

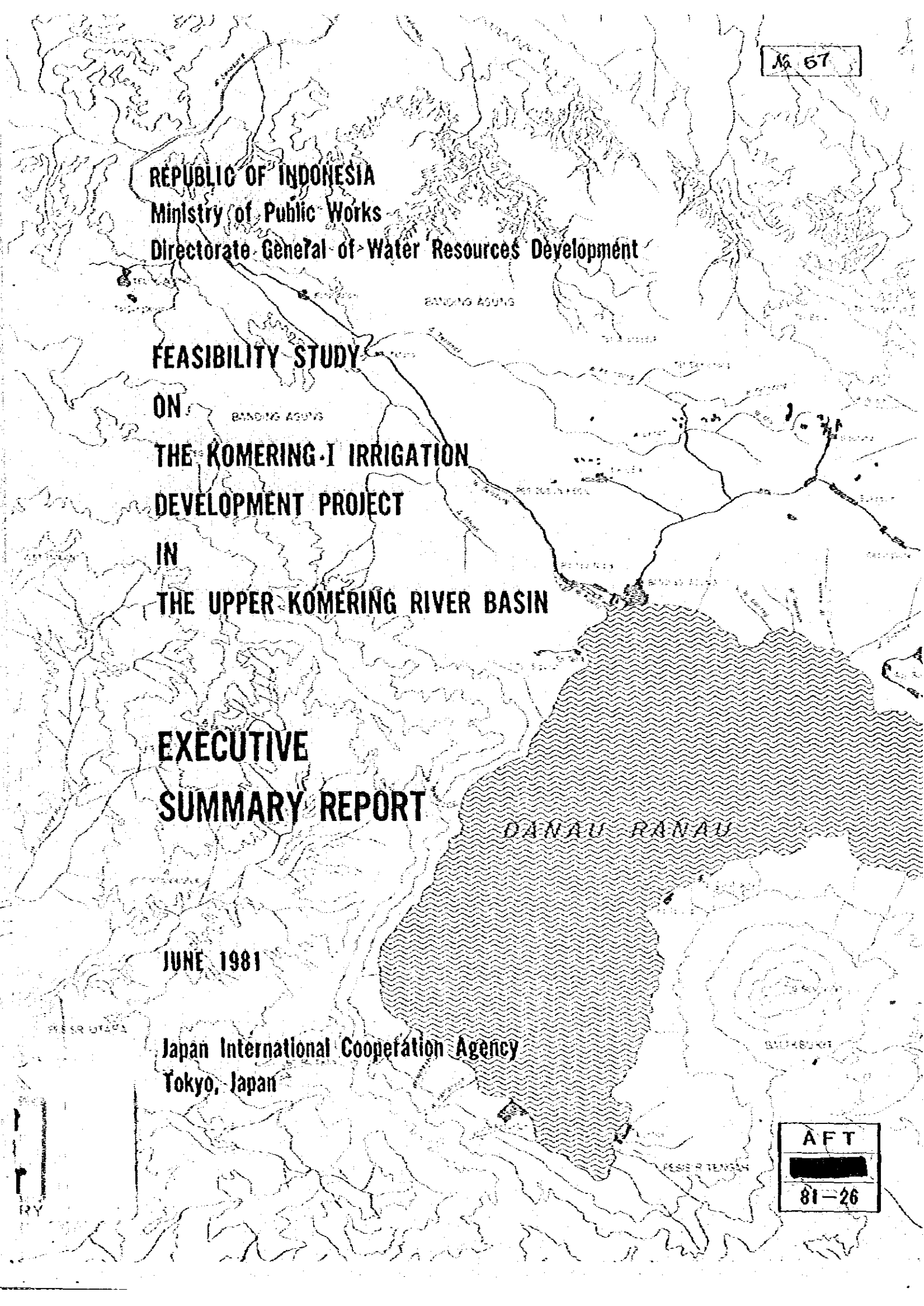
REPUBLIC OF INDONESIA
Ministry of Public Works
Directorate General of Water Resources Development

FEASIBILITY STUDY
ON
THE KOMERING-I IRRIGATION
DEVELOPMENT PROJECT
IN
THE UPPER KOMERING RIVER BASIN

EXECUTIVE
SUMMARY REPORT

JUNE 1981

Japan International Cooperation Agency
Tokyo, Japan



JICA LIBRARY



1055913[6]

REPUBLIC OF INDONESIA
Ministry of Public Works
Directorate General of Water Resources Development

FEASIBILITY STUDY
ON
THE KOMERING-I IRRIGATION
DEVELOPMENT PROJECT
IN
THE UPPER KOMERING RIVER BASIN

EXECUTIVE
SUMMARY REPORT

JUNE 1981

Japan International Cooperation Agency
Tokyo, Japan

国際協力事業団		
受入 月日	84.9.14	108
		81
登録No.	09633	AFT

PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to provide the technical services for the feasibility study on the Upper Komering River Basin Development Project as a part of the technical cooperation of the Government of Japan from 1979 through 1982. In accordance with the Scope of Works for the feasibility study agreed upon between the Government of Indonesia and the Government of Japan, the Japan International Cooperation Agency dispatched a feasibility study team headed by Mr. S. Yano of Nippon Koei Co., Ltd. on the Komering-I Irrigation Development Project which was identified as the priority project in the Comprehensive Study previously carried out in 1979/80 fiscal year. The study team performed field investigation from July 14, 1980 to November 13, 1980.

The report is hereby presented based on the findings obtained in the field survey as well as the subsequent study in Japan. I sincerely hope that this report will substantially contribute to the implementation of this project.

Finally, I wish to express my hearty gratitude to the Government of Indonesia and other authorities concerned for their kind cooperation and assistance extended to the study team.

June, 1981


Keisuke ARITA
President
Japan International Cooperation Agency

Mr. Keisuke ARITA
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Sir,


LETTER OF TRANSMITTAL

We have the pleasure of submitting the feasibility report on the Komering-I Irrigation Development Project in the Upper Komering River Basin, the Republic of Indonesia, in accordance with the terms of reference issued by your Agency.

