almost right angle to the coastal line with pitches of 50m - 1,000m. For the plantation area, 9 drainage canals with a total length of 28.6 Km are designed.

The following table shows the required lengths of the drainage canals and the numbers of their related structures.

Division	Irrigation Area		Plantation	Total
	Right Side	Left Side		
Drainage canal				
Number (nos.)	14	18	9	41
Length (Km)	38.5	32.7	28.6	99.8
Related structure				
Crossdrain	8	1	1	10
Bridge	6	2	9	17

4.5.5 Tertiary Development

The tertiary development program will be prepared for every tertiary block to be irrigated by tertiary system. The tertiary system will consist of tertiary canals and quaternary canals which will respectively cover the tertiary block of 150 ha at maximum and quaternary blocks (10-15 ha), tertiary drains and quaternary drains which will also be required to evacuate excess water from the blocks, and farm roads with 1.5 m effective wide principally constructed along the tertiary canals.

The following table shows the total required length of each on-farm facility.

On-farm Facility	Right Side	Left Side	Total
Tertiary canal (Km)	34	41	75
Tertiary drain (Km)	29	39	68
Quaternary canal (Km)	90	119	209
Quaternary drain (Km)	18	24	42
Farm road (Km)	36	48	84

4.5.6 Inspection Road

In the Project area except the areas for tertiary blocks, the following two types of inspection roads will be provided.

- a) Main inspection roads along the link canal and the main canals with 4-meter effective width and gravel metaling.
- b) Secondary inspection roads along the secondary canals and the drainage canals with 2.5-meter effective width and gravel metaling.

The following table shows the respective road length.

Division	Right Side	Left Side	Total
Main inspection road (Km)			
Link canal	-	-	4.6
Main canal	10.6	14.0	24.6
Secondary inspection road (Km)	85.2	54.5	139.7

4.5.7 Land Reclamation

The clearing works of forest for the first arable farm land for the new transmigration program in the Project area will be carried out by the Ministry of Transmigration. The clearing work is made and followed by firing. Uprooting work is made after firing and finally the rough leveling work is carried out.

The construction of on-farm facilities and farm land including leveling work are principally carried out by the farmers themselves under the land development project of the Ministry of Agriculture.

Actually, however, the land clearing works of about 470 ha for the existing transmigrants should be carried out by the Project taking into consideration the difference of the

demarcation between the first arable farm land and the proposed irrigation area, and the lack of fund of the farmers in the Project area.

4.5.8 Offices and Quarters

Offices and quarters are required for the persons to be engaged in the project implementation and in the operation and maintenance of the project facilities. The required number and space of these facilities are briefly estimated as follows:

a)	Main office	:	1,000	m ²
b)	Quarters	:	1,500	m ²
c)	Store house	:	200	m ²
d)	Motor pool	:	200	m ²

4.6 CONSTRUCTION PLAN

The implementation period is planned at six (6) years from 1991/92 to 1996/97. Two (2) years from 1991/92 to 1992/93, are the period necessary for survey and investigation, detailed design of weir and irrigation and drainage facilities, preparatory works, tender and contract business, etc.

The construction period is estimated at four (4) years from 1993/94 to 1996/97 taking into account the scale of works, the project economy, etc. As to the construction of each work diversion, it is generally durable to carry out the construction in sequence of drainage canal, main canal, secondary canal and tertiary networks and to complete the construction of tertiary networks in each work division.

Each work division is generally proposed as shown in the following table and the implementation schedule of the project is shown in Fig. 4.6.1.

Work Division	Main Works	Construction Year	
I	Weir (H=3.8m, B=74.0m), Link canal (4.58Km) Tertiary development (69ha) Related structures	1993/94	
	Sand trap : 1	- 1996/97	
	Diversion : 1		
	Turnout : 3		
	Check : 1		
	Spill/waste way : 1		
	Crossdrain : 6		
	Bridge : 3		
	Main canal (10.51Km) Secondary canal (12.47Km) Tertiary development (1,477ha) Drainage canal (6.76Km) Related st. (main)(Secun- (Drain- Total dary) age)		
	II (Right Side)		Diversion 1 2 - 3
	Turnout 12 24 - 35	- 1996/97	
	Check 4 5 - 9		
	Stop log - 2 - 2		
	Spillway 1 3 - 4		
	Siphon 1 1 - 2		
	Drop - 7 - 7		
	Crossdrain 12 10 2 24		
	Bridge 7 8 - 15		

Work Division	Main Works			Construction Year	
	Main canal (20.06Km)				
	Secondary canal (5.57Km)				
	Tertiary development (1,038ha)				
	Drainage canal (9.95Km)				
	Related st. (main)	(Secondary)	(Drainage)	Total	
III (Left Side)	Diversion	2	1	3	1994/95
	Turnout	19	10	29	-
	Check	5	3	8	1996/97
	Spillway	2	1	3	
	Siphon	2	-	2	
	Drop	-	8	8	
	Crossdrain	9	3	12	
	Bridge	8	4	12	
	Secondary canal (5.61Km)				
	Tertiary development (245ha)				
	Drainage canal (60.15Km)				
	Related st. (main)	(Secondary)	(Drainage)	Total	
IV (Right Side)	Turnout	-	7	7	1994/95
	Check	-	3	3	1996/97
	Spillway	-	1	1	
	Crossdrain	-	4	7	11
	Bridge	-	4	15	19
	Main canal (1.90Km)				
	Secondary canal (16.15Km)				
	Tertiary development (1,371ha)				
	Drainage canal (22.75Km)				
	Related st. (main)	(Secondary)	(Drainage)	Total	
V (Left Side)	Diversion	-	1	1	1994/95
	Turnout	5	20	25	
	Check	1	8	9	1996/97
	Spillway	1	4	5	
	Drop	-	6	6	
	Crossdrain	1	2	1	4
	Bridge	1	11	2	14

Fig. 4.6.1 PROJECT IMPLEMENTATION SCHEDULE

W O R K	ITEM(Quantity)	1991/92												1997/98			
		GA	LA	△	5	△	15	12	52	1993/94	1994/95	1995/96	1996/97				
I. LOAN AGREEMENT I-1 Loan Agreement I-2 Selection of Consultant I-3 Detailed Design I-4 Aero-photo Survey(14,800 ha) I-5 Construction Supervision																	
II. PREPARATORY WORK II-1 Tendering II-2 Office and quarters II-3 Land Acquisition II-4 Access Road																	
III. IRRIGATION & DRAINAGE CONSTRUCTION III-1 Work Division -I (Right Bank)	1. Head work (H=3.5m, W=74m)																
	2. Link canal (4.58km)																
	3. Tertiary canal (69 ha)																
III-2 Work Division -II (Right Bank)	1. Right main canal (10.51km)																
	2. Secondary canal (12.47km)																
	3. Tertiary canal (1.477ha)																
	4. Drainage canal (6.75km)																
III-3 Work Division -III (Left Bank)	1. Left main canal (12.06km)																
	2. Secondary canal (5.57km)																
	3. Tertiary canal (1,038ha)																
	4. Drainage canal (9.95km)																
III-4 Work Division -IV (Right Bank)	1. Secondary canal (5.61km)																
	2. Tertiary canal (245ha)																
	3. Drainage canal (60.15km)																
III-5 Work Division -V (Left Bank)	1. Left main canal (1.90km)																
	2. Secondary canal (16.15km)																
	3. Tertiary canal (1,371ha)																
	4. Drainage canal (22.75km)																
IV. SMALL-SCALE HYDRO-POWER STATION IV-1 Civil Works IV-2 Electric Equipment	290 kw																

V. ORGANIZATION AND MANAGEMENT

5.1 Organization for Project Execution

The Directorate General of Water Resources Development (DGWRD) in the Ministry of Public Works would be the executing agency for implementation of the Air Selagan Irrigation Project. DGWRD would be responsible for both the engineering works and the construction works of the project. It would coordinate all activities of the relevant government agencies and regional administrative organizations in connection with the project implementation.

Actually, the Directorate of Irrigation-II under the said DGWRD would direct responsibility for the project implementation. Public Works Bengkulu Province would directly coordinate the construction of the Project at the provincial level on behalf of Ministry of Public Works.

In order to attain the project successfully, it is proposed to organize the project executing office under the superintendent of the Directorate of Irrigation-II. The main tasks of the project office would be as listed below.

- a) Financial arrangements needed for the engineering and construction works of the project.
- b) Design, preparatory work and construction supervision of all the implementation activities.
- c) Technical assistance and guidance of the on-farm development to be executed by the farmers.
- d) Coordination along the government authorities concerned with implementation of the project; the transmigration office (Kantor Transmigrasi), namely agricultural office (Dinas Pertanian), Estate Office, KUD and regional governments.
- e) Personnel arrangements for staffs to be required during the construction and O&M stage.
- f) Accounting and management of the engineering services and the construction works.

The project office during the construction stage will be organized in the project area. The organizational structure is proposed as presented in Fig. 5.1.

5.2 Operation and Maintenance of the Project

After completion of the construction works, the project executing office will be reorganized into the O&M office which will be responsible for the operation and maintenance of all facilities, covering the irrigation facilities up to tertiary blocks. The operation and maintenance between the tertiary blocks and terminal facilities will be entrusted to the farmers' water user group (KP2A) and farmers themselves.

The proposed organizational structure of the O&M office will have four sections, namely operation section, repair and maintenance section, assistance section and administrative section (see Fig. 5.2). The main tasks of these sections are summarized below.

a) Operation Section

- Planning of irrigation schedule
- Arrangement of water distribution
- Hydrological measurement
- Data collection and processing

b) Repair and Maintenance Section

- Repair and maintenance of facilities and equipments
- Management and inspection of facilities and equipments

c) Assistance Section

- Guidance and training to water users' association
- Monitoring and evaluation

d) Administrative Section

- Personnel services
- Accounting and cashiering
- General affair services

It is proposed that O&M Office be established in these areas in order to execute the smooth and effective water management, otherwise the project area are divided into two areas and water delivery made separately within these areas.

The staff necessary for the O&M office were estimated at 87 persons including water management engineering, hydrologist, mechanics, driver/operators, accountant, etc.

The O&M equipment that will be required during the O&M stage are bulldozer, motor grader, vehicles, measuring instrument, etc. These are listed in Table 5.1.

5.3 Water Users' Association

The O&M of irrigation and drainage facilities in the tertiary block will be done by the farmers' water user group (KP2A). Before completion of construction of the project facilities, this association should be established in each village with guidance from the O&M section of the project executing office during the construction period, O&M office and the agricultural extension office. In particular, the O&M office will provide full technical guidance and advice for water supply management and maintenance of the facilities.

In order to ensure effective water supply and smooth operation and management of irrigation facilities, it is recommended that the water user group be established in the Project area, taking the following items into consideration.

- a) Establishment of water user group should be on a village basis and covering several tertiary blocks, and such that every farmer who is either a land proprietor or a share-cropper in the tertiary block must be a member.
- b) The management and operation of the water user group should be conducted by a manager with technical assistance under supervision of the Public Works and Agricultural Services at both of Kabupaten and/or Kecamatan levels.
- c) Good relationships with the concerned government agencies such as Public Works, Agricultural Service, Rural Extension Center and KUD will promote the successful performance of the activities of these associations.

The proposed organization of a water user group is presented in Fig. 5.3. The association would have a Board, and be staffed by a manager, treasurer, secretary and several Ulu-Ulu (water masters). It is suggested that a unit water user's association be set up in each tertiary block, which will take overall responsibility for distributing irrigation water. They will, therefore, be trained by the staff of the O&M Office.

The number of water user group to be established in the Project area was estimated as seventeen.

Table 5.1 O&M EQUIPMENT

No. Equipment	Type	Nos.
1 Backhoe	0.3 m3	1
2 Bulldpzer	6 ton	1
3 Motor Grader	Blade 3m	1
4 Tire Roller	6-8 ton	1
5 Rammer	80 kg	2
6 Concrete Mixer	0.2 m3	1
7 Concrete Vibrator	Dia 45 mm	2
8 Submersible Pump	11kW*a50 mm	2
9 Generator	20 kVA	1
10 Dump Truck	4 ton	2
11 Truck with Crane	4 ton	1
12 Jeep (4WD)		3
13 Motor cycle	100 cc	10
14 Micro computer with printer and CRT		1 set
15 Current Meter		2
16 Communication system		1 set
17 Spare parts		L.S