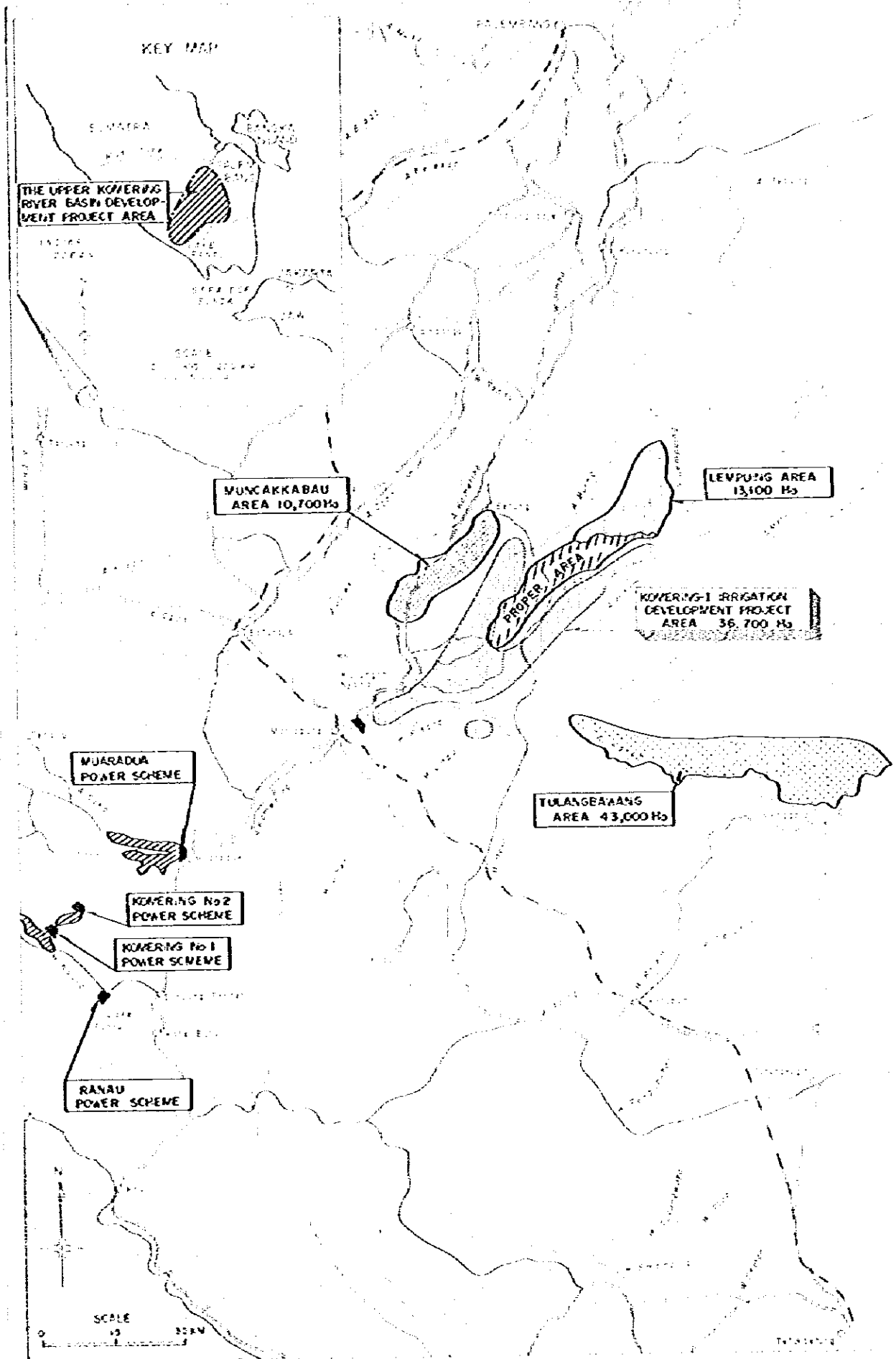
The project is basically formulated for the sharp increase in food production and the improvement of farmers' living standards in the Komering-I area of 36,700 ha. After implementation of the project, the increased amount of agricultural products would substantially contribute to the national economy as well as the regional economy in the South Sumatra region. We would recommend that the project will be soon implemented in line with the conclusion presented in this report.

We wish to express our deep appreciation and gratitude to the personnel concerned of your Agency, the Authorities concerned of the Government of Indonesia and the Embassy of Japan in Indonesia for the courtesies and cooperation extended to us during our field survey and study period.

Sincerely yours,


Shinichi YANO
Leader of the Study Team for
the Komering-I Irrigation
Development Project

LOCATION OF DEVELOPMENT PLAN



FEASIBILITY STUDY
ON
THE KOMERING-I IRRIGATION DEVELOPMENT PROJECT
IN
THE UPPER KOMERING RIVER BASIN

EXECUTIVE SUMMARY REPORT

CONTENTS

	<u>Page</u>
INTRODUCTION	1
GENERAL ECONOMIC AND AGRICULTURAL BACKGROUND	3
THE PROJECT AREA	5
THE PROJECT	9
RECOMMENDATIONS	17

LIST OF TABLE

	<u>Page</u>
Table 1 Summary of Construction Cost	20

LIST OF FIGURES

- Fig. 1 General Layout Map
- Fig. 2 Soil Map of the Project Area
- Fig. 3 Land Suitability Map for Paddy and Upland Crops of the Project Area
- Fig. 4 Proposed Cropping Pattern Type-I
- Fig. 5 Proposed Cropping Pattern Type-II
- Fig. 6 Irrigation Diagram
- Fig. 7 Project Implementation Schedule

INTRODUCTION

1. This report presents the results of survey and study for feasibility study on irrigation development of the Komering-I area with about 37,300 ha of net irrigable area in the upper Komering river basin.
2. The Government of Indonesia has laid great emphasis on substantial increases in food production over a wide range of crops and promoting transmigration to outer islands in order to relieve population pressure in the densely-populated islands, through which the Government intends to raise the production of foodstuff and to accelerate a more balanced economic development in the region.
3. The Government had formulated the project in 1970 and identified the agricultural and irrigation development of about 48,000 ha in the Belitang Extension Area and hydro-power development of some 128 MW in installed capacity in the upper reach of the Komering river. About 33,000 ha of flat land extending along the Tulangbawang river was further conceived to be developed with the diversion of water from the Komering river.
4. In response to the request of the Government of Indonesia on the technical aid to carry out the feasibility study of the project, the Government of Japan decided to provide the technical services for the feasibility study on the project as a part of the technical cooperation program of the Government of Japan from 1979 through 1982.
5. In accordance with the scope of works for feasibility study on the Upper Komering River Basin Development Project agreed upon between the Government of Indonesia and the Government of Japan, the comprehensive study on the project was carried out by JICA (Japan International

Cooperation Agency) in cooperation with the Government of Indonesia from September 1979 to April 1980. Following the above study, the feasibility study of the Komering-I area with about 37,300 ha identified as the first priority for irrigation development within the promising irrigation development potentials of around 104,000 ha, was carried out by JICA from July 1980 to June 1981.

GENERAL ECONOMIC AND AGRICULTURAL BACKGROUND

6. The economic growth of Indonesia during the past five years has been impressive. Annual growth rate of GDP accounted for about 20%. The agricultural output accounted for about 31% of GDP in 1978, which still played an important role on economy in Indonesia. More than 60% of the national active population are engaged in agriculture.

7. The export and import values of Indonesia have substantially increased in recent years, particularly, the export value increased remarkably at an annual rate of as high as about 30% from 1973 to 1979. The export value of agricultural products corresponding to about 25% of the total exports in 1979 came from mainly wood products, rubber, coffee and palm oil.

8. Production of rice, the main staple food in Indonesia, has substantially increased at an annual rate of about 3.8% from 1970 to 1978 and would reach about 19 million tons in 1980. It is expected to attain the self-sufficiency in rice production in the near future, whereas the rice production in the South Sumatra Province still can not meet its increasing demand resulting from the rapid population growth. The following table shows the import of rice in Indonesia in recent 5 years.

Unit: 10 ³ tons				
<u>75/76</u>	<u>76/77</u>	<u>77/78</u>	<u>78/79</u>	<u>79/80</u>
670	1,509	2,308	1,800	1,922

9. Following the successful implementation of the First and Second Five Year Development Plans (Repelita I and II), the Government has set up the Third Five Year Development Plan (Repelita III) for 1979/80

to 1983/84. Repelita III is a continuation and enhancement of the previous plan and places the major objectives on raising living standard of the people, high economic growth and more equitable distribution of welfare of the whole population. In this context the following target is established for the five years.

- i) Real economic growth rate of about 6.5% per annum.
- ii) Per-capita gross domestic product of about 4.4% per annum.
- iii) Population growth of about 2% per annum.

10. Regarding the agricultural development sector, the Plan envisages to grow rice production at an annual rate of 3.3% and secondary crops by 5 to 7% per annum, for which the first priority in the Plan is given to the water resources development comprising approximately 2.37 million ha. The transmigration program is also considered to be one of the major development activity in Repelita III in which the program aims to settle 500,000 families in 250 settlement locations in Sumatra, Sulawesi, Kalimantan and Irian Jaya.

THE PROJECT AREA

11. The project area is situated at both the south-west corner of South Sumatra Province and the northern part of Lampung Province. The Komering river originates from Lake Ranau with a surface area of about 127 km² and about 542 m above mean sea level. Forest still covers a large area of the mountainous region but its deforestation has resulted in heavy erosion and deposition of the eroded materials in the lower reach of the Komering river. The Komering-I area is situated within the flat land of the upper Komering basin and gently slopes from the right bank of the Komering river to the Lempuing river sandwiching the Belitang Proper Area where about 20,000 ha are provided with irrigation system of about 105 km long main and secondary canals at present. The ground elevation of the project area ranges from 25 m to 80 m.

12. Results of geological investigations reveal that the geological conditions of two alternative headworks sites are favorable in foundation of headworks to be constructed. The Ranau regulating dam site would have also favorable geological conditions. Gravel and sand for concrete are sufficiently available along the upstream reaches from Martapura in the Komering river.

13. The soils in the proposed irrigation development area are classified into eight mapping units consisting of one uniformity and seven associations. The soils comprise Podzolic Soils, Alluvial Soils, Gley Soils, Hydromorphic Soils and Andosols in the Great Soil Group as shown in Fig. 2. Except for some hilly and steep lands, the project area is fairly suitable for both paddy and upland crops cultivation as shown in Fig. 3.

14. Climate in the project area is tropical. Average annual rainfall in the project area is approximately 2,600 mm, of which about 80% fall during the rainy season from October to May. The fluctuation of mean

temperature in the flat lands is rather small throughout the year ranging from 26°C to 28°C. The annual relative humidity is as high as about 80% at Belitang. The annual average sunshine hour is about 5.2 hr/day.

15. Annual average runoff of the Komering river is about 207 m³/sec at Martapura with about 4,260 km² of its catchment area. The maximum monthly runoff of about 305 m³/sec in April and the minimum of about 133 m³/sec in August are observed. From Lake Ranau, about 18 m³/sec of average runoff flow fairly constantly to the Komering river. The Komering river transports the considerable quantities of eroded materials to its lower reach. The annual sediment transport is roughly estimated to be about 880 m³/km² on an average.

16. Population in the project area is estimated at about 114,000 in 1980, of which about 46,000 are living in the southwestern half of the project area, about 65,000 in the northeastern half of the area and about 3,000 in the Pisang Area. Average family size is estimated to be about 5.4 persons.

17. The project area covers about 51,000 ha, of which about 14,000 ha, 28.5%, are cultivated with paddy and about 12,000 ha, 24.6%, with upland and perennial crops of cassava, maize peanuts, coffee etc. forest and Alang-Alang lands still cover about 19,000 ha, approximately 38% of the area. Average farm holding size in the southwestern half of the project area is about 1.0 ha, while that in both the northeastern half of the project area and the Pisang Area, where transmigrants settled rather recently, is about 1.75 ha.

18. Three types of cropping pattern are prevailing in the project area. Type-I pattern is predominant in 1 ha farm holding area in the upper part of the project area. Rainfed paddy covering about 64% of the area is transplanted during a period from the mid-October to December. The harvesting is made from February to May. Upland crops are planted in about 11% of the area under the rain-fed conditions. Type-II pattern prevails in the lower parts of the Belitang Extension Central Area. At present about 20% of lands are cultivated with paddy and about 21% for

both upland crops and perennial crops and the remainings are still covered with forest. Type-III pattern is predominant in the Pisang Area where only 15% of the area is planted with mainly upland crops and perennial crops.

19. The present farming practices in the area are still conventional. Very limited amounts of fertilizer and chemicals are used for paddy cultivation. High yielding varieties of paddy are introduced in the very limited area owing to the lack of irrigation facilities. Upland paddy, maize, cassava, peanuts etc. are traditionally cultivated during the period of rainy season. Negligible amounts of fertilizers and chemicals are applied to both paddy and upland crops cultivation at present.

20. Present crop yields are rather low except for paddy cultivation under the BIMAS program. The average yields of crops in the project area in 1978/79 were about 2.5 t/ha of rainy season paddy, 1.0 t/ha of maize, 0.8 t/ha of peanuts, 0.7 t/ha of soybeans and 6.0 t/ha of cassava, etc. Total production of paddy and upland crops in the project area are estimated at about 43,000 tons of paddy, about 23,000 tons of cassava and about 1,100 tons of peanuts respectively.

21. Surplus of paddy produced by farmers in the project area is mostly marketed through two channels, DOLOG/KUD and itinerant grain buyers. The DOLOG/KUD market the rice for stabilization of price of rice under the Government control. The following table shows the present farm gate prices of major farm products prevailing in the project area.

	<u>Price (Rp./kg)</u>
Rice	175
Maize	150
Cassava	25
Soybeans	300
Peanuts	430

22. Extension services to the farmers are carried out by field extension workers (PPL) under the supervision of the Agricultural Extension Office in Kabupaten through PPS and PPM. Service area of PPL averages about 1,200 ha of paddy fields cultivated. The Belitang Seed Center is located near the project area. The stock seeds of paddy produced at the Center are distributed to the some seed growers authorized. Then the seeds produced by the seed growers are distributed to farmers through BUUD/KUD. The amount of paddy seeds is still insufficient.

THE PROJECT

23. The project is formulated with the main concepts of:

- (1) increase and stabilization of yield and production of the rainy season paddy through supply of irrigation water, proper drainage improvement and introduction of improved irrigation farming,
- (2) introduction of diversified cropping pattern including the rainy season paddy, dry season paddy and Polowijo through provision of year-round irrigation.
- (3) increase of agricultural production by opening up new agricultural lands in the areas which have favorable physical conditions for agricultural development,
- (4) improvement of living standard and more equitable distribution of income and welfare of the people, and
- (5) successful settlement of transmigrants through irrigation and agricultural development.

24. The project area covers about 51,000 ha in gross of which about 36,700 ha of irrigation area in net are delineated taking into account the land suitability, topography, land use and the Government's policy for development. From the viewpoint of project development sequence, the project area is divided into two sub-areas. Sub-Area-I covering 18,500 ha extends over the western half of the project area and Sub-Area-II covering 18,200 ha extends over the eastern half including the Pisang Area of about 2,900 ha of net irrigable land.

25. For the proposed agricultural development in the area, five cropping patterns, i.e. two types for 1-ha farm holding area and three types for 1.5-ha farm holding area, are recommended taking into account the agro-climatic conditions and the farm holding size. The rainy season paddy will exclusively be grown in the whole project area in every cropping pattern. In order to maximize the yields and profits, improved high yields and tasty varieties will be introduced under this project. During the dry season, the whole 1-ha farm holding area will be cultivated with paddy, but 1.5-ha farm holding area will be cultivated with paddy and Polowijo such as peanuts, soybeans and maize from the viewpoints of crops diversification and water saving. Fig. 4 and Fig. 5 show proposed typical cropping patterns.

26. After implementation of the project, the following crop yields and production are expected.

<u>Crops</u>	<u>Yield</u> (ton/ha)	<u>Area</u> (ha)	<u>Production</u> (10 ³ tons)
Rainy season paddy	4.0	36,700	146.8
Dry season paddy	4.5	27,260	122.7
Peanuts	1.3	8,920	11.6
Soybeans	1.3	4,720	6.1

27. After the implementation of the project, about 24,000 ha of forest and Alang-Alang area in the Belitang Extension Central Area would be reclaimed for irrigable paddy lands. In the Pisang Area, approximately 1,700 families of transmigrants would newly be settled mostly in its northern portion where a large area is still unopened. In the northern parts of the Central Area the forest and Alang-Alang areas are rather scattered so that the transmigration program is proposed to be thoroughly assessed according as the reclamation of the areas.

28. The irrigation requirement for the project is estimated for the proposed cropping pattern. Effective rainfall with 80% probability of exceedence of the drought year is taken into account for its calculation. Canal conveyance and operation losses are estimated to be 15% and 30% of the diversion requirement respectively. The total diversion requirement for the project is estimated at 44.1 m³/sec which include the diversion requirement for the BK-1 area of 1,300 ha in the Belitang Proper Area also.

29. Two alternative sites for the headworks, Pracak and Perjaya, were thoroughly surveyed and studied from the technical and economical viewpoints. As the results, the Perjaya site is recommendable for constructing diversion weir at an elevation of 79.3 m in its intake water level. The headreach between the settling basin and the bifurcation structure would be unlined with 1/8,000 in gradient on an average.

30. Since the irrigation water for the Lempuing and Tulangbawang Projects would be diverted from the Perjaya headworks, the development sequence of those projects was studied whether the headreach and main canals of Komering-I system should be constructed with the capacity including the discharge for those areas from the initial stage of construction, or the expansion of facilities to be co-used should be made at their respective development stage. The results of study indicate that it is rather economical to construct the headreach and main canal of the Komering-I Project for its own capacity, unless the development of the Lempuing and Tulangbawang Projects is commenced within 5 years.