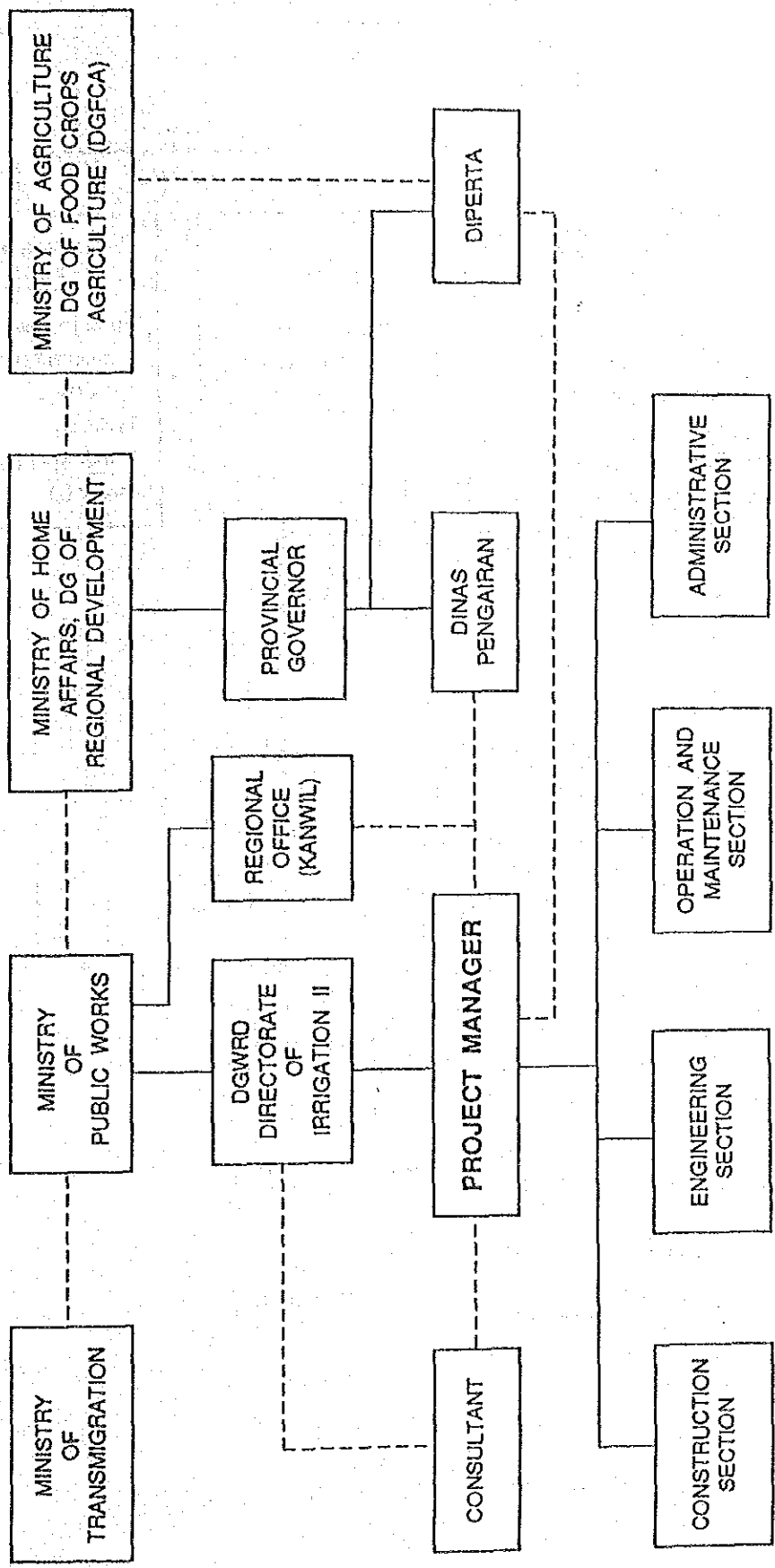


Fig. 5.1 PROPOSED ORGANIZATION OF PROJECT EXECUTING OFFICE

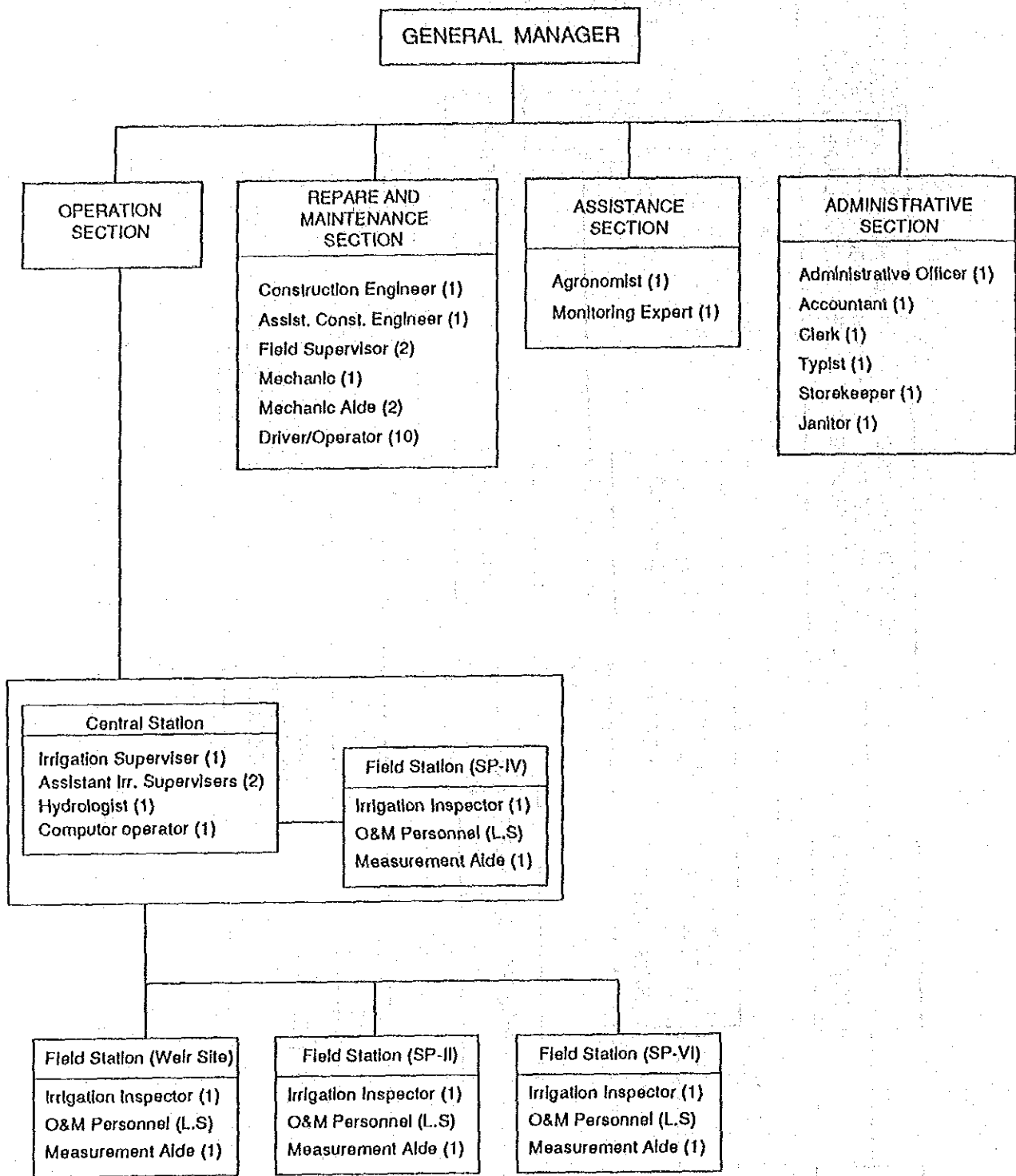


Fig.5.2 PROPOSED ORGANIZATION OF O & M OFFICE

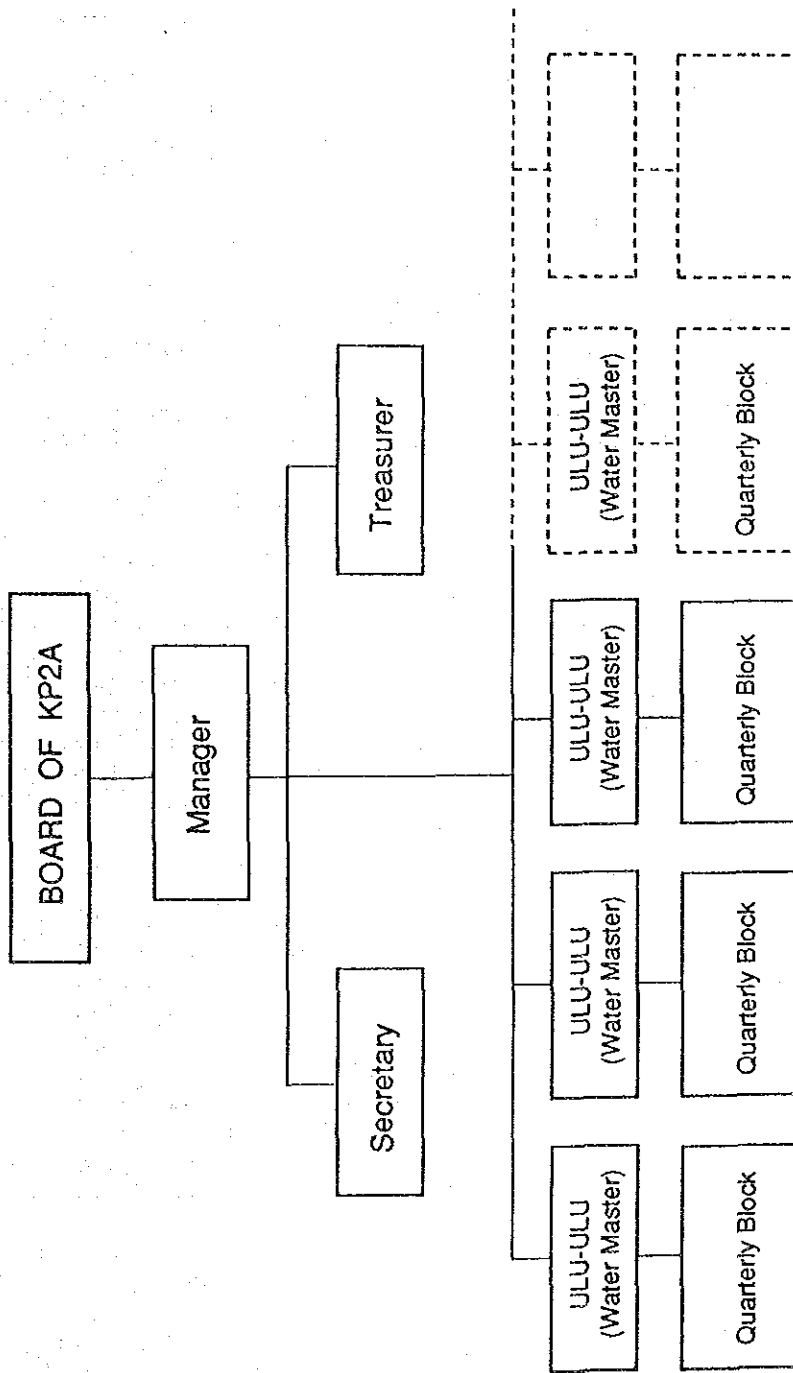


Fig. 5.3 PROPOSED ORGANIZATION OF WATER USERS' ASSOCIATION

VI. COST ESTIMATION

6.1 Conditions

Construction cost required the development plan is estimated under the following conditions.

- (1) Exchange Rate : 1.0 US\$ = 1,845 Rp.
- (2) All the construction work is under contract by a contractor with his own construction machinery.
- (3) Unit cost of the construction works is calculated by the actual cost of materials and labour costs in the end of 1989.
- (4) Construction cost consists of portions of foreign currency and local one and each of them includes the following items.

Local currency portion

- Labour force
- Aggregate, Gravel and timber
- Fuel, oil, etc. (raw cost)
- Costs of internal transport
- General fee of Indonesian Government during the construction period
- Expenses & benefit of internal contractors
- Engineering service fee of the internal consultants
- and others.

Foreign currency portion

- Reinforcement and structural iron material
 - Iron gate, Diesel power generator, motor and other iron works
 - Cement excluding raw cost
 - Fuel, oil, etc. excluding raw cost
 - Cost of the depreciation of construction machinery
 - Vehicles required for construction supervision and operation and management
 - Expenses & benefit of foreign contractors
 - Engineering service fee of foreign consultants
- (5) A part of the cost clearing trees & bush off, is included in the preparatory works.
 - (6) The physical contingency is given 5% of the direct costs. And the price contingency for the foreign currency portion is calculated about 3.7 - 4.8% per annum and for the local currency portion 9.9%.
 - (7) The associated costs to be financed by the Government, such as the cost for strengthening the extension services, facilities of the water users' association, and improvement

of the social infrastructures are not included in the estimate.

6.2 Estimate

Total cost of this project is about 37.3×10^6 US\$ consist of 9.8×10^6 US\$ in local portion and 27.5×10^6 US\$ in foreign portion.

The detail of total cost estimation is shown in Table 6.1.

6.3 Annual Disbursement Schedule

Annual disbursement schedule is carried out based on the annual construction plan. It is shown in the following table.

Year	Foreign Portion (10^3 US\$)	Local Portion (10^3 US\$)	Total (10^3 US\$)
1991/92	337	138	475
1992/93	1,307	394	1,701
1993/94	1,673	795	2,468
1994/95	6,583	2,588	9,171
1995/96	11,347	3,937	15,284
1996/97	6,236	1,990	8,226
Total:	27,483	9,842	37,325

Table 6.1 SUMMARY OF PROJECT COST
(Unit: Million Rp.)

Item	Project Cost		
	Foreign Portion	Local Portion	Total
1. Preparatory Works	1,451	622	2,073
2. Irrigation and Drainage Construction(4,200ha)	25,879	7,909	33,788
2.1 Work Division-I	4,324	1,662	5,986
Head Works	2,754	1,219	3,973
Main & Sec. System	1,530	431	1,961
Tertiary System	40	12	52
2.2 Work Division-II	7,102	2,172	9,274
Main & Sec. System	6,242	1,924	8,166
Tertiary System	860	248	1,108
2.3 Work Division-III	6,533	1,847	8,380
Main & Sec. System	5,928	1,673	7,601
Tertiary System	605	174	779
2.4 Work Division-IV	2,323	602	2,925
Secondary System	2,181	561	2,742
Tertiary System	142	41	183
2.5 Work Division-V	5,597	1,626	7,223
Main & Sec. System	4,798	1,397	6,195
Tertiary System	799	229	1,028
3. Small-scale Hydro-power Generation(290KW)	6,323	887	7,210
3.1 Electric Equipment	5,742	638	6,380
3.2 Civil Works	581	249	830
4. O & M Facilities Cost	735	245	980
5. Land Acquisition Cost	-	237	237
6. Administration Cost	-	880	880
7. Engineering Services	4,342	482	4,824
7.1 Detailed Design	1,737	193	1,930
7.2 Construction S/V	2,605	289	2,894
Sub-total(1 to 7)	38,730	11,262	49,992
8. Physical Contingency	1,937	563	2,500
Sub-total(1 to 8)	40,667	11,825	52,492
9. Price Contingency	10,038	6,334	16,372
Total	50,705	18,159	68,864

VII. PROJECT EVALUATION

7.1 Economic Evaluation

7.1.1 Project Costs

The project costs for economic evaluation consist of capital cost, annual operation and maintenance (O&M) cost, replacement cost and transmigration cost. These economic costs can be obtained by applying economic conversion factors (ECF) to the financial costs according to the guidelines of Public Work.

The construction cost for implementation of the Project consist of seven (7) items and the total economic construction cost would amount to Rp. 45.09 billion as shown in Table 7-1. The annual O&M cost for project facilities and small-scale hydro-power generator was estimated at Rp. 117 million and would be initially disbursed in 1997/1998 when full operation would start. Regarding the replacement cost, the steel gates installed in the project facilities would be replaced once during the entire period of the project life. Their useful lives were estimated to be 30 years, and their replacement costs were estimated at Rp. 1,009 million in total. Furthermore, the Electric equipment installed in the small-scale hydro-power generator would be replaced twice during the entire period of the project life. The useful life were estimated to be 20 years, and their replacement costs were estimated at Rp. 5,840 million at a time. The O&M equipment would be replaced every 10 years.

The transmigration cost consists of five items; i.e. 1) construction cost of houses, 2) construction cost of shallow wells, 3) land clearing, 4) settlement cost including traveling expenses of transmigration and 5) government subsidy for transmigrants. Their total cost was estimated at Rp 11,088 million.

Land acquisition costs and price contingency were excluded from the project economic costs. Since EIRR of the Project is measured at constant prices, provision for price contingency was excluded from the project costs.

7.1.2 Project Benefits

Economic prices of farm inputs and outputs were estimated in order to evaluate the expected project benefits. Economic prices of trade goods are to be based on border prices. They are estimated on the basis of the World Bank's projections of world market prices for the year of 2000. The World Bank forecasted prices in 1985 constant price are adjusted to 1990 constant price multiplying the factor of 1.444 derived from MUV index. Non-trade goods such as, cassava and seeds are valued at financial prices estimated on the basis of current market or farm gate prices prevailing in the Project area in March 1990. As for the economic labour wage, it was valued at a shadow wage rate of 0.60 to the

financial labour wage.

The project benefits consist of irrigation benefits, drainage benefit and power benefit. The irrigation benefits will accrue primarily from increased crop production owing to stable irrigation water supply. The drainage benefit will accrue from growing oil palm and upland crops in the drained swamp area. Furthermore, the power benefit which will accrue from small-scale hydro-power generation is estimated by the least costly alternative method.

(1) Irrigation Benefits

The irrigation benefit to be expected is defined as the difference in net return from paddy between the future with and the future without project conditions.

(2) Drainage Benefits

The drainage benefit to be expected is defined as the net return from oil palm and upland crops, which oil palm farmers cultivate in their field in the future with project conditions.

(3) Power benefit

The power benefit of small-scale hydro-power generation is estimated by the least costly alternative method. In this study, a diesel generator with same capacity of the small-scale hydro-power generator is selected as an alternative power plant, considering the scale of 290 kW.

Then, annual irrigation and drainage benefit at full development stage was estimated at Rp 9,467 million, as shown below. The benefits would start to accrue from 1995/1996, and would gradually increase up to the full benefit in 2003/2004. The details are shown in Table 7-2. The power benefit of small-scale hydro power generator consists of capacity benefit and energy benefit. They based on the alternative power plant are estimated at Rp 1,084 million (see Table 7-3). The benefits would start from 1997/1998.

(Unit: Rp.million)

Crops	Total Net Return		
	Without Project	With Project	Benefits
1) Irrigation Benefit			
Paddy (Irrigated) 1st	-	2,505	2,505
Paddy (Irrigated) 2nd	-	2,505	2,505
Paddy (Rainfed) Lowland	17	-	-17
2) Drainage Benefit			
Maize	-	216	216
Oil Palm	-	4,312	4,312
3) Power Benefit			
Capacity benefit	-	832	832
Energy benefit	-	252	252
4) Negative benefit			
Rubber	54	-	-54
Total	71	10,622	10,551

Negative benefits will occur on lands to be occupied by house lot and public land. About 460 ha of rubber land would be required for right of way for house lot and public land. The production foregone was counted and deducted from benefit under the future with project condition. As regards the swamp forest, no opportunity cost in a national economic sense was evaluated, since there was no potential alternative.

7.1.3 Economic Evaluation

(1) EIRR, B/C and B-C

In order to compute the EIRR, B/C and B-C, the annual economic costs and benefits flows were firstly prepared as shown in Table 7-4. The results were also obtained as follows. Assuming the discount rate of 10%, The B/C and B-C are estimated.

EIRR (%)	12.7
B/C	1.32
B-C (Rp. 10 ⁶)	12,209

As shown in the above table, these results indicate that the Project is economically viable.

(2) Sensitivity Analysis

Project sensitivity in terms of the EIRR was analyzed in respect of changes in project costs and benefits. The results of analysis are summarized below.

(EIRR: %)

Project Costs	Delay in commencement of construction			
	0 year		1 year	
increased	Benefit Decreased			
	0%	-10%	0%	-10%
0%	12.7	11.7	11.7	10.8
10%	11.8	10.7	10.9	10.0
15%	11.3	10.3	10.5	9.6

As a result of sensitivity analysis, if project costs increase by 10% and project benefits decrease by 10%, the feasibility of the Project is economically marginal.