31. Economic comparison on integration of intake for the Belitang Proper Area into the intake system of the Komering-I Project was made, because the large amount of sediment loads from the Komering river is deposited at the head of headreach of the Proper Area, resulting in very less discharge in the headreach. In addition, stoplogs provided at BK-1 check and turnout commanding 1,300 ha of elevated land bottleneck the flow capacity of the headreach. As the results, it is proposed to construct the headreach of the Komering-I Project at its own capacity inclusive of diversion of water to 1,300 ha of BK-1.

32. Economic comparison on integration of intake of the Muncak Kabau Project into the Komering-I system was also carried out. The result of study shows that water intake through its own intake structure near Muncak Kabau is rather economical, though certain O & M costs for desilting are required annually. Meanwhile, some hydropower generation can be made by harnessing the head difference between the canal water elevation of the Komering-I system and the intake water level of the Muncak Kabau system, if the diversion of water for the Muncak Kabau Project is integrated into the Komering-I headreach.

33. In order to utilize efficiently the large amount of water of Lake Ranau, a regulating concrete dam will be constructed at about 2.3 km downstream from the outlet of the Lake. The salient feature of the dam is as follows:

1) Active storage capacity of lake	300 MCM
2) Design discharge (max.)	50 m ³ /sec
3) Dam	
Height	8 m
Length of crest	84 m
Size of gate (H x B)	1.6m x 2.5m
Number of gate	6 Nos.

34. The following table shows the salient features of the headworks, irrigation, drainage and road networks. General layout of the project is shown in Fig. 1. The irrigation diagram showing the canal networks and capacity is presented in Fig. 6.

1) Headworks

Intake water level	El.79.3 m
Crest length of fixed weir	171.0 m
Size of gate (B x H x Nos.)	17.5m x 5.4m x 2 sets
Intake gates (B x H x Nos.)	7.0m x 4.0m x 3 sets

2) Driving channel	
Length	1.6 km
Type of canal	Trapezoidal concrete
Base width	5.0 m
Side slope	1 : 1.5
3) Settling basin	
Size of basin (H x L)	40m x 35m
Number of basin	2 Nos.
Number of gate	2 x 12 Nos.
4) Headreach	
Length	8 km
Canal slope	1/8,000
Type of canal	Trapezoidal unlined
Width of canal base	18 m
5) Main irrigation canals	
Length	134 km
Type of canal	Trapezoidal unlined
Related structures	222 Nos.
6) Secondary irrigation canals	
Length	237 km
Type of canal	Trapezoidal unlined
Related structures	774 Nos.
7) Tertiary irrigation canals	
	880 km
8) Drainage system	
Main drains	180 km
Secondary drains	310 km
Tertiary drains	954 km
Related structures	299 Nos.

9) Inspection roads	
Main roads	135 km
Secondary roads	237 km
Tertiary roads	1,064 km

35. The project will be implemented taking the following five stages:

- 1) Construction of headworks and headreach including those detailed design,
- 2) Detailed design and implementation of Sub-Area-I, 18,500 ha, and tertiary development of about 2,000 ha,
- 3) Implementation of tertiary development of 16,500 ha in Sub-Area-II,
- 4) Detailed design and implementation of Sub-Area-II, 18,200 ha, and tertiary development of about 2,000 ha and construction of Ranau regulating dam, and
- 5) Implementation of tertiary development of 16,200 ha in Sub-Area-II.

The time required for the implementation of the project is estimated to be approximately nine years including the design works and preparatory works as shown in Fig. 7.

36. Office and quarters required for the project implementation are briefly estimated as follows:

1) Main office	2,000 m ²
2) Branch offices	500 m ²
3) Repair shop	500 m ²
4) Store house	5,000 m ²
5) Quarters	3,100 m ²
6) Motor pool	15,000 m ²

37. In order to implement the project successfully it is proposed to establish the Komerang-I Project Office under the superintendence of the Provincial Department of Public Works. The main functions of the Project Office are as follows:

- 1) Financial arrangement needed for construction works and operation and maintenance of the project facilities,
- 2) Design and construction supervision of the construction works down to tertiary systems,
- 3) Assistance to farmers in construction of quaternary canals,
- 4) Design and construction supervision and operation of the pilot scheme, and
- 5) Accounting and management of the construction works.

38. In order to attain the expected crop production, more intensive agricultural support services are essential. In this context, the agricultural extension services should be strengthened. For agricultural credit services it is desired to establish a branch office of BRI within the project area. More farmers' cooperatives are organized and strengthened for proper operation of irrigation farming. In addition, it is desired to establish the water users' association for proper water management.

39. The total project costs required are estimated to be about US\$321 million which comprise US\$122 million equivalent of local currency and US\$199 million of foreign currency, which include the physical contingency of about 10% of direct cost and the price contingency of 5% per annum for the foreign currency portion and 8% per annum for the local currency portion as shown in Table 1. The annual operation and maintenance costs are estimated to be about Rp.720 million per annum.

40. The agricultural net incremental benefit through the project is estimated to be about Rp.27,100 million per annum including the benefit to be derived from 1,300 ha of elevated land in the Belitang Proper Area.

41. The economic feasibility of the project is evaluated in terms of internal rate of return on the basis of a 50 years useful life. The calculated internal rate of return is about 16.2% as a whole, which indicates the economic soundness of the project.

RECOMMENDATIONS

42. The feasibility investigation and study for the project were carried out based on the following topographic maps:

- 1) 1/5,000 scale with 2.5 m contour intervals covering the southwestern half of the irrigable area,
- 2) 1/50,000 scale with 2.5 m contour intervals covering the whole project area,
- 3) 1/50,000 scale with 20 m contour intervals covering the Lake Ranau area.

For the successful implementation of the project, a considerable supplementary topo-survey and preparation of maps in acceptable scale are required to be carried out particularly for the following stage of the detailed design works of the project. Namely,

- 1) topographic maps of either 1/5,000 scale with 0.5 m contour intervals or 1/2,500 scale with 0.5 m contour intervals for cadastral survey covering the entire project area, and
- 2) topographic maps of 1/500 scale with 0.25 m contour intervals at both headworks and settling basin sites for hydraulic model tests.

43. Hydrological analysis was carried out based on the available data provided by the Authorities concerned and supplementary investigation carried out by the Comprehensive Survey Team in 1979. Those data were rather insufficient for analysis due to certain interruption in measurement of river runoff and meteorological observation. In view of vital

importance of meteorological data on the water resources development, it is urgently needed to carry out the periodical measurement of river runoff and establishment of additional meteorological and hydrological stations to obtain the reliable data.

44. The upper basin of the Komering river has widely been developed for perennial crops cultivation and shifting culture by deforesting the lands, resulting in acceleration of considerable amount of sediment transport and unforeseen flood discharge of the river. The consolidated watershed management of the upper reach basin is indispensable. In this context, it is strongly recommended to promote the reforestation work for land conservation and water resources.

45. For the proper operation of settling basin to be constructed for the project as well as for study on reservoirs proposed for future development of the river basin, periodical measurement of sediment transport of the river at Martapura is essential.

46. Geological investigations at the headworks site and regulating dam site were carried out to a certain extent in 1980/81. Further additional test drillings at those sites including proposed settling basin site are required to be carried out in order to ensure the successful implementation of the works.

47. Based on the results of geological investigations and topographic maps prepared, hydraulic model tests of the proposed headworks and settling basin are proposed to be carried out for proper design on effective working of the structures.

48. In the estimation of irrigation water requirement for the project area, percolation rate measurement in the paddy field and intake rate measurement in the uplands were carried out to some extents. The estimation of consumptive use by crops was made based on the empirical formula. Actual field measurement of both consumptive use and additional percolation rate for paddy and intake rate measurement for

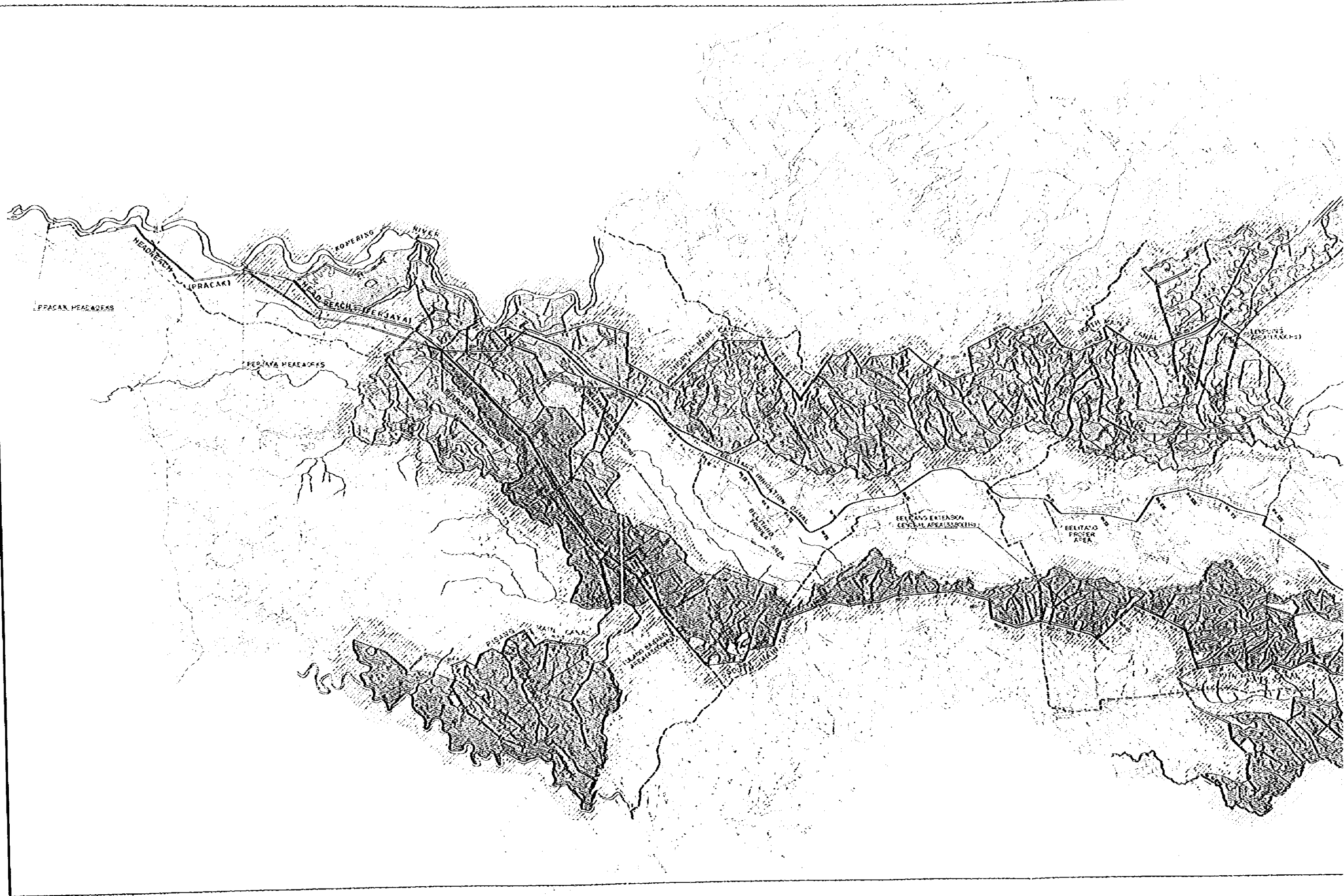
uplands, particularly at the lands to be newly reclaimed, are needed to be carried out in the project area so as to obtain more reliable figures.

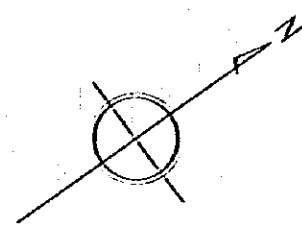
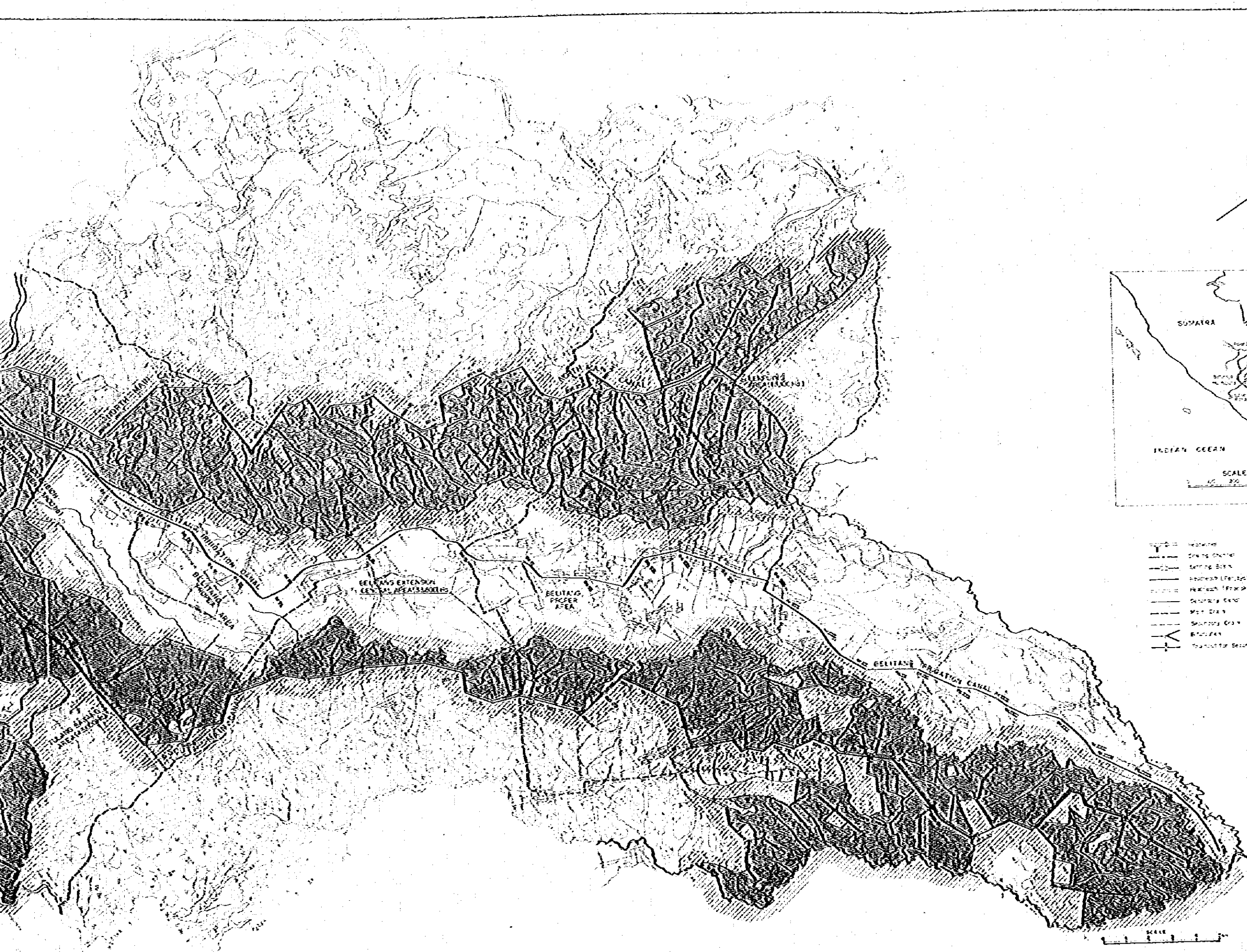
49. In order to exploit the full potential of the lands for agricultural development, rather intensive cropping patterns were proposed to the project, which require more improved farming technics together with careful water management. For the successful introduction of the proposed cropping pattern and its water management to the farmers in the project area, a pilot demonstration scheme is proposed to be established within the project area, for which the proposed plan is given in ANNEX-XII. Along with the above, the present institutions for agricultural support services have to be strengthened through increase of staff and budget allocation. In particular, cooperative movement is to be enhanced through effective extension services.