Additionally, the EIRR, B/C and B-C of small-scale hydro-power generation at the discount rate of 10% is estimated. The result is as follows:

EIRR (%)	14.6
B/C	1.37
B-C (Rp. 10 ⁶)	1,612

Accordingly, the construction of small-scale hydro-power generator could be feasible.

7.2 FINANCIAL EVALUATION

7.2.1 Repayment of Project Cost

The repayment capability of the Project was studied by preparing cash flow statements on the basis of an annual disbursement schedule of the construction cost, fund requirement and anticipated project revenue. The total project cost including price contingency is summarized below.

(Unit: Rp. million)

Item	F.C.	L.C.	Total
1) Preparatory Work	1,451	622	2,073
2) Civil Work	25,879	7,909	33,788
3) Small-scale Hydro-power Generation	6,323	887	7,210
4) O & M Facilities	735	245	980
5) Land Acquisition	0	237	237
6) Administration	0	880	880
7) Engineering Service	4,342	482	4,824
8) Physical Contingency	1,973	563	2,500
Sub Total	40,667	11,825	52,492
9) Price Contingency	10,038	6,334	16,372
Total	50,705	18,159	68,864

To estimate funding requirements, it's assumed that the capital required for the implementation of the project will be arranged under the following conditions:

- (1) Foreign currency portion of the capital cost is financed by a loan of international organization.
- (2) Interest rate of the loan is 2.5% per annum and repayment period is 30 years including 10 years grace period.
- (3) Local currency portion of the capital cost is financed by the Government budget without repayment.

According to the above assumptions, the total fund requirements for construction of the Project was estimated with its yearly breakdown as shown below.

(Unit: Rp. million)

Year	International Fund	Government Budget	Total
'91/'92	622	254	876
'92/'93	2,411	727	3,138
'93/'94	3,087	1,467	4,554
'94/'95	12,145	4,775	16,920
'95/'96	20,935	7,264	28,199
'96/'97	11,505	3,672	15,177
Total	50,706	18,158	68,864

As shown in the above table, the estimated fund requirement is Rp.68,864 million divided between foreign currency portion of

Rp.50,705 million equivalent and local currency portion of Rp.18,159 million.

Assuming that service fee is imposed on rice farm and oil palm farm to recover all O & M costs according to proposed plan, the annual irrigation service fee is estimated Rp.3,8200 for rice farmer and Rp. 17,300 for oil palm farmer in conformity to the principle that beneficiaries should pay for a project. The annual project revenue which accrue from the service fee will amount to Rp. 126 million, it's equal to O & M cost. Considering that, cash flow statement of the Project executing agency are prepared under with irrigation service fee (see Table 7-5). For reference, cash flow statement without irrigation service fee is shown Table 7-6.

7.2.2 Capacity to pay of farmers

In order to assess the capacity to pay of farmers, the analysis of their farm budget is studied under future with project condition.

(Unit: Rp. thousand)

Item	Without Project		With Project	
	Fund	Rice Farmer	Oil Palm Farmer	
(Farm Size)	(1.25)	(2.00)		(2.50)
1) Gross Income	876	3,750	3,700	
Farm Income	780	3,750		3,700
Off-farm Income	96	-		-
2) Gross Outgoing	811	1,525	1,297	
Production Cost	72	786		558
Living Expense	739	739		739
3) Net reserve/ Capacity to pay	65	2,225	2,403	

As shown in above table, the future farm's net profit of rice farmer and oil farmer will increase remarkably to Rp.2.2 - 2.4 million, respectively under the with-project condition. The increase net reserve would enable farmers to pay the irrigation service fee, if it is impose to them.

7.3 INDIRECT BENEFITS AND SOCIO-ECONOMIC IMPACTS

In addition to the direct benefits counted in the economic evaluation, various secondary and intangible benefits and/or favorable socio-economic impacts are expected from the implementation of the project. Principal socio-economic impacts are described hereunder.

(1) Securing a stable food supply

The Project will contribute to attainment of self-sufficiency in rice, which has been one of the main objects of the national development plan. Sufficient supply of food will also make an important contribution to attainment of economic independence of Bengkulu province.

(2) Expansion of the willingness to work

In contrast with low productivity of the current agricultural husbandry, the farmers would find the satisfaction due to the improvement of the living standard through the increment of the crop production in future condition. In result, they will desire to gain more agricultural products and improve the living standard through the expansion of the willingness to work.

(3) Enlargement of the employment opportunity

Employment opportunity to local people will be increased by the implementation of the Project, and favorable impact to the regional economy will be expected through the increased monetary movement. The employee will gain more experience, technical know-how, skillfulness in various working fields. These accumulations of working techniques would be applied to the future development in the region.

(4) Enhancing of economic and social activities

The local transportation will be improved much by the construction of the operation and maintenance road along the irrigation canals. The expanded road system will not enhance the economic activity in and around the project area but also contribute to inter-regional accessibility and communication.

(5) Enhancing of the social supporting services

Social supporting services will be enhanced according to rehabilitation of road network and establishment of the rural development center. Road network would provide the easy access to anywhere, due to transmission of the information and activities on supporting services. Furthermore, in accordance with the certain of the close connection between the farmers and the agencies concerning the supporting services, current agricultural activities would be innovated under the future condition.

(6) Development of the regional economy

After implementation of the Project, income of farmers estimated at 2,450 households is expected to increase considerably as a direct result of the increase in crop production. Such increase in income would contribute to improving farmers' living standards. Moreover, it is expected that farmers' purchasing power would increase along with improvement of their living standards,

and this increased purchasing power would benefit the development of the regional economy.

Future marketing in the area is likely expand as compared with the present condition. With anticipated higher agricultural production, more farm products could be marketed by the farmers and the proportion of sales would also increase relative to consumption. The merchants would have a larger turnover which could increase their incomes.

(7) Acquisition of foreign money after development of the Swamp area

As regards the swamp forest, there is no potential alternative. But, after completion of the project, significant increase in Oil palm production is expected in the swamp area drained. The estimated marketable production is estimated at about 46,200 tons. The surplus would increase the annual amount of exports and thereby save and earn the foreign exchange.

Table 7.1 ANNUAL DISBURSEMENT SCHEDULE OF ECONOMIC CONSTRUCTION COST

Item	Financial Cost	ECF	Economic Cost	(Unit: Rp. Million)					
				1991/1992	1992/1993	1993/1994	1994/1995	1995/1996	1996/1997
1. Preparatory Works	2,073	0.85	1,762	264	529	353	353	263	
2. Irrigation & Drainage Construction	33,788	0.85	28,720			2,005	9,429	12,861	4,425
2-1 Work Division-I	5,986	0.85	5,088			1,374	2,188	1,476	50
2-2 Work Division-II	9,274	0.85	7,883			631	2,759	3,232	1,261
2-3 Work Division-III	8,380	0.85	7,123				2,350	3,704	1,069
2-4 Work Division-IV	2,925	0.85	2,486				597	1,318	572
2-5 Work Division-V	7,223	0.85	6,140				1,535	3,131	1,473
3. Small-scale Hydro-power Generation	7,210		6,448				177	3,224	3,047
3-1 Electric Equipment	6,380	0.90	5,742					2,871	2,871
3-2 Civil Works	830	0.85	706				177	353	176
4. O & M Facilities	980	0.90	882						882
5. Land Acquisition	237	-	-						-
6. Administration	880	0.90	792	79	119	158	158	158	120
7. Engineering Service	4,824	0.90	4,342	348	1,650	521	651	651	521
6-1 D/D	1,930	0.90	1,737	348	1,389				
6-2 S/V	2,894	0.90	2,605		261	521	651	651	521
8. Physical Contingency	2,500	-	2,148	35	115	152	538	858	450
Total	52,492		45,094	726	2,413	3,189	11,306	18,015	9,445

1US\$ = Rp. 1845
Price Index (1990=100)

Table 7.2 ECONOMIC PROJECT BENEFIT

Crops	Harvested Area*1 (ha)	Net Return per Hectare (Rp. 1,000)	Total Value (Rp. million)
Paddy Field			
I. With project			
1) Irrigated Paddy			
1st	4,200	596 *2	2,505
2nd	4,200	596 *2	2,505
Total	8,400		<u>5,010</u>
II. Without Project			
1) Lowland Paddy	140	120 *3	-17
Total	140		<u>-17</u>
Benefit			<u>4,993</u>
Peat Land			
I. With project			
1) Oil Palm	2,200	1,960 *2	4,312
Maize	1,100	196 *4	216
Total	3,300		<u>4,528</u>
Benefit			<u>4,528</u>
Others			
Without Project			
1) Rubber	460	118 *3	-54
Total			<u>-54</u>
Total Benefit			<u>9,467</u>

Remarks)

*1: Refer to Table IV-29

*2: Refer to Table VIII-15

*3: Refer to Table VIII-16

*4: Discount 40% of Net Production Value of Maize (Table VIII-15)

Table 7.3 BENEFIT FROM SMALL-SCALE HYDRO-POWER GENERATION

1. Alternative power plant	Diesel generator			
2. Installed capacity				
3. Construction cost (Economic cost)	Rp. 3,807,000,000			
Generated output	290 kW			
4. Service life of the alternative plant	20 years			
5. Annual O&M cost	3%			
6. Adjustment factor	<u>kW-adjustment</u>		<u>kWh-adjustment</u>	
	<u>Hydro</u>	<u>Thermal</u>	<u>Hydro</u>	<u>Thermal</u>
Transmission loss	0.040	0.015	0.050	0.012
Forced outage	0.005	0.050	0.005	0.025
Auxiliary power use	0.011	0.030	0.007	0.044
Overhaul	0.004	0.100	0.004	0.16
(a) kW-adjustment =	1.152			
(b) kWh-adjustment =	0.999			
7. kW-value				
Discount rate	12%			
capital recovery rate	0.13388			
kW-value (Rp. 1,000,000/kW)	2.87			
8. kWh-value				
Annual possible generated energy (1,000 kWh)	2,540			
Annual fuel consumption (1,000 liter)	1,051			
Annual fuel consumption rate (lit./kWh)	0.414			
Fuel cost (Rp./lit)	240			
kWh-value (Rp./kWh)	99.20			
9. Capacity benefit (1,000 Rp.)	832,300			
290 kW x 2,870,000 Rp./kW				
10. Energy benefit (1,000Rp.)	252,008			
2,540,400 kWh x 99.20 Rp./kWh				
11. Total power benefit (Rp.1,000)	1,084,308			

Table 7.4 PROJECT COSTS AND BENEFIT FLOWS

(Unit:Rp.million)

No	Year	Project Costs				Total (C)	Gross Benefit		Balance (B-C)
		Capital	O&M	Trans- migration	Replacement		Hydro-Irrigatio Power Drainage	Total (B)	
1	1991	726	0	1,345		2,071	-8	-8	-2,079
2	1992	2,413	0	1,223		3,636	-14	-14	-3,650
3	1993	3,189	0	1,260		4,449	-21	-21	-4,470
4	1994	11,306	0	858		12,164	-25	-25	-12,189
5	1995	18,015	0	887		18,902	-702	-702	-19,604
6	1996	9,445	74	2,120		11,639	328	328	-11,311
7	1997		117	2,173		2,290	1,084	2,678	1,472
8	1998		117	120		237	1,084	4,431	5,278
9	1999		117	65		182	1,084	7,037	7,939
10	2000		117			117	1,084	8,704	9,788
11	2001		117			117	1,084	9,322	10,406
12	2002		117			117	1,084	9,458	10,542
13	2003		117			117	1,084	9,467	10,551
14	2004		117			117	1,084	9,467	10,551
15	2005		117			117	1,084	9,467	10,551
16	2006		117		882	999	1,084	9,467	10,551
17	2007		117			117	1,084	9,467	10,551
18	2008		117			117	1,084	9,467	10,551
19	2009		117			117	1,084	9,467	10,551
20	2010		117			117	1,084	9,467	10,551
21	2011		117			117	1,084	9,214	10,298
22	2012		117			117	1,084	8,962	10,046
23	2013		117			117	1,084	8,962	10,046
24	2014		117			117	1,084	8,962	10,046
25	2015		117			117	1,084	8,962	10,046
26	2016		117		6,624	6,741	1,084	8,962	10,046
27	2017		117			117	1,084	8,962	10,046
28	2018		117			117	1,084	8,962	10,046
29	2019		117			117	1,084	8,426	9,510
30	2020		117			117	1,084	7,435	8,519
31	2021		117			117	1,084	6,585	7,669
32	2022		117			117	1,084	5,886	6,970
33	2023		117			117	1,084	5,508	6,592
34	2024		117			117	1,084	5,993	7,077
35	2025		117			117	1,084	7,056	8,140
36	2026		117		1,891	2,008	1,084	8,005	9,089
37	2027		117			117	1,084	8,805	9,772
38	2028		117			117	1,084	9,284	10,368
39	2029		117			117	1,084	9,436	10,520
40	2030		117			117	1,084	9,465	10,549
41	2031		117			117	1,084	9,467	10,551
42	2032		117			117	1,084	9,467	10,551
43	2033		117			117	1,084	9,467	10,551
44	2034		117			117	1,084	9,467	10,551
45	2035		117			117	1,084	9,416	10,500
46	2036		117		6,624	6,741	1,084	9,315	10,399
47	2037		117			117	1,084	9,214	10,298
48	2038		117			117	1,084	9,114	10,198
49	2039		117			117	1,084	9,013	10,097
50	2040		117			117	1,084	8,962	9,929

NPV(10%) = 37,586

49,794

12,209

EIRR	12.7%	Cost up (%)	Benefit Down (%)	
		0	0	10
		0	12.7%	11.7%
		5	12.2%	11.2%
		10	11.8%	10.7%
		15	11.3%	10.3%

Table 7.5 CASH FLOW STATEMENT WITH IRRIGATION SERVICE FEE

(Unit: Rp. million)

Year in Order	Year	Capital Cost		Cash Outflow			Cash Inflow		Balance		
		FC	LC	Loan Repayment		O & M Cost	Replacement Cost	Total		Revenue	
				Interest	Principal						
		FC	LC	FC	LC	FC	LC	FC	LC		
1	1991 - 1992	622	254	16	0	0	0	892	0	876	-16
2	1992 - 1993	2,411	727	76	0	0	0	3,214	0	3,138	-76
3	1993 - 1994	3,087	1,467	153	0	0	0	4,707	0	4,554	-153
4	1994 - 1995	12,145	4,775	457	0	0	0	17,377	0	16,920	-457
5	1995 - 1996	20,935	7,264	920	0	0	0	29,119	0	28,199	-920
6	1996 - 1997	11,505	3,672	1,268	0	82	0	16,527	82	15,259	-1,268
7	1997 - 1998	0	0	1,268	0	131	0	1,399	0	126	-1,273
8	1998 - 1999	0	0	1,268	0	131	0	1,399	0	126	-1,273
9	1999 - 2000	0	0	1,268	0	131	0	1,399	0	126	-1,273
10	2000 - 2001	0	0	1,268	0	131	0	1,399	0	126	-1,273
11	2001 - 2002	0	0	1,204	0	131	0	3,870	0	126	-3,744
12	2002 - 2003	0	0	1,141	0	131	0	3,807	0	126	-3,681
13	2003 - 2004	0	0	1,077	0	131	0	3,744	0	126	-3,618
14	2004 - 2005	0	0	1,014	0	131	0	3,680	0	126	-3,554
15	2005 - 2006	0	0	951	0	131	0	3,617	0	126	-3,491
16	2006 - 2007	0	0	887	0	131	1,121	4,675	0	126	-4,549
17	2007 - 2008	0	0	824	0	131	0	3,490	0	126	-3,364
18	2008 - 2009	0	0	761	0	131	0	3,427	0	126	-3,301
19	2009 - 2010	0	0	697	0	131	0	3,363	0	126	-3,237
20	2010 - 2011	0	0	634	0	131	0	3,300	0	126	-3,174
21	2011 - 2012	0	0	570	0	131	0	3,237	0	126	-3,111
22	2012 - 2013	0	0	507	0	131	0	3,173	0	126	-3,047
23	2013 - 2014	0	0	444	0	131	0	3,110	0	126	-2,984
24	2014 - 2015	0	0	380	0	131	0	3,047	0	126	-2,921
25	2015 - 2016	0	0	317	0	131	0	2,983	0	126	-2,857
26	2016 - 2017	0	0	254	0	131	7,501	10,421	0	126	-10,295
27	2017 - 2018	0	0	190	0	131	0	2,856	0	126	-2,730
28	2018 - 2019	0	0	127	0	131	0	2,793	0	126	-2,667
29	2019 - 2020	0	0	63	0	131	0	2,730	0	126	-2,604
30	2020 - 2021	0	0	0	0	131	0	2,666	0	126	-2,540