50. The comparative studies on irrigation water intake system between the proposed Perjaya headworks for both the Belitang Proper Project and the Muncak Kabau Irrigation Project and the present free intake system at Kurungang Nyawa for the Belitang Proper Project and the original plan of free intake at Muncak Kabau were carried out without considering the possibilities of hydro-power development. From the rough studies based on the available topographic maps and the proposed plan of Komerling-I Project, it is expected to generate about 1,000 kW at Kurungan Nyawa and about 800 kW at Muncak Kabau harnessing the head between the proposed canal water level in the Komerling-I System and the proposed intake water level at each said Project. In view of future rural electrification in and around the project area for raising living standard and welfare of the people as well as agro-industry development, the detailed comparative studies on such micro-hydropower development are recommended to be carried out at the time of realization of both the Lumpung and the Muncak Kabau Projects.

Table 1 SUMMARY OF CONSTRUCTION COST

Item	Total (10 ³ US\$)	Foreign Currency (10 ³ US\$)	Local Currency (10 ⁶ Rp.)
1. Preparatory Works	10,979	7,993	1,866
2. Ranau Regulation Dam	1,832	1,229	377
3. Headworks and Headreach	18,854	15,294	2,225
4. Irrigation Canals and Inspection Roads	64,038	42,584	13,409
5. Drainage Canals	10,985	6,294	2,932
6. Tertiary Development	26,684	17,097	5,992
7. Land Reclamation	31,173	21,235	6,211
8. Office and Quarters	1,816	-	1,135
<u>Sub-total</u>	<u>166,361</u>	<u>111,726</u>	<u>34,147</u>
9. Land Acquisition	3,431	-	2,144
10. O & M Equipment	4,888	4,490	249
11. Administration Expenses	2,534	-	1,584
12. Engineering Services	16,072	14,318	1,096
13. Physical Contingency	15,379	11,173	3,629
<u>Sub-total</u>	<u>43,904</u>	<u>29,981</u>	<u>8,702</u>
<u>Total</u>	<u>210,265</u>	<u>141,706</u>	<u>42,849</u>
14. Price Contingency	110,984	57,656	33,330
GRAND TOTAL	321,249	199,362	76,179