Remarks: FC = Foreign Currency, LC = Local Currency

Condition of Loan Repayment of Foreign Currency:

Interest (%) : 2.5

Grace Period : 10 years

Repayment Period : 30 years (including grace period)

Table 7.6 CASH FLOW STATEMENT WITHOUT IRRIGATION SERVICE FEE

(Unit: Rp. million)

Year in Order	Year	Capital Cost		Cash Outflow			Cash Inflow			Balance		
		FC	LC	Loan Repayment	O & M Cost	Replacement Cost	Total	Fund	Total			
				Interest Principal			FC			LC		
1	1991 - 1992	622	254	16	0	0	0	892	622	254	876	-16
2	1992 - 1993	2,411	727	76	0	0	0	3,214	2,411	727	3,138	-76
3	1993 - 1994	3,087	1,467	153	0	0	0	4,707	3,087	1,467	4,554	-153
4	1994 - 1995	12,145	4,775	457	0	0	0	17,377	12,145	4,775	16,920	-457
5	1995 - 1996	20,935	7,264	920	0	0	0	29,119	20,935	7,264	28,199	-920
6	1996 - 1997	11,505	3,672	1,268	0	82	0	16,527	11,505	3,672	15,177	-1,350
7	1997 - 1998	0	0	1,268	0	131	0	1,399	0	0	0	-1,399
8	1998 - 1999	0	0	1,268	0	131	0	1,399	0	0	0	-1,399
9	1999 - 2000	0	0	1,268	0	131	0	1,399	0	0	0	-1,399
10	2000 - 2001	0	0	1,268	0	131	0	1,399	0	0	0	-1,399
11	2001 - 2002	0	0	1,204	2,535	131	0	3,870	0	0	0	-3,870
12	2002 - 2003	0	0	1,141	2,535	131	0	3,807	0	0	0	-3,807
13	2003 - 2004	0	0	1,077	2,535	131	0	3,744	0	0	0	-3,744
14	2004 - 2005	0	0	1,014	2,535	131	0	3,680	0	0	0	-3,680
15	2005 - 2006	0	0	951	2,535	131	1,121	4,738	0	0	0	-4,738
16	2006 - 2007	0	0	887	2,535	131	0	3,554	0	0	0	-3,554
17	2007 - 2008	0	0	824	2,535	131	0	3,490	0	0	0	-3,490
18	2008 - 2009	0	0	761	2,535	131	0	3,427	0	0	0	-3,427
19	2009 - 2010	0	0	697	2,535	131	0	3,363	0	0	0	-3,363
20	2010 - 2011	0	0	634	2,535	131	0	3,300	0	0	0	-3,300
21	2011 - 2012	0	0	570	2,535	131	0	3,237	0	0	0	-3,237
22	2012 - 2013	0	0	507	2,535	131	0	3,173	0	0	0	-3,173
23	2013 - 2014	0	0	444	2,535	131	0	3,110	0	0	0	-3,110
24	2014 - 2015	0	0	380	2,535	131	0	3,047	0	0	0	-3,047
25	2015 - 2016	0	0	317	2,535	131	7,501	10,484	0	0	0	-10,484
26	2016 - 2017	0	0	254	2,535	131	0	2,920	0	0	0	-2,920
27	2017 - 2018	0	0	190	2,535	131	0	2,856	0	0	0	-2,856
28	2018 - 2019	0	0	127	2,535	131	0	2,793	0	0	0	-2,793
29	2019 - 2020	0	0	63	2,535	131	0	2,730	0	0	0	-2,730
30	2020 - 2021	0	0	0	2,535	131	0	2,666	0	0	0	-2,666

Remarks: FC = Foreign Currency, LC = Local Currency
 Condition of Loan Repayment of Foreign Currency:
 Interest (%) : 2.5
 Grace Period : 10 years
 Repayment Period : 30 years (including grace period)

7.4 ENVIRONMENTAL IMPACT ASSESSMENT

(1) Influence on Environment

This area will be newly developed for agriculture composing irrigation and plantation, and the development should be performed without affecting the environmental condition of the Air Selagan river basin. From the view points of environmental protection, the following items are required to keep in mind.

- a. The conversion of the least forest to farmland is inevitable for agricultural development.
- b. Since the project area belongs to the transmigrant area, the transmigrant people should live together with native people. Therefore, farm land should be supplied to both of them. The paddy field is allocated to 75% for transmigrant people, and 25% for native people, based on the policy of the provincial government, while the distribution of the plantation is to be 50% for the settlers from conservation area in the mountainous region, and 50% for the transmigrant people supported by the government.
- c. As for the area to be used for paddy cultivation, the existing area for the village and the roads is allotted to the native people as much as possible to prevent conflict with transmigrants concerning location of the area to be distributed.
- d. Irrigation water is to be derived from the Air Selagan by constructing a diversion weir. Few backwater can be expected unless a high weir is constructed.
- e. Water to be supplied from the weir will not cause troubles both for irrigation and for drinking because the proposed weir site is located 50 km upstream from the estuary. Water analysis, however, should be made from time to time after development.
- f. Since the ratio of the catchment area to the irrigable area is high, adequate irrigation water can be expected at the weir site, and river maintenance flow is also abundant at the lower reach of the river ($Q = 0.5 - 10 \text{ m}^3/\text{sec}/100 \text{ km}^2$).
- g. To the extent over about 23 Km from the estuary, the river is used for lumber carriers, and the draw-down of water level can be expected due to taking water at the weir site. However, the establishment of the weir may not affect navigation because the catchment area is stretching over 300 Km^2 downstream from the weir, and irrigation water with 1/5 non-exceedance probability is to be supplied.

- h. A fish way should be installed not to prevent fish for going upstream.
- i. Living water for Muko² is lifted with a pump at Pondok Batu located about 8 Km upstream from the estuary of the Air Selagan. After development, the use of fertilizer, and agricultural chemicals are surely increased. To prevent excessive use of them, agricultural extension services may be required. Water analysis should be performed continually after development. In addition, the improvement of the existing water purification facilities may be necessary according to water quality.
- j. In the case of the paddy field, good water circulation resulting from the establishment of both irrigation and drainage facilities prevents soil acidification, while in plantation and in farm land, the establishment of drainage canals may result in over-drainage which causes change in soil texture. Subsequently, the sprinkling of lime may be required.
- k. The establishment of new drainage canals not only accelerates draining the area but also reduces flood damage to Muko².
- l. In order to prevent the influence of waste water produced in the process of oil-palm, a sewage disposal site is desirable where the drainage canal leading to the downstream part of Muko² can be used.

(2) Environmental Impact Assessment

Environmental impact assessment for the Air Selagan region has been made preliminary to development as agency contract on the basis of the criteria formulated by Directorate General of Water Resources Development, Ministry of Public Works.

In assessment, the effect on the region has been judged, combining environmental factors consisting of 23 items such as meteorology, hydrology, geology, fauna, flora, social economy, culture, etc. with activity factors composing 19 items such as sort of construction works, management, maintenance, administration, etc., the evaluation of each factor is divided into three grades according to the degree of influence, and the result is shown in Table 7.6. Zero (0) in the table means no or little effect on environment, one (1) injurious, and 0.5 neutral. The total and that for activity factor are positioned respectively according to the following three grades:

a. Evaluation of effect on environmental facts

Table of evaluation mark	Degree of Influence	Percentage
0 - 8	Light impact	100%
0 - 18	Medium impact	0%
> 19	Heavy impact	0%

b. Evaluation of effect on activity factors

Table of evaluation mark	Degree of Influence	Percentage
0 - 6	Monitoring is not necessary	89.5%
7 - 14	Monitoring is necessary	10.5%
> 15	Detailed monitoring is necessary	0%

In the above a., each item has a small evaluation mark, and the degree of little influence account for 100 percent.

In the above b., 89.5% does not give impact and these activity factors are not necessary to be monitored.

After 10.5% in the medium impact shall be monitored. Mainly they consist of rice field development and oil palm development.

Table 7.7 MATRIX OF IMPACT ANALYSIS

SENSIBLE ENVIRONMENT COMPONENT	CONTRANT ACTIVITY COMPONENT	CONSTRUCTION										OPERATION							TOTAL WEIGHT					
		LAND ABANDON	BASE CAMP	MODIFICATION OF WATER FLOW	EROSION CONTROL	MATERIAL EXPLORATION	MATERIAL REPLACEMENT	COVER OAK	WEIR	INTAKE CANAL	CONVEYANCE CANAL	DRAINAGE CANAL	REFORMATION	FLUSH GATE OPERATION	CONTROL	GUARD	HAIR-FERRENTING	MOVI-TORING		RICEFIELD DEVELOP NEXT	FARM INPUT USAGE			
I. HYDROLOGY	GROUND WATER	0	1	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5
	SURFACE WATER	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	WATER QUALITY	0	1	0.5	0	1	1	0	0	0.5	0.5	0	0	0	0	0	0	0	0	0	0	0	0	5
	WATER QUANTITY	0	1	0	0	0	0	0	0	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0	0	3.5
	BACK WATER SEDIMENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.5
II. CLIMATE	AIR CONDITION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TEMPERATURE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
III. GEOLOGY	ROCKS	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	SOIL	0	0	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	8
	LAND FORM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
IV. FLORA & FAUNA	TREES	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
	SCRUBS	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
	FARMLAND	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	BIRD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LAND ANIMAL WATER ANIMAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5
V. SOCIO-ECONOMIC	THE CHANGE OF EMPLOYMENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	EDUCATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	POPULATION MIGRATION	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	INCOME	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
VI. SOCIO-CULTURAL	TOURISM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	HEALTH	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5
TOTAL WEIGHT		3	8	7	2	6	3	1	1.5	1.5	1	1	0	2.5	0.5	0.5	0	0	0	0	0	0	0	51

NOTE :
 PERCENTAGE RESULTING FROM :
 THE TOTAL OF COMPONENT INCLUDED IN GROUP X 100%
 THE TOTAL OF ALL COMPONENTS

Weight to the environment component
 Height Classification Percentage
 0 - 8 Light effect 100
 9 - 18 Medium effect 0
 >19 Heavy effect 0

Weight to activity component
 Height Classification Percentage
 0 - 5 the activity which is not necessary to be monitored 39.5
 7 - 14 the activity which is necessary to be monitored 10.5
 >15 the activity which is necessary to be monitored tightly 0

Source : Final Report / Environmental Assessment Study on the Air Salagan Irrigation Project in Bengkulu Province, Dec. 1988, JICA

APPENDIX

COLLECTED DATA

No.	Category*	Title
01	PA	Laporan Penunjang/ Pengembangan Waduk Kecil Air Selagan-Air Ketahun Propinsi Bengkulu 1983/84, PT.ISUDA, Jan.1984
02	PA	Nota Perhitungan/ Pra Design Bendung 1984/85, CV.SECON, Jan.1985
03	PA	Gambar Cetakan/ Perencanaan Peta Petak 1984/85 CV.SECON, Jan.1985
04	PA	Penyelidikan Geologi Teknik dan Mekanika Tanah Tanggul Penutup (110 M.) D.I.Air Selagan 1984/85 CV.SECON, Feb.1985
05	PA	Executive Summary Report/ Penelitian D.I.Air Selagan 1984/85, CV.SECON, Feb.1985
06	PA	Penyelidikan Geologi Teknik dan Mekanika Tanah Calon Bendung Air Selagan, Pusat Penelitian dan Pengembangan Pengairan, Jul.1985
07	PA	Pengukuran & Perencanaan D.I.Air Selagan/ Final Design dan Model Test Bendung 1 Buah 1985/86, CV.SECON, Mar.1986
08	PA	Final Report Design Bendung D.I.Air Selagan Prop. Bengkulu, CV.SECON, Mar.1986
09	PA	Final Design Tanggul Penutup Bendung 1985/86 CV.SECON, Mar.1986
10	PA	Pekerjaan Pengukuran Jaringan Utama Trace Saluran 2000 Ha, 1985/86, CV.SECON, Mar.1986

Remarks: Category*:

PA; Study report on Air Selagan Project

PM; Study report on Air Manjuto Project

R ; Five-year National Development Plan

W ; Water Resources Development

Se; Socio-economy

M ; Map

Ae; Agro-economy

DWG; Drawing

A ; Agriculture

S ; Statistics

Ge; Geology

I ; Irrigation & Drainage

St; Structure

H ; Hydrology & Meteorology

Cs; Construction

So; Soil Science

C ; Cost Estimate

Sm; Soil Mechanics

G ; General

T ; Transmigration

O ; Others

E ; Environment

No.	Category*	Title
11	PA	Draft Report/ Pemetaan Geologi Teknik Daerah Rencana Bendung Air Selagan, CV.PEMETA
12	PA	Final Report/ Lampiran Gambar, CV.PEMETA
13	PA	Final Report/ Prarencana Bendung, CV.SECON, Oct., 1987
14	PA	Diskripsi BM 1988/89, CV.SECON
15	PA	Pengukuran Teristris dan Pengumpulan/ Pengolahan Data Hidroklimatologi D.I. Air Selagan, CV.SECON, Mar. 1989
16	R	Repelita V, Chapter 9 Agriculture and Irrigation (Draft), English Version
17	I	Status Reports and Action Plans for the Second Provincial Irrigation Development Project/ Final Report Main Volume, S.M Macdonald & Partners Asia and PT. Indah Karya, Mar. 1989
18	I	Bengkulu Province Irrigation Project / Project Aid Proposal, P3SA Bengkulu, Dec. 1986
19	I	Perkembangan Pembangunan Bidang Pengairan Dinas Pekerjaan Umum Propinsi Bengkulu, Pemerintah Propinsi Daerah Tingkat I Bengkulu, Jun. 1989
20	I	Answer of Questionnaire on Irrigation Development Projects under Repelita V in Bengkulu Province, JICA, May 1989
21	S	Bengkulu Dalam Angka 1986, Statistik Propinsi Bengkulu, Aug. 1987
22	M	Operational Navigation Chart, 1:1,000,000, ONC M-10
23	M	Topo-map around Project Area, 1:100,000, 4 sheets
24	M	Topo-map of Air Selagan Project, 1:25,000, 1 sheet
25	M	Topo-map of Air Selagan Project, 1:5,000, 83 sheets
26	M	Location of transmigration in Air Manjuto and Air Selagan area, 1:25,000
27	M	Map of Concession for Plantation in Air Selagan Area 1:25,000
28	Cs	Gambar Kerja Sub Proyek Irigasi Mukomuko Paket XVI 1988/89, KanWil Prop. Bengkulu

No.	Category*	Title
29	Cs	Gambar Kerja Sub Proyek Irigasi Mukomuko Paket XVII 1988/89, KanWil Prop.Bengkulu
30	Cs	Gambar Pelaksanaan Sub Proyek Irigasi Mukomuko Paket XIX 1988/89, Kanwil Prop.Bengkulu
31	Cs	Gambar Pelaksanaan Sub Proyek Irigasi Mukomuko Paket XIII 1987, Kanwil Prop.Bengkulu
32	Cs	Gambar Pelaksanaan Sub Proyek Irigasi Mukomuko Paket XIV 1987, Kanwil Prop.Bengkulu
33	Ge	Laporan Geologi Lembar Bengkulu, Sekala 1:250,000 R.Pardede, Pusat Penelitian dan Pengembangan Geologi, Mar.1986
34	Ge	Geologic Map of Indonesia Peta Geologi Indonesia, Direktorat Geologi Indonesia, 1:2,00,000, 1962
35	T	Booklet Proyek Pemukiman Transmigrasi di Propinsi Bengkulu 1989, Kantor Wilayah Dep. Transmigrasi Propinsi Bengkulu, Jun.1989
36	T	Tugas Pokok, DitJen Penyiapan Pemukiman, KanWil Propinsi Bengkulu
37	T	Proyek Perencanaan Pemukiman dan Jalan Transmigrasi Bengkulu, 1985-1986. Lokasi; Air Manjuto I/G/4, Final Report, Mono Heksa Konsultan, Nov.1985
38	T	Proyek Transmigrasi Rencana Teknis Satuan Pemukiman Tahap III A, 1988/89, Lokasi; Air Manjuto, WPP/SKP/SP; I/G/6,7,8, Laporan Akhir, Direktorat Bina Program, Departmen Transmigrasi, Nov.1988
39	T	-ditto-, Proyek Transmigrasi Redisan Rencana Teknis Satuan Pemukiman, Lokasi; Mukomuko, WPP/SKP; I/G, SP 5, Jul.1988
40	T	-ditto-, Lokasi; Air Manjuto, WPP/SKP/SP; I/G/3, Dec.1988
41	I	Booklet, Proyek Irigasi Mukomuko Propinsi Bengkulu Kanwil Prop. Bengkulu
42	G	Rencana Tata Guna Tanah Propinsi Daerah Tingkat I Bengkulu, Data Pokok Pertanahan untuk Pembangunan, KanWil Badan Pertanahan Nasional Prop. Bengkulu, 1989