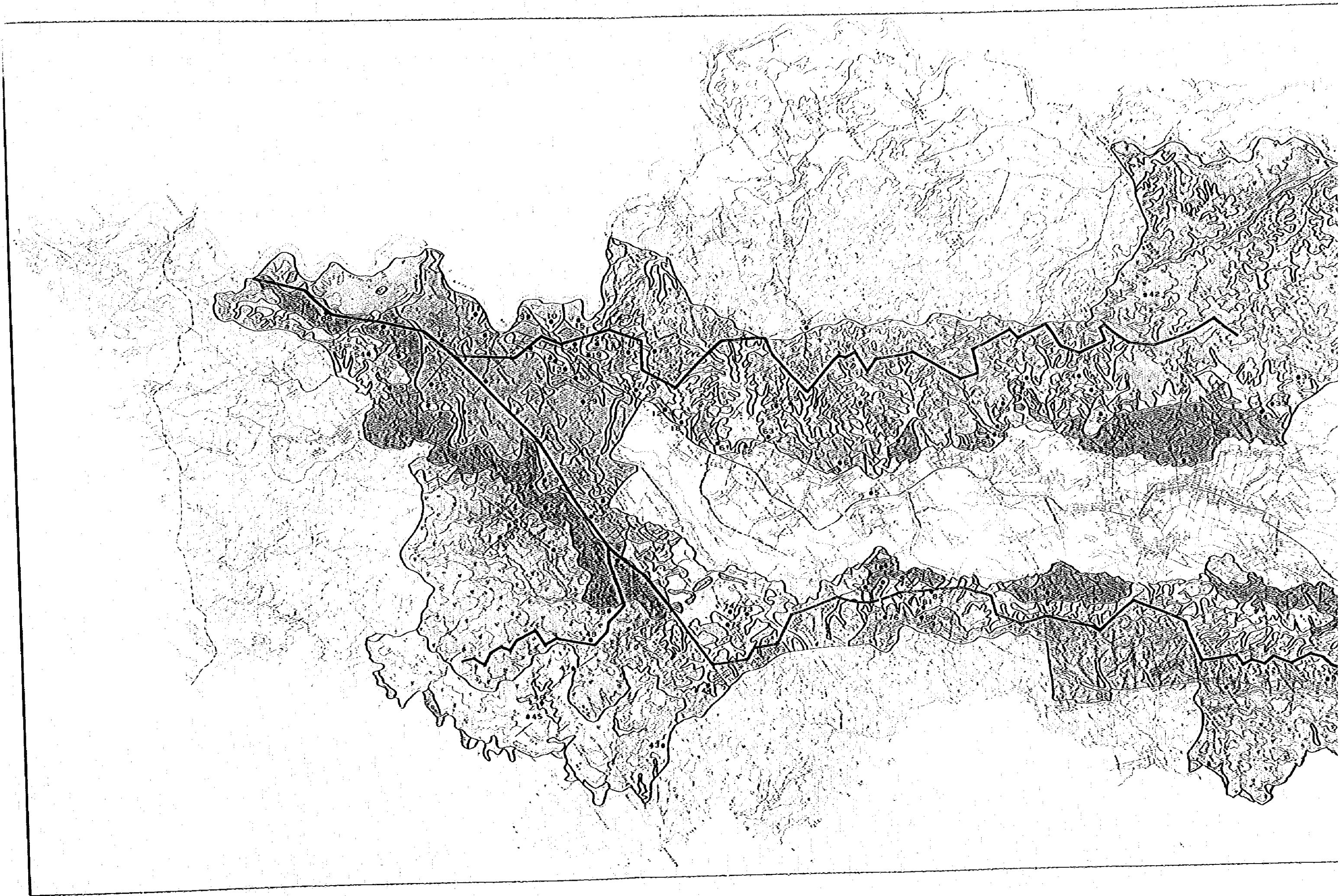


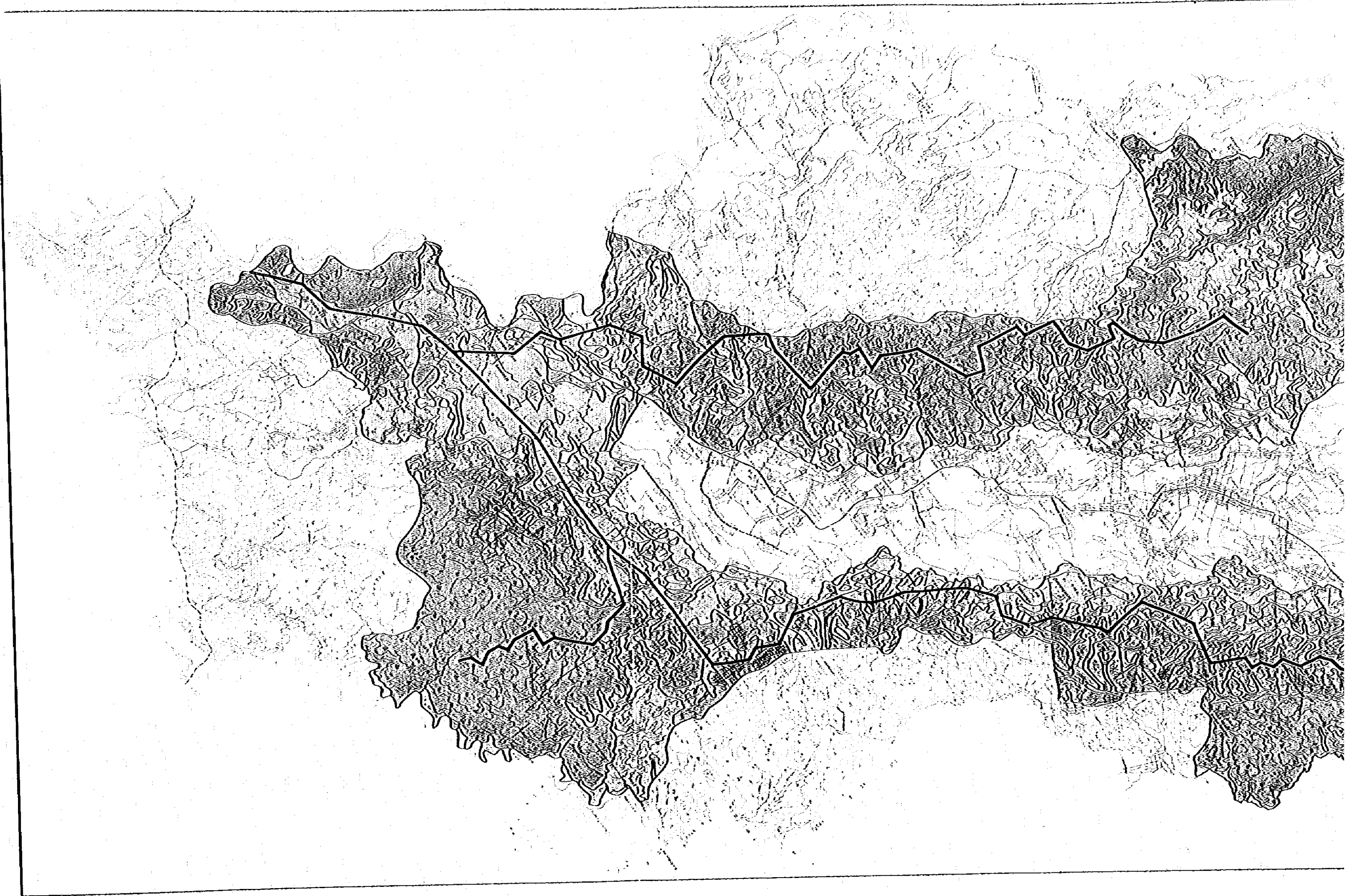


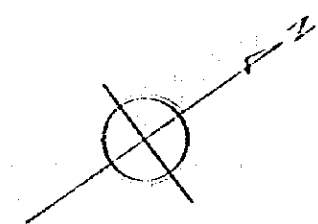
LEGEND

Weir	Tunnel for Tertiary Canal
Ditch Channel	Check Gate on Main Canal
Setting Bank	Aqueduct
Headreach (Franchise)	Bridge
Main Drain	Spring and Wellhead
Secondary Canal	Piped Structure for 2nd or 3rd Area
Secondary Canal	Trapped Road
Boundary	Main Existing Road
Tunnel for Secondary Canal	Boundary
	Scheme I
	Scheme II

DISCRETE GENERAL OF WATER RESOURCES DEVELOPMENT
 KUMERING - I IRRIGATION DEVELOPMENT PROJECT
 TITLE OF DRAWINGS
GENERAL LAYOUT MAP
 JAPAN INTERNATIONAL COOPERATION AGENCY
 ICAND





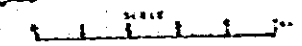


LEGEND

Symbol	Category	Area (Ha)	Area (%)	Area (Ha)	Area (%)
[Stippled]	Very Good	11,000	12	10,000	11
[Dotted]	Good	11,100	12	9,900	11
[Horizontal Lines]	Medium	49,740	55	24,400	27
[Vertical Lines]	Poor	12,500	14	14,800	16
[Diagonal Lines /]	Very Poor	1,500	2	1,200	1
[Diagonal Lines \]	Unsuitable	400	0	80	0
[Cross-hatched]	Water	1,000	1	3,800	4
[Blank]	Total	98,240	100	87,200	100

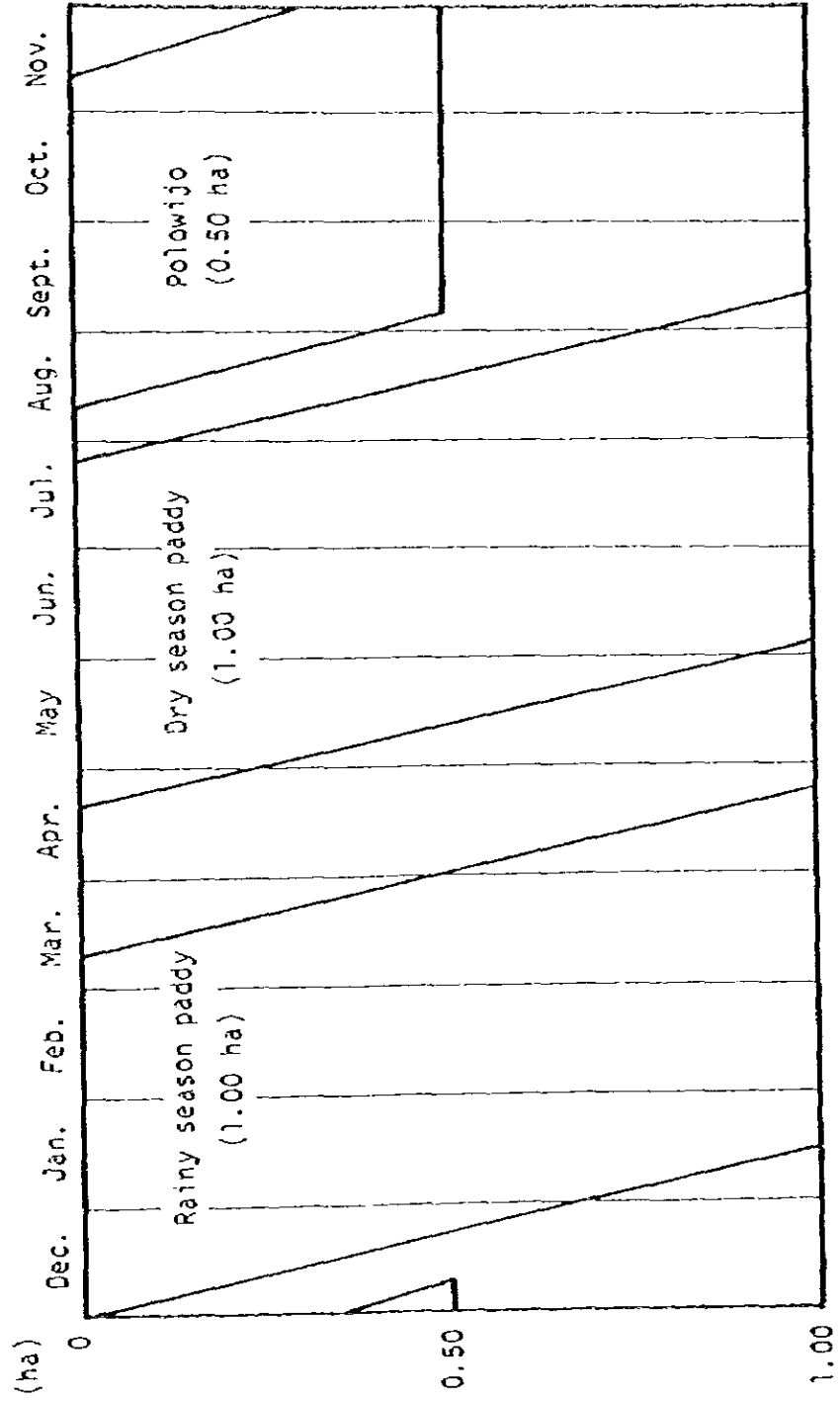
Scale: 1:50,000
 1 cm = 500 m

Category	Area (Ha)	Area (%)	Area (Ha)	Area (%)
Very Good	11,000	12	10,000	11
Good	11,100	12	9,900	11
Medium	49,740	55	24,400	27
Poor	12,500	14	14,800	16
Very Poor	1,500	2	1,200	1
Unsuitable	400	0	80	0
Water	1,000	1	3,800	4
Total	98,240	100	87,200	100



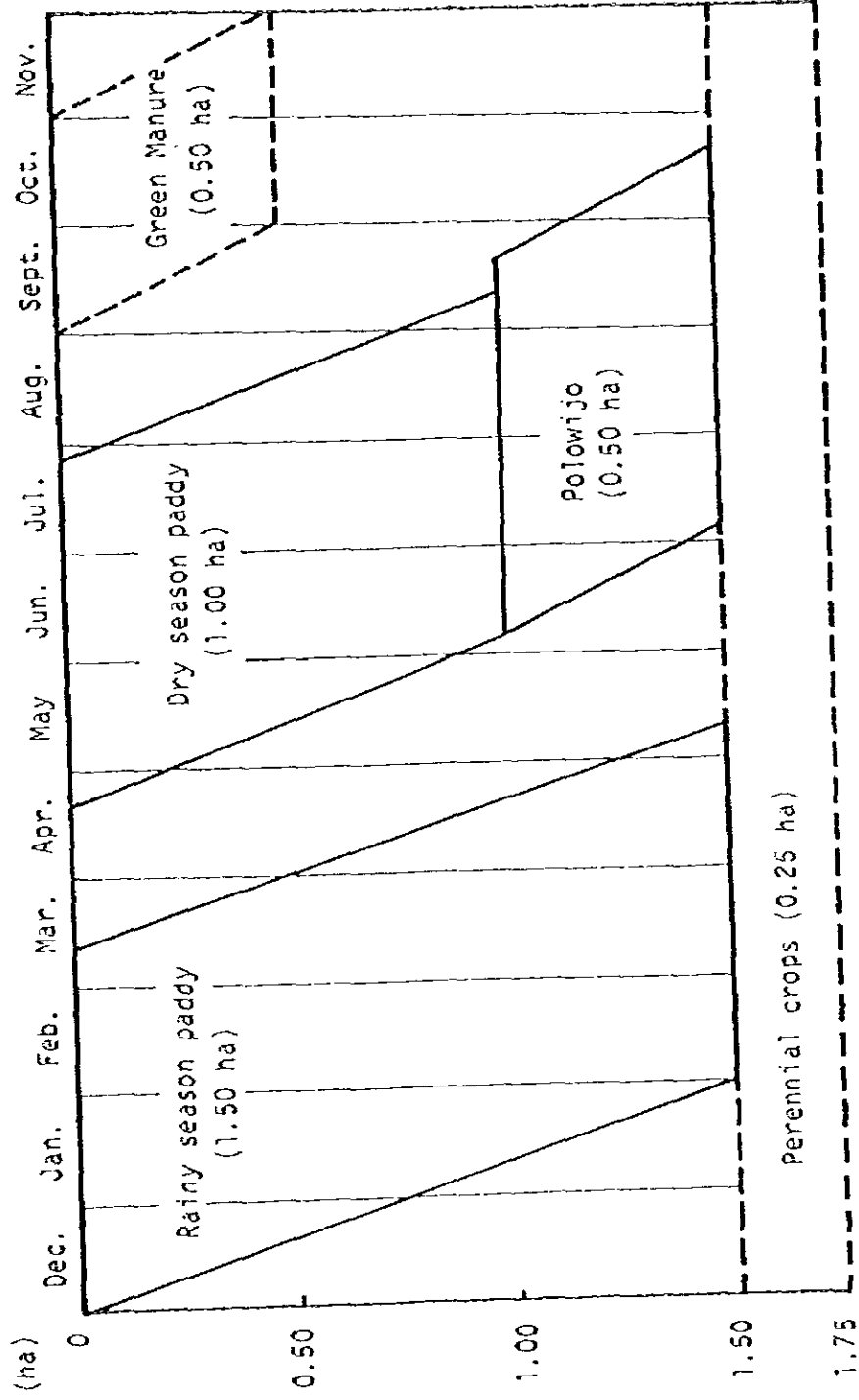
DEPARTMENT OF WATER RESOURCES DEVELOPMENT
 RIVER-REGULATED IRRIGATION DEVELOPMENT PROJECT
 TITLE OF DRAWING
**LAND SUITABILITY MAP FOR PADDY AND
 UPLAND CROPS OF THE PROJECT AREA**
 FIELD INVESTIGATION DIVISION
 TOKYO

Fig. 4 PROPOSED CROPPING PATTERN TYPE I (1.0 ha)



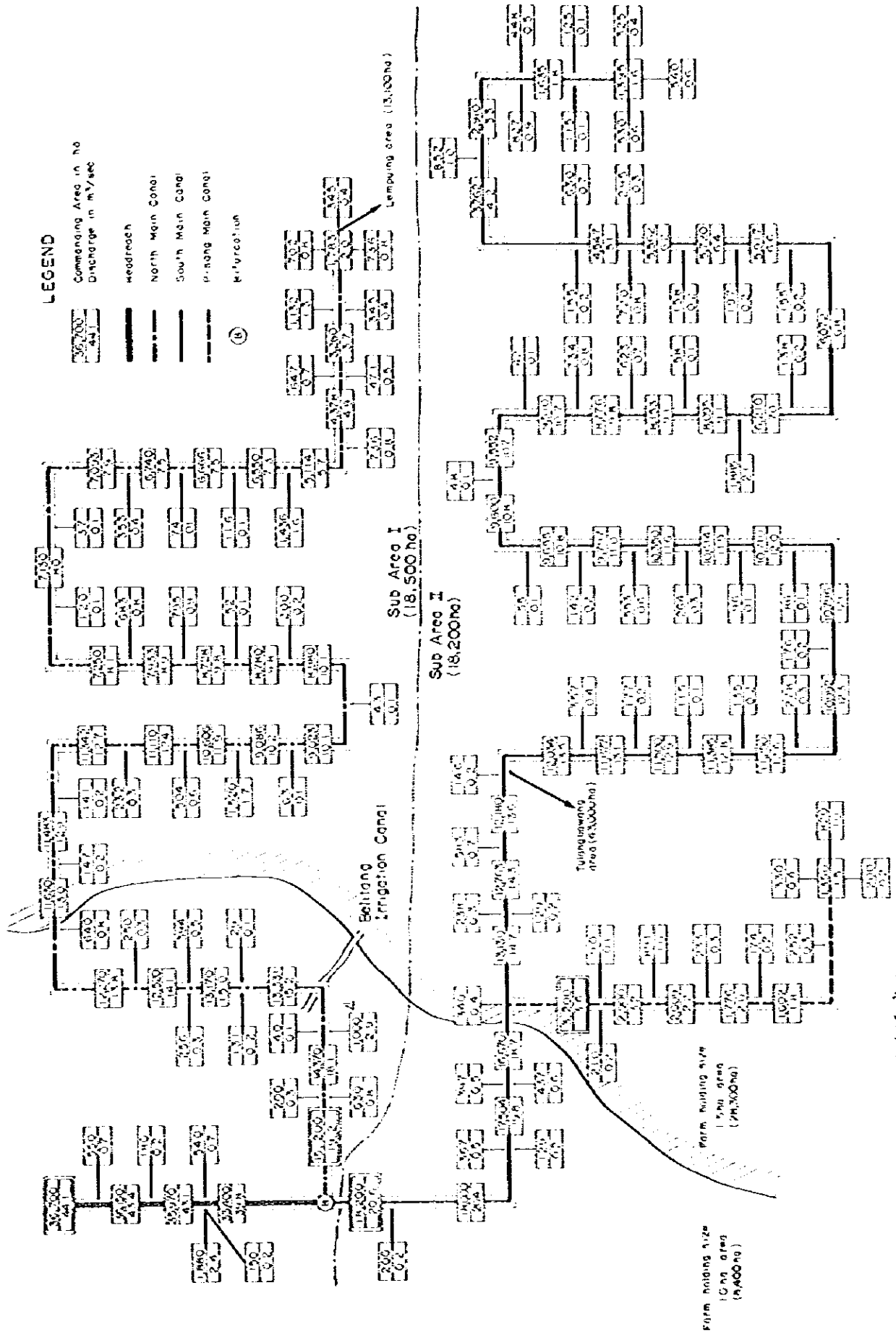
Crop Intensity: 2.50

Fig. 5 PROPOSED CROPPING PATTERN TYPE II (1.50 ha)



Crop Intensity: 2.00 (Except 0.50 ha of Green Manure and 0.25 ha of Perennial crops)
 Perennial crops are excluded from economic evaluation, because these crops are not benefited by irrigation.

FIG. 6 IRRIGATION DIAGRAM



JICA

11
8
41
1451