No.	Category*	Title
43	M	Identifikasi Fisik Areal Pengembangan Perkebunan Propinsi Bengkulu, Dit. Agraria, Apr.1985 S= 1:100,000 (Land use, Soil texture, Soil)
44	I	Proyek Irigasi Mukomuko, KanWil Prop. Bengkulu Budgetary Record 1983/84 to 1986/87
45	I	Irrigation Sub-Sector Loan Project Preparatory Designs, Status Report on Second Provincial Irrigation Development Project, Final Report for First 42 Schemes, Main Volume, S.M.Macdonald & PT.Indah Karya, Aug.1988
46	I	-ditto-, Annex 4 Bengkulu Province, Aug.1988
47	I	Laporan Pelaksanaan Pencetakan Sawah di Propinsi Bengkulu, Dinas Pertanian Tanaman Pangan Prop. Daerah TK I Bengkulu, Aug.1989
48	PA	Executive Summary, Studi Perencanaan Pengembangan Waduk Kecil Air Selagan-Air Ketahun Propinsi Bengkulu, 1983/84, PT.Isuda, Jan.1984. (ref.01-PA)
49	H	Hasil Survey Pengumpulan Data Hidroklimatologi, Propinsi Bengkulu 1987/88, DPU KanWil Prop. Bengkulu, Mar.1988
50	H	Penelitian Kualitas Air dan Sediment Transport Air Dikit, Air Selagan dan Air Manjuto, Direktorat Jenderal Pengairan DPU, Dit. Penyelidikan Masalah Air, Apr.1984
51	PA	Laporan Akhir, Penelitian D.I.Air Selagan 1984/85 CV. Secon, Feb.1985
52	G	Questionnaire for Fact Finding Survey on Micro Hydro Project in Bengkulu Province, Dec.1986
53	I	Laporan/ Studi Analisa Kebutuhan dan Keseimbangan Air/ Wilayah Sungai Air Manjuto Kanan Prop. Bengkulu 1985/86, DPU KanWil Prop. Bengkulu
54	I	Irrigation Sub-sector Loan Project/ Questionnaire for Project Preparation, On-going Project, Proyek Irigasi Sedang Mukomuko Kanan, Bengkulu Utara Directorate of Irrigation I, Dec.1986
55	S	Laporan Akhir/ Land Suitability Survey Air Lelangi-Air Selagan Kabupaten Bengkulu Utara/ Bagian IV; Air Dikit-Air Selagan, Institut Pertanian Bogor, Fakultas teknologi Pertanian, Dec.1982

No.	Category*	Title
56	A	2nd Symposium Data on Agriculture in Indonesia, JICA Sep.1989, Japanese Version
57	S	Appraisal Report on Air Manjuto Sedang Kecil Irrigation Project Bengkulu, DPU Bina Program Jakarta, Jul.1983
58	G	Indonesia Handbook, 1987, Jakarta Japan Club Japanese Version
59	H	Bengkulu Design Unit/ A Report on an Assessment of Surface Water in Bengkulu Province, Acres International Ltd. Canada, Mar.1982
60	PA	Laporan Akhir/ Pekerjaan Penelitian D.I. Air Selagan CV.Secon, Feb.1985
61	PA	Nota Penjelasan Peta-Petak/ Pengukuran Situasi dan Perencanaan Peta-Petak 6000 ha. 1985/86, CV.Secon Oct.1985
62	PA	Laporan Akhir/ Pemotetan Udara Wilayah Air Sebelat, Air Selagan 47000 ha., Skala 1:10000 Propinsi 21 Juli 1984, Bengkulu, PT.Indah Karya, Mar.1985
63	PA	Nota Penjelasan Pengukuran, CV.Secon (ref.15-PA)
64	PA	Final Report/ Perencanaan Teknis Pendahuluan D.I. Air Selagan, Bagian Prarencana Bendung, CV.Secon
65	H	Data Book of Rainfall Record at Lalang Luas DPU Bengkulu (1980-1989)
66	H	Data Book of Rainfall Record at Jalinjing DPU Bengkulu (1982-1989)
67	H	Data Book of Rainfall Record at Pondok Kopi DPU Bengkulu (1981-1988)
68	H	Data Book of Rainfall Record at Penarik DPU Bengkulu (1980-1986)
69	H	Data Book of Rainfall Record at Ujung Padang DPU Bengkulu (1980-1989)
70	H	Data Book of Climatological Record at Pondok Panjang DPU Bengkulu (1982-1989)
71	H	Tinggi Muka Air Dalam Meter dan Banyaknya Aliran Rata-rata Dalam Meter Kubik Per Ditik Air Manjuto DS. Lubuk Pinang (1981-1986)

No.	Category*	Title
72	H	Tinggi Muka Air Dalam Meter dan Banyaknya Aliran Rata-rata Dalam Meter Kubik Per Ditik Air Manjuto DS. Lalang Luas (1978-1987)
73	H	Tinggi Muka Air Dalam Meter dan Banyaknya Aliran Rata-rata Dalam Meter Kubik Per Ditik Air Dikit DS. Sali Bulan (1980-1986)
74	H	Tinggi Muka Air Dalam Meter dan Banyaknya Aliran Rata-rata Dalam Meter Kubik Per Ditik Air Selagan DS. Teras Terunjam (1981-1987)
75	M	False Color Photograph, S= 1:500,000, 1 sheet PUS Data Jakarta, Mar. 1, 1985
76	T	Peta Lokasi Calon Unit Pemukiman Transmigrasi di Propinsi Bengkulu, (Masa Pelita V), S= 1:200,000
77	T	-ditto-, S= 1:1,000,000, P2D-Bina Program, 1989
78	T	Peta RK WPP/SKP; I/G, Lokasi; Air Manjuto S= 1: 50,000
79	M	Peta Rencana Pengukuhan dan Penatagunaan Hutan Prop. Dati I Bengkulu, S= 1: 500,000, 1985
80	M	-ditto- , around Air Selagan, S= 1:100,000 Sep. 30, 1989
81	M	Peta Pembagian Wilayah Administrasi Pemerintahan Propinsi Dati I Bengkulu, S= 1: 500,000
82	M	Peta Pembagian Wilayah Administrasi Kehutanan Prop. Dati I bengkulu, S= 1: 500,000
83	M	Peta Penggunaan Lahan Prop. Dati I Bengkulu S= 1: 500,000, 1974/76, 1983, 1985
84	M	S= 1:500,000, 7 sheets, Prop. dati I Bengkulu
	84-1	Peta Geologi, 1977
	84-2	Peta Tanah (Soil)
	84-3	Peta Dasar, 1985
	84-4	Peta Iklim, 1977
	84-5	Peta Bentuk Lapangan
	84-6	Pola Peruntukan Tanah, 1977
	84-7	Peta Intensitas Hujan, 1981
85	M	Boundary map of PT.Tolang Tiga MMP-I ; S= 1:50,000, 1:25,000 MMP-II; S= 1:25,000

No.	Category*	Title
86	M	Topographic map around Project area S= 1:250,000, 1 sheet of original S= 1: 50,000, 7 sheets of copy
87	01	Reconnaissance Land Resource Surveys 1:250,000 scale, Atlas Format (rocedures, Center for Soil Research, 1983
88	02	Survei Kapabilitas Tanah Daerah Air Menjuto WPP I/SKP G(SP1) 1984, Pusat Penelitian Tanah
89	03	ditto, WPP I/SKP G(SP2) 1984
90	04	ditto, WPP I/SKP G(SP1) 1984
91	05	Pengamanan Tanah Yang Telah Dicadangkan untuk Lahan Pengembangan Perkebunan Besar Seluas 400,000 ha Propinsi Daerah Tingkat I Bengkulu (Scale 1:500,000)
92	06	Laporan Hasil Penelitian Sosial Ekonomi Propinsi Bengkulu Tahun 1983, Badan Perencanaan Pembangunan Daerah Tingkat I Bengkulu, 1984
93	07	Laporan Hasil Perhitungan Pendapatan Perkapita Masyarakat Propinsi Daerah Tingkat I Bengkulu Tahun 1979 - 1980, Badan Perencanaan Pembangunan Daerah (BAPPEDA) Tingkat I Bengkulu, 1981
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99	S5	Statistik Potensi Desa di Propinsi Bengkulu 1986, KSPB
100	S6	Statistik Harga-Harga Propinsi Bengkulu 1987, KSPB
101	S7	Indikator Kesejahteraan Rakyat 1987, KSPB

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102	S8	Luas Penggunaan Tanah dan Alat-Alat Pertanian Propinsi Bengkulu 1987, Dinas Pertanian Tanaman Pangan Propinsi Bengkulu dan KSPB
103	S9	Penduduk Propinsi Bengkulu Akhir 1987, KSPB
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105	S12	Rencana Pembangunan Lima Tahun Keempat Daerah 1984/85 - 1988/89, Propinsi Daerah tingkat I Bengkulu
106	S13	Bengkulu Dalam Angka 1987, KSPB
107	S14	ditto 1986, 1985, 1984, 1983
108	S18	Statistik Harga-Harga Propinsi Bengkulu 1988, KSPB
109	S19	Penduduk Propinsi Bengkulu Hasil Sensus Penduduk 1980, Biro Pusat Statistik Jakarta (BPSK)
110	S20	Statistik Indonesia 1988
111	S21	Keadaan Burh/Pekerja di Indonesia 1987, BPSK
112	S22	Sensus Ekonomi 1986, Statistik Koperasi Unit Desa 1986, BPSK
113	S23	Indikator Ekonomi Juli 1989, BPSK
114	S24	Buletin Ringkas Agustus 1989, BPSK
115	S25	Buletin Statistik Perdagangan Luar Negeri IMPOR April 1989, BPSK
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117	S27	Statistik Keuangan Desa Sumatera dan kalimantan 1986/1987, BPSK
118	S28	Pendapatan Nasional Indonesia 1984 - 1987, BPSK
119	S29	Struktur Ongkos Usaha Tani Padi dan Palawija 1986, BPSK
120	S30	Statistik Harga Perdagangan Besar Berapa Propinsi di Indonesia, BPSK

No.	Category*	Title
121	S31	Rata-rata Upah Pekerja Perkebunan 1985 - 1987, BPSK
122	S32	Indikator Pertanian 1986, BPSK
123	S33	Statistik Potensi Desa, Sensus Pertanian 1983, BPSK
124	S34	Sensus Ekonomi 1986, Statistik Potensi Desa 1986, BPSK
125	S35	Proyeksi Penduduk Indonesia per Propinsi 1985 - 1995, BPSK
126	S36	Statistik Keuangan 1987/1988, BPSK
127	S37	Nerca Bahan Makanan di Indonesia 1986, BPSK
128	S38	Produksi Tanaman Padi dan Palawija di Indonesia 1987, BPSK
129	S39	Luas dan Intensitas Serangan Jasad Pengganggu Padi dan Palawija di Indonesia, BPSK
130	S40	Sensus Pertanian 1983 Seri A2, BPSK
131	S41	Sensus Pertanian 1983 Seri B.07, BPSK
132	S42	Kecamatan Mukomuko Utara Dalam angka 1987, Mantri Statistik Kecamatan Mukomuko Utara
133	S43	ditto 1985
134	S44	Data Hasil Pendaftaran Rumah Tangga, Sensus Pertanian 1983, Kantor Statistik Kabupaten Bengkulu Utara (KSKBU)
135	S45	Bengkulu Utara Dalam Angka 1987, Kantor Statistik dan PEMDA TK, II Bengkulu Utara, KSKBU
136	S46	ditto 1986, 1985, 1984
137	A1	Pembangunan Pertanian Tanaman Pangan Propinsi Daerah Tingkat I Bengkulu REPELITA V 1988, Dinas Pertanian Tanaman Pangan Propinsi Daerah Tingkat I
138	A2	Kajian Inventarisasi Potensi Wilayah Untuk Menjang per Wilayahan Komoditi Pertanian di Propinsi Bengkulu, 1989, Kantor Wilayah Departemen Pertanian Propinsi Bengkulu
139	A3	Gema Penyuluhan Pertanian Seri No.37/NAEP/1989, Departemen Pertanian

No.	Category*	Title
140	A4	Laporan Dalam Rangka Kunjungan Direktur Jenderal Pertanian Tanaman Pangan di Propinsi Bengkulu pada Tanggal 6-8 Agustus 1989, Dinas Pertanian Tanaman Pangan Propinsi Daerah TK I Bengkulu
141	A5	Studi Pola Tanam Padi Palawija di Propinsi Bengkulu, Dinas Pertanian tanaman Pangan Propinsi Daerah TK I Bengkulu, 1988
142	T1	Tentang Mekanisme Pengadaan dan Penyampaian Paket Sarana Produksi di Daerah Transmigrasi, 1984, Direktorat Jenderal Pertanian Tanaman Pangan
143	T2	Petunjuk Pelaksanaan Kegiatan Penyediaan Sarana Produksi Pertanian Daerah Transmigrasi 1989/1990 Daerah Penerima, Direktorat Jenderal Pertanian Tanaman Pangan, Direktorat Perluasan Areal Pertanian
144	T3	Laporan Tahun Anggaran 1988/89, Kantor Departemen Transmigrasi Kabupaten Bengkulu Utara
145	E1	Rencana Pembangunan Lima Tahun Kelima Kehutanan Propinsi Dati I Bengkulu (1 April 1989 s/d 31 Maret 1994), Kantor Wilayah Departemen Kehutanan Propinsi Bengkulu 1988
146	E2	Statistik Kehutanan Propinsi Bengkulu 1987/1988, Kantor Wilayah Propinsi Bengkulu 1988
147	E3	Rencana Umum Kehutanan Propinsi Daerah Tingkat I Bengkulu (1 April 1984 s/d 31 Maret 1989) Buku I, 1987, Kantor Wilayah Departemen Kehutanan Propinsi Bengkulu
148	I1	Air Selama Irrigation Project Feasibility Study Volume 4, directorate General of Water Resources Development, 1981
149	A6	Programa Penyuluhan Pertanian Ujung Padang Mukomuko Utara, Kabupaten Dati II Bengkulu Utara, 1989/1990
150	A7	Programa Penyuluhan Pertanian BPP Sidomulyo, Kabupaten Daerah Tingkat II Bengkulu Utara, 1989/1990
151	A8	Kajian Penyempurnaan Informasi Sumber Daya Alam di Tingkat BPP Sebagai Dasar Perencanaan Paling Bawah di BPP Ujung Padang, Kabupaten Bengkulu Utara, Kantor Wilayah Departemen Pertanian Propinsi Bengkulu, 1989

No.	Category*	Title
152	A9	Profil Pengembangan Perkebunan di Propinsi Bengkulu 1989, Dinas Perkebunan Daerah Propinsi Dati I Bengkulu (DPPB)
153	A10	Data Statistik Perkebunan Tahun 1988, DPPB
154	A11	ditto 1987, 1986, 1984/85
155	A14	Buku Dokumen Proyek Tahun anggaran 1982/1983, Direktorat Jenderal Perkebunan, Direktorat Bina Program, 1982
156	A15	Evaluasi Pelita III (1979-1983) dan Rencana Pengembangan Produksi Pelita IV (1984-1988), Dinas Pertanian Tanaman Pangan, Kabupaten Dati II Bengkulu Utara (TPKBU), 1984
157	A16	Laporan Tahun 1988, TPKBU
158	A17	ditto 1987, 1985, 1984
159	A20	Rencana Intensifikasi Pertanian dan Struktur Organisasi Pelaksana BIMAS Tahun Anggaran 1989/1990, Satuan Peleksana BIMAS Kabupaten Dati II, Bengkulu Utara, 1989
160	A21	ditto Dinas Pertanian Tanaman Pangan, Kabupaten Dati II, Bengkulu Utara, 1989
161	A22	Rama Penyelenggaraan Penyuluhan Pertanian Tahun Anggaran 1989/1990, Dinas Pertanian Tanaman Pangan Kabupaten Bengkulu Utara, April 1989
162	A23	Laporan & Evaluasi Kegiatan Dinas Pertanian Tanaman Pangan Kabupaten Dati II Bengkulu Utara, Juni 1989
163	A24	Pedanan Penyelenggaraan Insus Paket D Tanaman Padi, Departemen Pertanian, 1988
164	A25	Vadecum Bimas Volume IV, Sekretariat Badan Pengendali Bimas, 1987
165	A26	Benih Bermutu Tanaman Pangan dan Diskripsi Beberapa Varietas Tanaman Palawija, Hortikultuna Perkebunan, Departemen Pertanian Sekretariat Badan Pengendali Bimas Jakarta, 1988
166	09	Laporan Hasil Pengolahan/ Analisa Data dari Propinsi Bengkulu, Direktorat Jenderal Perdagangan Dalam Negeri Departemen Perdagangan 1987/1988

No.	Category*	Title
167	Ge	Peristilahan Geologi dan Ilmu yang Berhubungan 1975
168	C	Daftar Harga satuan Pekerjaan Dalam Wilayah Propinsi Bengkulu, tahun Anggaran 1988-1989
169	M	Road Map of Benkulu Province S= 1:500,000
170	St	Design Drawings of Manjuto Weir, 3 sheets
171	C	Annual Development Program of Air Manjuto Irrigation Project (2 charts)
172	G	Aerophotograph around Selagan River, S=1:10,000 Shooted Jan. 1985, 300 sheets (kept in DOI-II office)
173	W	Landsat/Satellite Remote Sensing False Color Map S=1:500,000, S=1:125,000, Shooted on May 28, 1985
174	So1	Center for Soil Research, Bogor. Field Book for the Reconnaissance Soil Survey of Sumatera. Version 2.0, October 1988
175	So2	Department of Transmigration. Indonesian soil units and subunits for survey and mapping of Transmigration Areas. (Translation). Technical Report No.9. Version 1.0, september 1987
176	So3	Ministry of Agriculture, Government of Indonesia. Reconnaissance Land resources Survey. Atlas format procedures. Centre for Soil Research, Bogor 1983
177	So4	Kusmo Nugroho, Gunawa P.& Widjaja-Adhi I.P.G. Morphological features and formation of inland peat soils: Case study in Tarusan, west coast of west Sumatera Province. Proiding Pertemuan Tehknis Penelitian Tanah, Bogor 1987
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OTHER REFERENCES FOR SOIL & LAND USE SURVEY		
179	So6	Dent D.Acid Sulphate Soils: a baseline for research and development. ILRI publication 39, 1986
180	So7	Framework for land evaluation. FAO soil bulletin No.32, 1976
190	So8	Landon J.R, et al. Booker Tropical Soil Manual. Longman 1984
191	So9	Western S. Soil survey contracts and quality control. Oxford University Press 1978









No.	Category*	Title
COLLECTED DATA DURING PHASE-II		
01	I	Rekapitulasi Daerah Irigasi PU Propinsi Bengkulu, DOI-I, DPU, Apr.1988
02	I	Jatigude Irrigation Project Design, Computer Program for Design of Irrigation System, Program Manual, PT. Indah Karya, Aug.1989
03	I	Penelitian Kebutuhan Air untuk Pengolahan Tanah dan Tanaman Padi di D.I. Air Ketahun, Institut Pertanian Bogor, Apr.1980
04	I	Laporan Reconnaissance survey D.I. Air Bengkulu dan Air Musi di Propinsi Bengkulu, Survey Agro Economy, Aug.1975
05	I	Second Provincial Irrigation Development Project Guideline No.7, Design of Sedang & Kecil Irrigation Projects (I), PT. Virama Karya
06	I	Laporan Akhir, Penelitian Pengaruh Pemberian Air dibawah Kebutuhan Normal Terhadap Penurunan Produksi (Water Management "A") di D.I. Air Duku/ Dusun Curup, Fakultas Teknorogi Pertanian, Institut Petanian Bogor, Jan.1983
07	G	Rencana Tata Guna Tanah Propinsi Daerah Tignkat I Bengkulu, Data Pokok Pertanahan untuk Pembangunan, Kantor BPN bengkulu, 1989 (S=1:500,000)
08	T	Surat Keputusan Menteri Pertanian, Petunjuk Umum Pelaksanaan Proyek Perusahaan Inti Rakyat Perkebunan, Departemen Pertanian, 1985
09	T	The Decree of the Ministry of Agriculture for General Guidelines for Implementation of Nucleus Estate Smallholder, Directorate Gweneral of Plantation, Ministry of Agriculture, 1985 (Extraction)
10	H	Water Level Record of Air Selagan at River Mouth, Bridge at Pasar Mukumuko and Pumping station, Oct. 23, 1989 to Feb. 28, 1990
11	C	Kontrak Pelaksanaan Pekerjaan Sub Proyek Irigasi Air Seluma Paket III, 25 Jul., 1988
12	C	ditto, Paket VI, 13 Jul., 1988
13	C	ditto, Paket VI, Kontrk Amendemen, 27 Nov., 1989
14	C	ditto, Paket VIII, 27 Nov., 1989

No.	Category*	Title
15	C	Kontrak Amendemen, Sub Proyek Irigasi Air Lais Paket II, 23 Jan.,1989
16	C	ditto, Paket III, 2,Sep.,1989
17	C	Kontrak Pelaksanaan Pekerjaan, Penanggulangan Akibat Bencana Alam Banjir Air Jenggalu Pulau Baai, Paket III, Tahap II, 22 Aug.,1989 Asia and PT.Indah Karya, Mar.1989
18	I	Air Lais Irrigation Project, Draft Feasibility Study Vol.1 Main Report, Binnie & Partners, Nov.1981
19	I	ditto Vol.2, Annex A: Meteorology and Hydrology, Annex B: Headworks, Dec.1981
20	I	ditto Vol.3, Annex c: Irrigation, Annex D: Survey, Dec.1981
21	I	ditto Vol.4, Annex E: Land Evaluation, Annex F: Agriculture, Annex G: Economics, Dec.1981
22	I	ditto Vol.5, Annex H: Socio-Economics and Social Survey Work, Annex I: Infrastructure
23	C	Daftar Harga Satuan Bahan Bangunan/Pekerja Propin Bengkulu, Aug.-Sep.,1989/90, Cipta Karya DPUP Bengkulu
24	R	Evaluasi Pelita IV, Program Pelita V Sub Dinas Pengairan Propinsi Bengkulu, DPUP
25	I	Project Preparation Report, Provincial Irrigation Agriculture Development Project, 1990
26	C	Daftar Harga Satuan Pekerjaan Dalam Wil. Propinsi Bengkulu, Cipta Karya, 1988-1989
27	I	Location Map of Irigasi Sedang Kecil dan Irigasi Sedaruhana di Propinsi Bengkulu, 1990
28	C	Rencana Anggaran Biaya, Third Provincial Irrigation Development Project, 1990/1991, Propinsi Bengkulu
29	C	Indeks Satuan Harga Umum, Tahun 1990/91, Bappenas-DPUP Keuangan
30	I	Irrigation Sub-sector Project, Preparatory Designs, Review of Second Twenty On-going Projects, Final Report, Macdonald & Partners Asia. March 1989




















No.	Category*	Title
31	I	Project Preparation Report, Provincial Irrigation Agriculture Development Project, Bengkulu Province, 1990
32	S	Bengkulu Dalam Angka, Bengkulu in Figures 1988, Kantor Statistik Provinsi Bengkulu, Jul., 1989
33	I	Pembuatan Detail Design on-going Peninjauan-Penago Propinsi D.T.I Bengkulu, Bagian Laporan Akhir, PT. Isuda Parama, Jun., 1989
34	I	ditto Bagian Pembuatan Peta Tata Guna Tanah (Land Use Map) Skala 1:10,000, PT. Isuda Parama, Mar., 1989
35	T	As Build Drawing of SP-II, III, IV, VI S=1:5,000, Bengkulu Transmigration Office
36	T	Himpunan Peraturan/Ketentuan untuk Landasan Operational Pengembangan Perkebunan Dengan Pola Perusahaan Inti Rakyat yang Dikaitan dengan Program Transmigrasi, Biro Hukum dan Organisasi Departmen Pertanian, direktorat Jenderal Perkebunan, Jakarta, Oct., 1986
37	T	Perkembangan Pembangunan Transmigrasi di Propinsi Bengkulu, Kantor Wilayah departemen Transmigrasi, Propinsi Bengkulu, 1990
38	T	Petunjuk Bersama Pelaksanaan/Transmigrasi Swakarsa PIR-Perkebunan (PIR-Khusus dan PIR-Berbantuan/NES), Direktorat Jenderal Perkebunan, Direktorat Jenderal Penyiapan Pemukiman, Direktorat Jenderal Pengerahan dan Pembinaan, Jakarta, Feb., 1986
39	C	Engineer's Cost Estimate for Contract IS-6(3)A and C, Way Rarem Irrigation Project Package-II, 1988
40	C	-ditto-, Contract TN-12, 16 and 18, 1989
41	O	Law of the Republic of Indonesia, No., 15 year 1985 on Electricity by the Grace of God Almighty, The President of the Republic of Indonesia
42	O	Perusahaan Umum Listrik Negara, Distribusi Jawa Barat
43	O	Rural Electrification Monthly Report, April 1989 by PLN
44	H	Water Level Record in Air Selagan, 3 places, Oct. 1989 to Feb. 1990

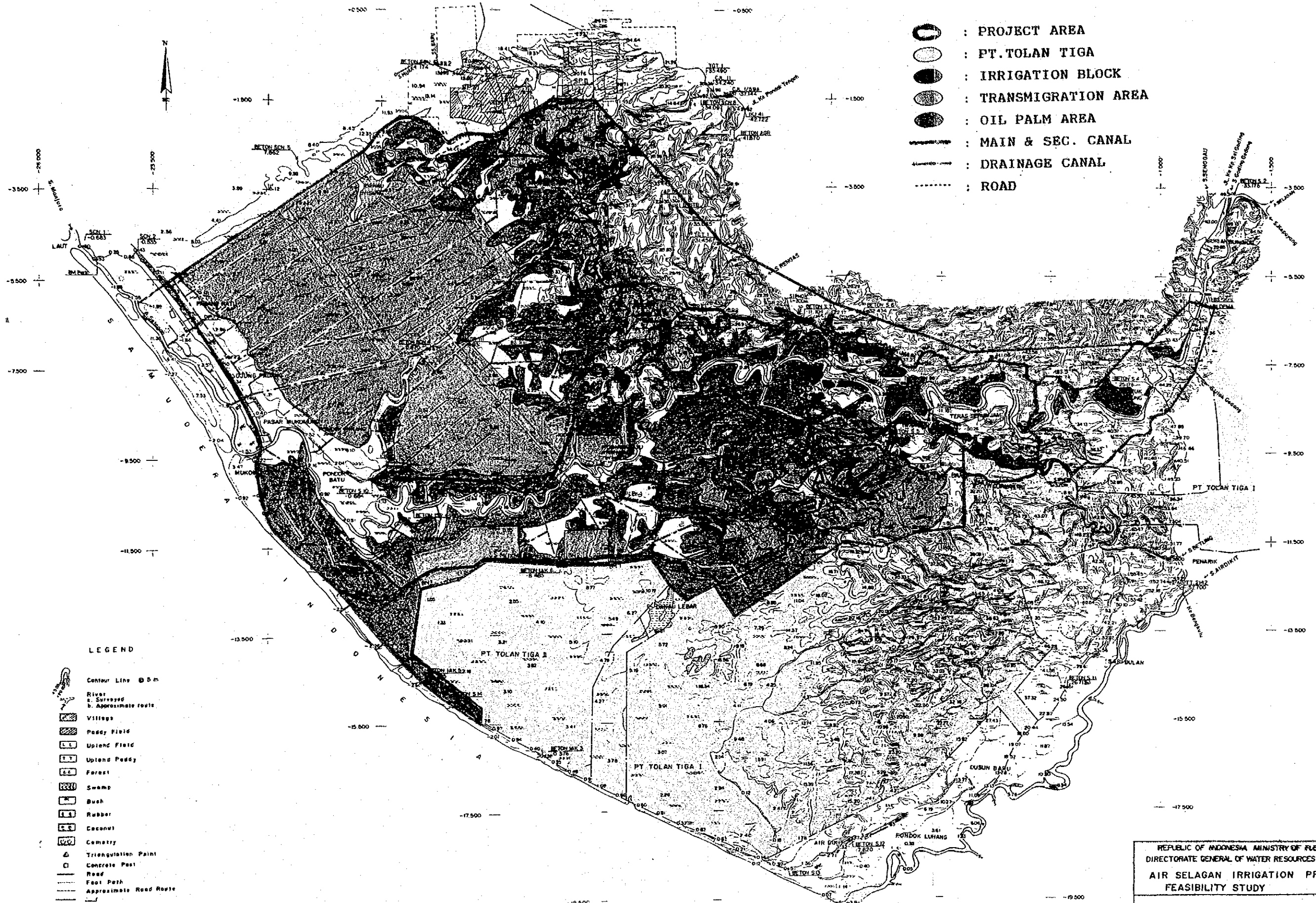
No.	Category*	Title
45	H	Rainfall Record at PK.Kopi,Lalang Luas,Julinging and Ujung Padang, May 1989 to Dec.1989
46	H	Chart of Automatic Water Level Record ion Air Selagan Nov.1989 to Jan.1989
47	H	Daftar: Kerugian Masyarakat dalam Kecamatan Muko muko Utara pada Bencana Alam Banjir, NOV.1988 and Jan. 1989
48	A	Laporan akhir Unit Rengujian Tata Air (UPTA) di Daerah Seluma Propinsi Bengkulu
49	S	Bulletin Ringkas, Biro Pusat Statistik, August 1989
50	S	Foreign Trade Statistical Bulletin-Exports, Biro Pusat Statistik, Jakarta 1989
51	S	Foreign Trade Statistical Bulletin-Imports, Biro Pusat Statistik, Jakarta 1989
52	A	Laporan Pelaksanaan Pencetakan sawah di Propinsi Bengkulu, Dinas Pertanian Tanaman Pangan, Propinsi Daerah TK I Bengkulu, 1989
53	A	General Guidelines of Land Development, Direktorat General of Food Crops Agriculture, Ministry of agriculture, Jakarta, Aug.1989
54	T	Guidelines, Second Stage Development with the TRANS V Programme, Directorate General Settlement Preparation, Ministry of Transmigration, Feb.1989 Jakarta
55	T	Project Preparation for TSSDP I, Appendices No.10 Credit and Support Services, Ministry of Transmigration, Jakarta, July 1988
56	T	Project Preparation for TSSDP I, Appendices No.7 Institutional Support, Jakarta, July 1988
57	I	Bengkulu Irrigation Rehabilitation Project, Water Resources Development Division, DPU Bengkulu, July 1984

LEGEND

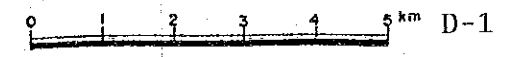
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-  : PT. TOLAN TIGA
-  : IRRIGATION BLOCK
-  : TRANSMIGRATION AREA
-  : OIL PALM AREA
-  : MAIN & SEC. CANAL
-  : DRAINAGE CANAL
-  : ROAD

LEGEND

-  Contour Line @ 5 m
-  River
-  a. Surveyed
-  b. Approximate route
-  Village
-  Paddy Field
-  Upland Field
-  Upland Paddy
-  Forest
-  Swamp
-  Bush
-  Rubber
-  Coconut
-  Cemetery
-  Triangulation Point
-  Concrete Post
-  Road
-  Foot Path
-  Approximate Road Route



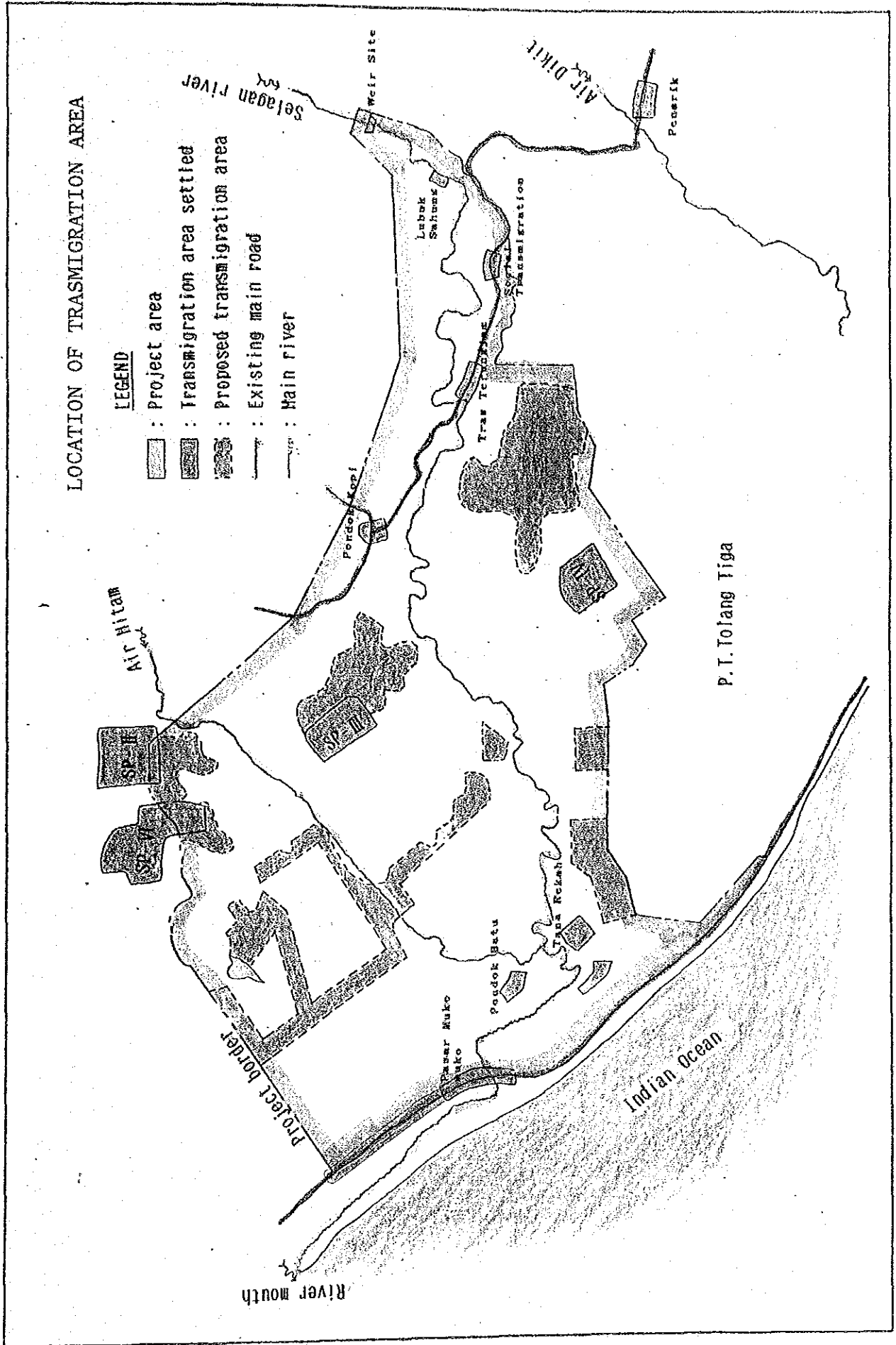
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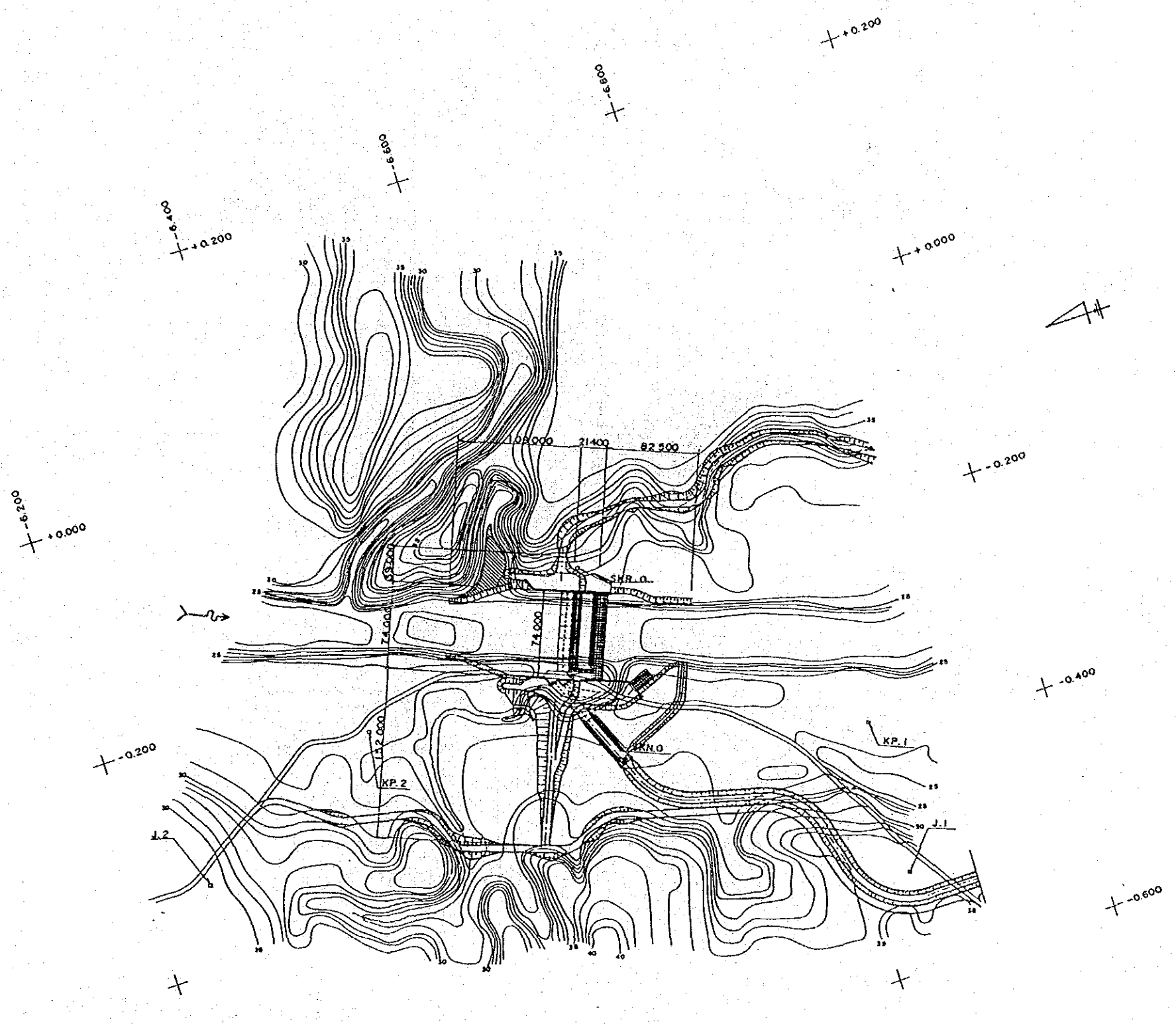


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 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 AIR SELAGAN IRRIGATION PROJECT
 FEASIBILITY STUDY








GENERAL PLAN

JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO (JICA) DWG. NO. 1

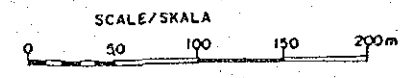




LEGENDA
LEGEND

-  LADANG
NON IRRIGATED FARMING
-  ALANG ALANG
MEADOW
-  HUTAN BELUKAR
PRIMAI FOREST
-  JALAN
ROAD
-  TITIK PORIGON
TRAVERSE POINT
-  ARAH ALIRAN
FLOW DIRECTION
-  TITIK TETAP
BENCH MARK

NO BM	COORDINATE		ELEVATION
	X	Y	
Kp.1	-380.00	-6.844.00	+26.608
Kp.2	-248	-6.426.150	+27.196
J.1	-312	-6.839	+34.622
J.2	-329	6.252	+36.520
SKN.0	-275.922	-6.602.572	+27.148
SKR.0	-169.162	-6.643.603	+28.414

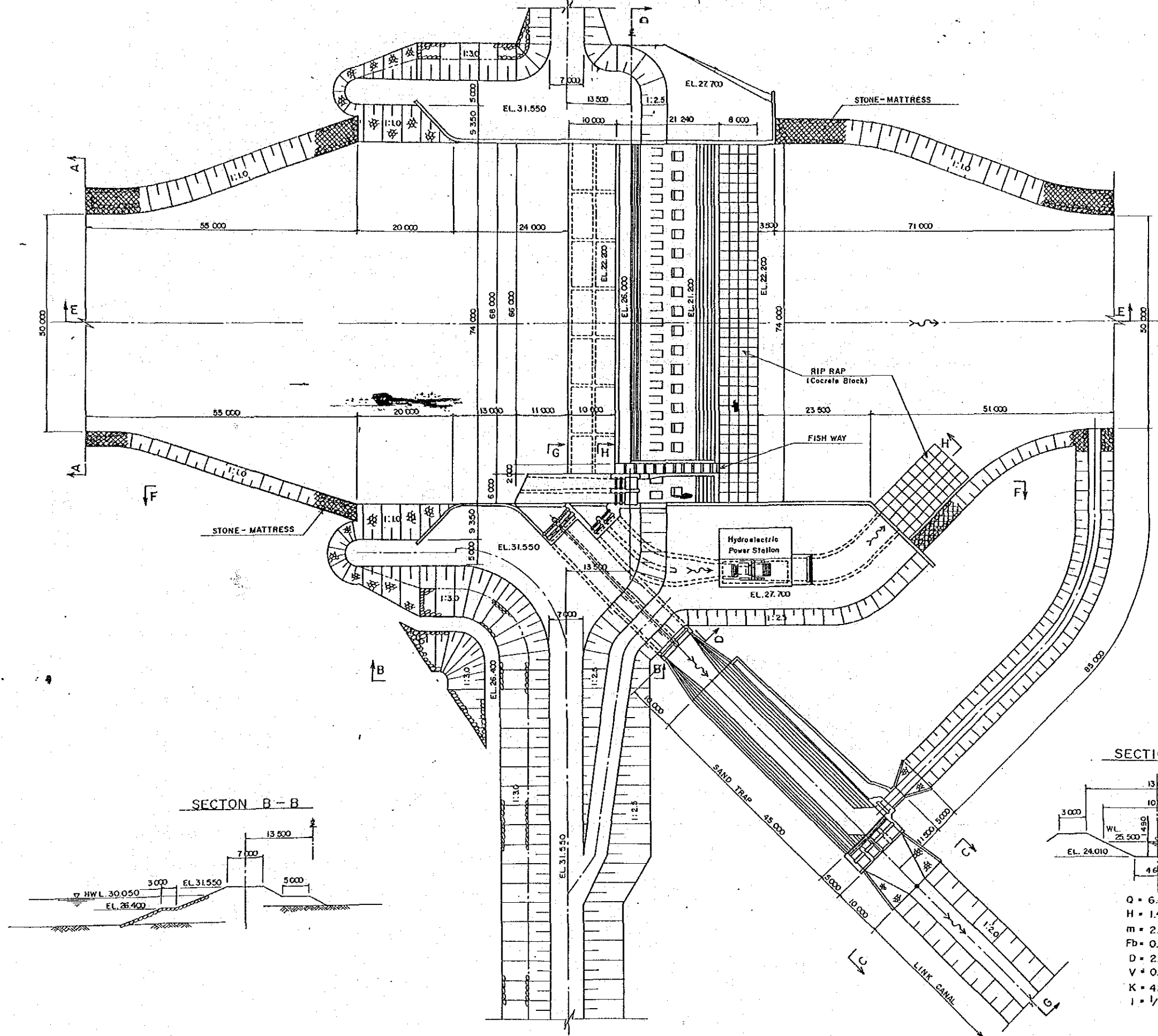


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DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
AIR SELAGAN IRRIGATION PROJECT
FEASIBILITY STUDY

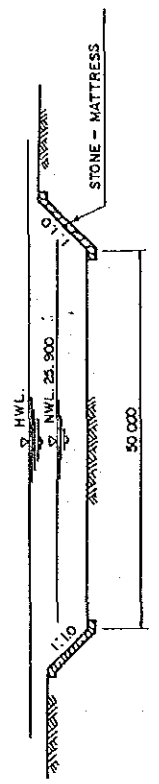
PLAN OF SELAGAN WEIR (1)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) DWG. NO. 9

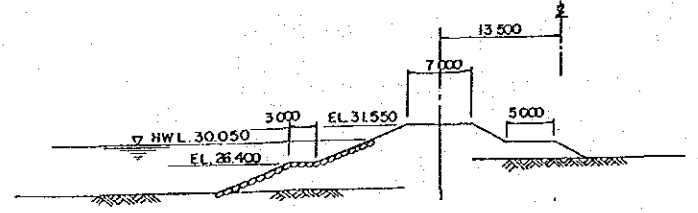
PLAN



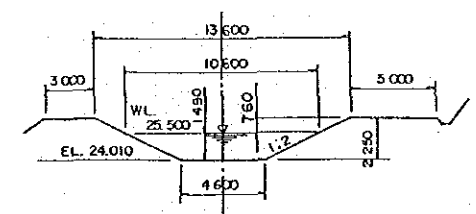
SECTION A - A



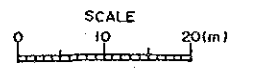
SECTION B - B



SECTION C - C



- Q = 6.45 m³/s
- H = 1.49 m
- m = 2.0
- Fb = 0.76 m
- D = 2.25 m
- V = 0.573 m/s
- K = 42
- I = 1/5522



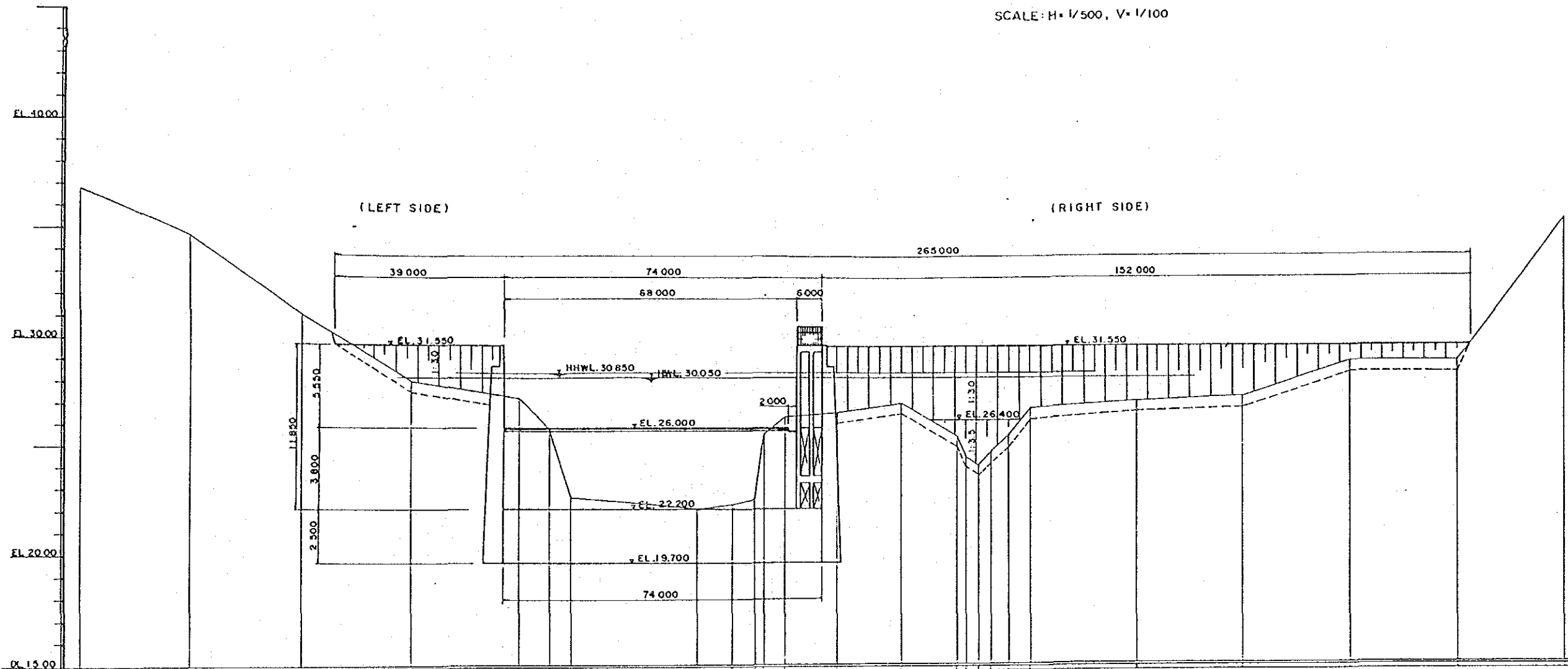
REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 AIR SELAGAN IRRIGATION PROJECT
 FEASIBILITY STUDY

PLAN OF SELAGAN WEIR (2)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) DWG. NO. 10

PROFILE OF WEIR AXIS

SCALE: H= 1/500, V= 1/100



STATION	DISTANCE	TOTAL DISTANCE	GROUND HEIGHT	CANAL BED ELEVATION	TOP ELEVATION
P. 32	0.00	0.00	36.842		
P. 31	25.00	25.00	34.763		
P. 30	50.00	50.00	31.258		
SKR. 0	75.00	75.00	28.174		
P. 30	100.00	100.00	27.409		
+5500	107.00	107.00	25.800		
+5000	112.00	112.00	22.750		
+2028	141.74	141.74	22.200		
+12.22	149.78	149.78	22.390		
+538	155.02	155.02	22.800		
+495	157.03	157.03	23.662		
B. H.	162.00	162.00	26.998		
P. 1	174.00	174.00	26.703		
SKR. 0	183.00	183.00	27.448		
+1700	202.00	202.00	25.200		
+1520	204.00	204.00	24.620		
+1200	207.00	207.00	24.180		
+900	210.00	210.00	24.070		
+500	214.00	214.00	23.300		
P. 23	219.00	219.00	26.867		
P. 24	244.00	244.00	27.215		
P. 25	268.00	268.00	27.429		
B. 1	284.00	284.00	28.005		
P. 26	318.00	318.00	28.048		
P. 27	344.00	344.00	33.670		

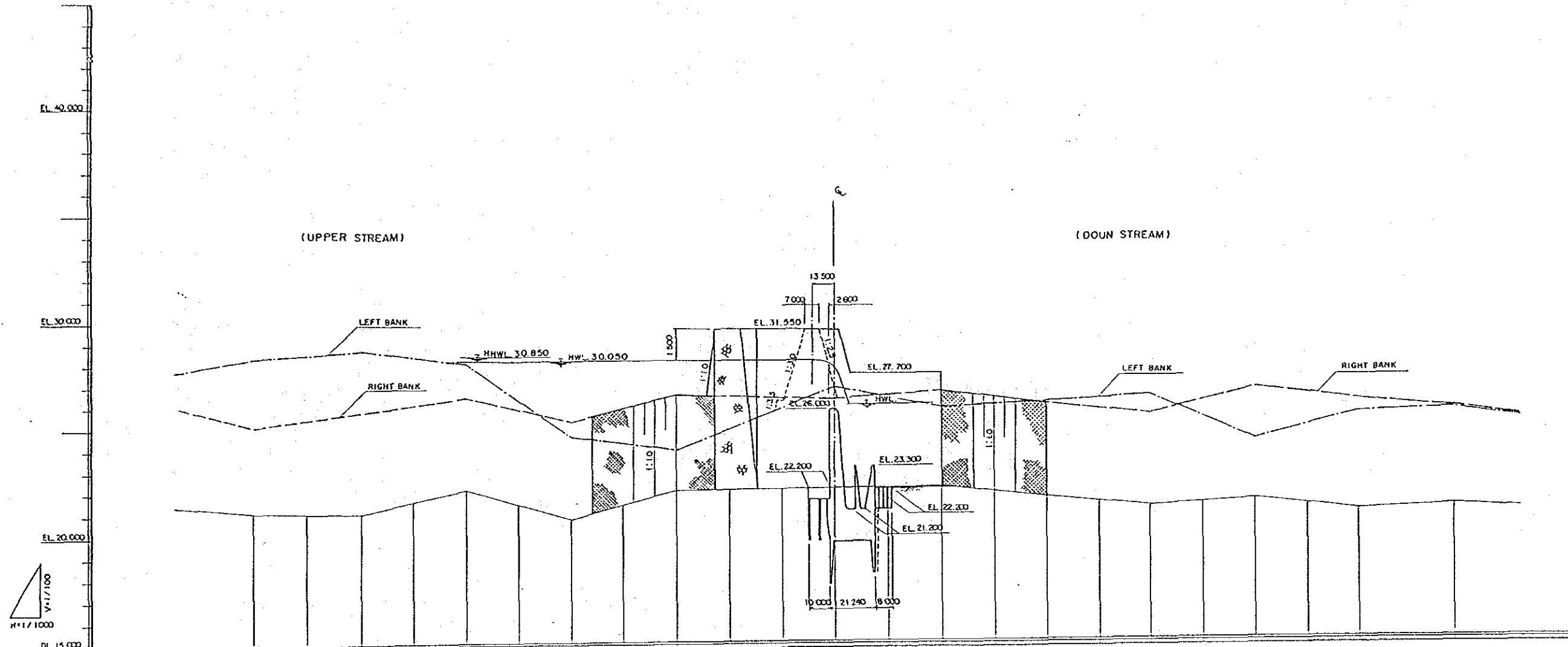
REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 AIR SELAGAN IRRIGATION PROJECT
 FEASIBILITY STUDY

PROFILE OF WEIR AXIS

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) DWG. NO. 11

PROFILE OF RIVER AXIS

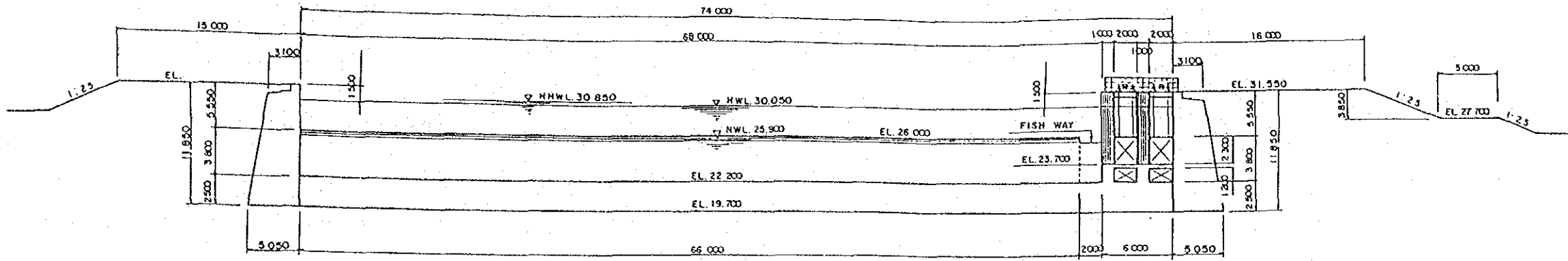
SCALE: H=1/1000, V=1/100



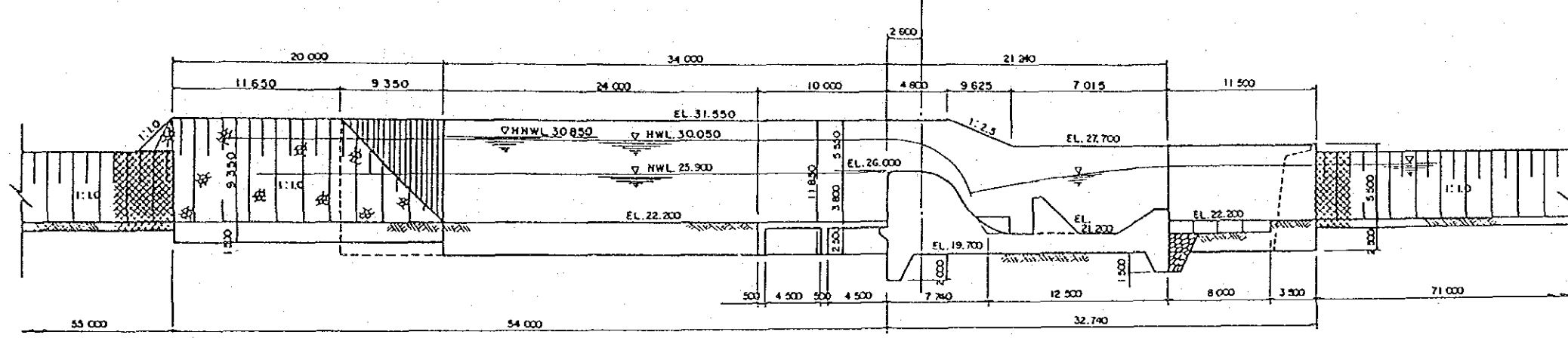
STATION	DISTANCE	TOTAL DISTANCE	EXISTING		DESIGN	
			GROUND HEIGHT	TOP EL.	CANAL BED EL.	
P. 12	0.00	479.00	21.17			
P. 11	25.00	504.00	21.06			
P. 10	25.10	530.00	22.22			
P. 9	25.00	555.00	20.81			
P. 8	25.00	580.00	22.17			
P. 7	25.00	605.00	22.20			
P. 6	25.00	630.00	22.26			
P. 5	25.00	655.00				
P. 4	25.00	680.00				
P. 3	25.00	705.00				
P. 2	25.00	730.00				
P. 1	25.00	755.00				
P. 13	25.00	780.00				
P. 14	25.00	805.00				
P. 15	25.00	830.00				
P. 16	25.00	855.00				
P. 17	25.00	880.00				
P. 18	25.00	905.00				
P. 19	25.00	930.00				
P. 20	25.00	955.00				
P. 21	25.00	980.00				
P. 22	25.00	1005.00				
P. 1025	45.00	1050.00	21.23			

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 FEASIBILITY STUDY
 PROFILE OF RIVER AXIS
 JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) TOKYO
 DWG. NO. 12

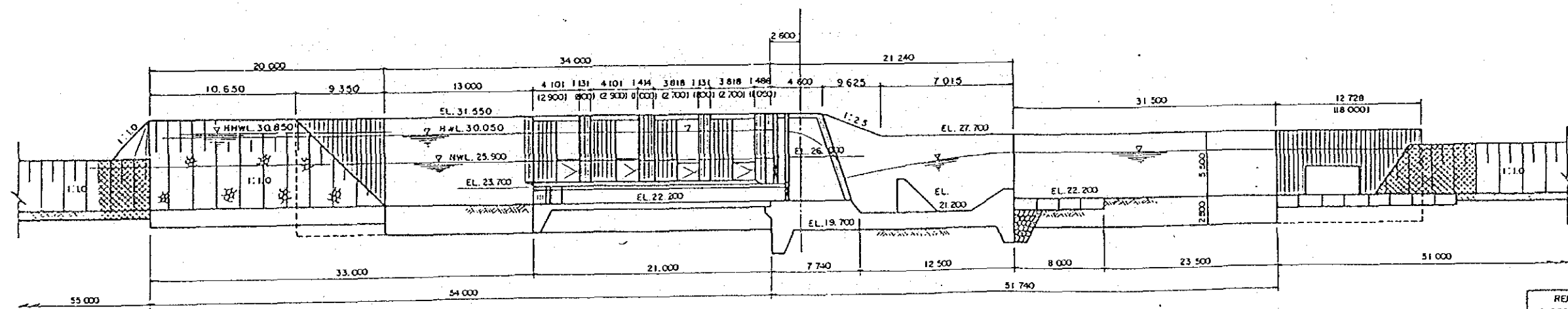
SECTION D--D



SECTION E--E

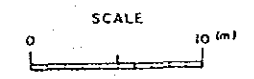


SECTION F--F

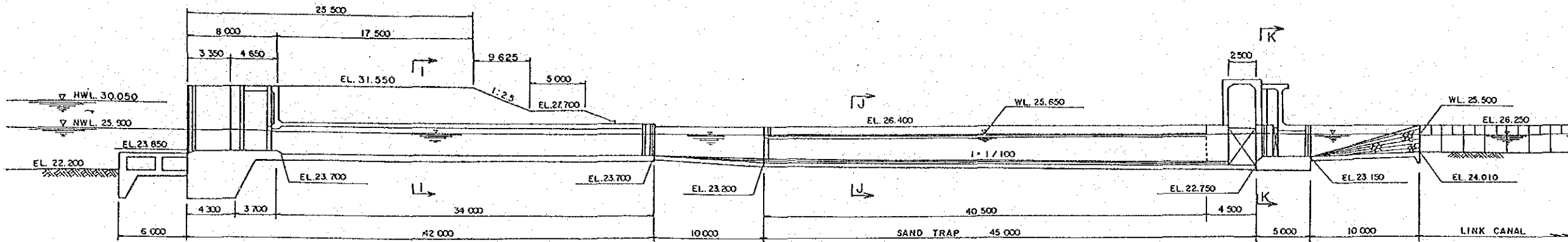


REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 AIR SELAGAN IRRIGATION PROJECT
 FEASIBILITY STUDY
 SECTION OF SELAGAN WEIR (I)

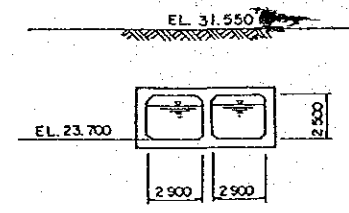
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) TOKYO
 DWG. NO. 13



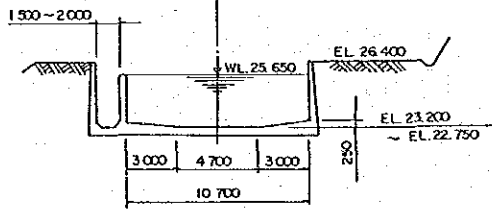
SECTION G-G



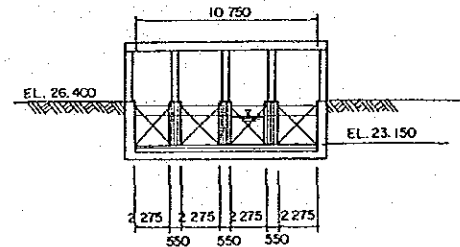
SECTION I-I



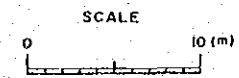
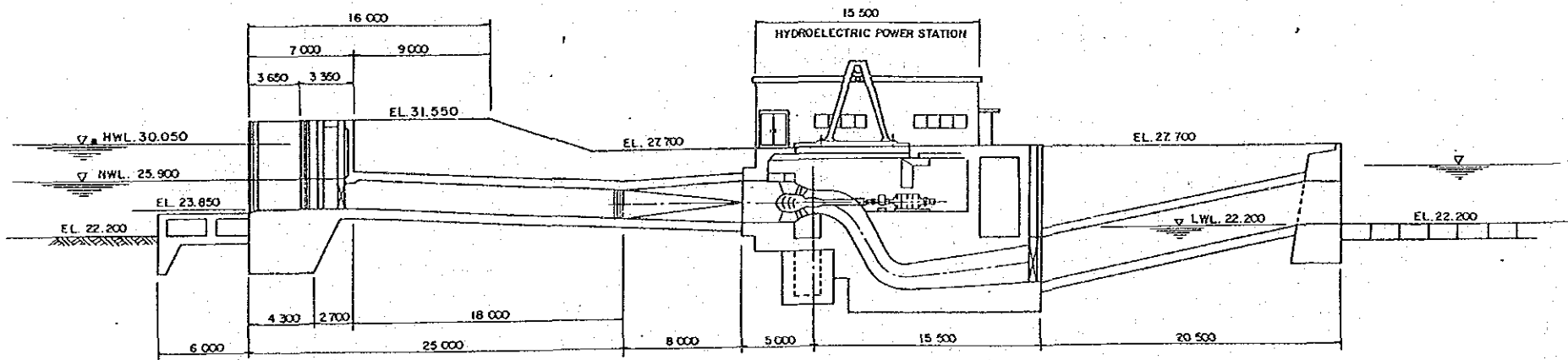
SECTION J-J



SECTION K-K



SECTION H-H



REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 AIR SELAGAN IRRIGATION PROJECT
 FEASIBILITY STUDY
 SECTION OF SELAGAN WEIR (2)
 JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) TOKYO (JICA) DWG. NO. 14

JICA