(3) Sediment transport

The sediment transport of the Bila river is estimated by use of the sediment discharge data measured in the master plan study and also by the sieve analysis of the riverbed material. The annual sediment production rate is rather low, averaging approximately 250 m^3/km^2. Further study on sediment transport on the Bila river and the Kalola river will be necessary at the proposed intake and dam sites.

(4) Water quality

In order to check the water quality of the Bila river, the water quality analysis was made for water samples taken both in the dry and wet seasons in the master plan study and for those taken in August, 1981 in this study. A study of the chemical properties of water samples showed that the river water could be used for irrigation.

3.4 INFRASTRUCTURE

3.4.1 Irrigation and Drainage

Six small scale irrigation systems have been developed in the Project area consisting of one DPU semi-technical irrigation system and five Desa non-technical irrigation systems, commanding about 500 ha and 700 ha respectively. Technical irrigation system has not been developed in the Project area.

Semi-technical irrigation system developed in the Project area is only Salodua scheme serving an area 500 ha. The water source of the scheme is the Manumanu river originating in the eastern hilly ranges. The irrigation system consists of a permanent intake weir constructed with wet stone masonry at a catchment area of 8 km^2, and a main canal of 5,190 m with four diversion structures. Tertiary canals are provided for the limited extent. Since the catchment area is small in scale, the stream dries up in the dry season sometime even in the wet season. The irrigation is limited in the rainy season. The irrigation system is presently used for drainage in the rainy season due to lack of technical drainage system.

Five Desa irrigation schemes are provided with intake facilities constructed with wet stone masonry. Their conditions, however, are poor and operation is not effective. The canal systems are primitive and the distribution system is not provided. All the facilities are superannuated. Irrigation is not systematically practiced and is limited also in the rainy season. No exclusive drainage facilities have been developed in Desa irrigation schemes.

3.4.2 Transportation and Communication

A national road runs through the Project area leading from Ujung Pandang to Sengkang via Tanru Tedong, running in from west and passing by the southeast boundary of the Project area. This road links itself to Ujung Pandang via Cabenge. It plays a major role in the

transportation around the Project area. A provincial road branches off from the trunk road at Sengkang stretching southeastwards by way of Watam Pone, the principal town in the eastcoast. The full spans of both roads are asphaltpaved and year-roundly better maintained. Another provincial road also branches off from the trunk road at Bola Malimpong and extends to Palopo towards northeast via Tarumpakkae.

In addition to the above, a district road branches from the trunk road at Tanru Tedong and stretches northwards along the bila river. This road leads to the intake structures and provides a function of main farm road to transport agricultural production and inputs in the northern part of the Project area. This road is gravel metalled and passable during the wet season.

A number of unpaved rural roads branch from the above national, provincial and district roads. Most of them are not passable during the wet season, and the density of them is still low. Insufficient farm road networks and poor maintenance limit the smooth access to villages and farmland throughout the year.

A domestic airport available for jetliners has been operated in Ujung Pandang, about 210 km far from the Project area. Garuda Indonesian Airway, a national carrier, and some domestic airways provide daily services between Ujung Pandang and other major cities.

The port Ujung Pandang and Pare Pare are located at about 210 km and 55 km respectively far from the Project area. The port Pare Pare plays a leading role of the export of the agricultural products in the Project area at present. The port has a capacity to receive ships of medium size.

Telephone system has been networked between major cities and Sengkang. So far as the Project area is concerned, the telephone system has not been installed at present.

3.4.3 Domestic Water Supply

The domestic water supply system has not been developed in the Project area. Each village in the Project area mainly depends on the groundwater or the stream flows. A number of shallow wells have been dug in each village by grouped village people.

3.5 PRESENT LAND USE AND AGRICULTURE

3.5.1 Land Use

The present land use are classified into 5 categories, comprising paddy field, upland field, orchard, forest/grass land and village/others as summarized as follows:

Land use category	Area	Proportional extent
	(ha)	(%)
Paddy field	13,700	68.5
Upland field	700	3.5
Orchard	1,260	6.3
Forest/grass land	3,800	19.0
Villages/others	540	2.7
Total	20,000	100.0

The farmland comprising paddy fields, upland fields and orchards amounts to about 15,600 ha or 78.3% of the total area. Paddy fields occupy about 13,700 ha or 68.5% of the total area. It has been mainly developed to the possible maximum extent, even over the undulating land as far as the soil-water regime is allowable to paddy cultivation. Most of paddy fields are generally under rainfed condition.

Upland fields of about 700 ha extend along the Bila and Kalola rivers and their tributaries in the study area, and are presently used for cultivation of maize, groundnuts, cassava, etc. Most of the orchards are sporadically located around the village areas and are cultivated for banana, coconuts, clove, kapok, pepper, etc. The total area of orchards is estimated at about 1,260 ha. The remaining of about 4,340 ha is covered with forest, grassland, villages and others.

The present land use in the study area is illustrated on Fig. 3.3.

3.5.2 Land Tenure and Land Holding

In the study area, the average size of farms is 1.54 ha, out of which the paddy field accounts for 1.29 ha. This average size is smaller by 0.20 ha as compared with that of the whole province (1.74 ha). According to the IPEDA offices of Kab. Sidrap and Wajo, about 48% and 26% of the farmers are owner farmers and partially owner farmers, respectively. Tenant farmers account for about 26%. Tenant system are complicated but most of them are of share cropping. Tenant charge is generally about 50% of the total products.

Studies on the frequency distribution of the size of farms indicate that farmers with farmland less than 0.5 ha constitute about 42% of the total number of farmers in the study area. As the crop incomes of these peasant farmers are not abundant and insufficient to maintain the livelihood of farmers, most of these farmers are engaged in various sideline business.

Land holding size distribution in the study area is summarized as follows:

Land holding size (ha)	Farmer (Nos.)	Percentage (%)
- 0.5	3,590	41.7
0.5 - 1.0	2,310	26.9
1.0 - 1.5	1,360	15.8
1.5 - 2.0	850	9.9
2.0 - 5.0	340	3.9
5.0 -	150	1.8
Total	8,600	100.0

3.5.3 Cropping Pattern

The main crop grown in the study area is paddy, followed by polowijo crops such as maize, groundnuts, greenbeans and soybeans. Other crops grown as adjunct to rice farming are coconuts, banana, clove, pepper, kapok, etc.

The paddy cultivation is concentrated in the wet season and is very limited in the dry season. The polowijo crops are generally planted in the dry season. The cultivation pattern is generally affected by seasonal distribution of rainfall. The planted and/or harvested areas fluctuate year by year, depending on the available rainfall water. The wet season paddy is planted at the onset of the monsoon, generally in May and June, and harvested in August and September. The dry season paddy and/or the polowijo crops cultivation generally starts in October/November.

The average planted area of paddy, from 1976 to 1980, is 12,600 ha for wet season paddy and 820 ha for dry season paddy. These figures correspond to 92% and 6% of the total paddy field, respectively. The planted area of polowijo crops is about 3,600 ha on an average, corresponding to 26% of the paddy fields. The present multi-cropping intensity is estimated at 124%. Such low cropping intensity is basically attributable to shortage of available water.

The average harvested areas of paddy and polowijo crops, from 1976 to 1980, are 10,800 ha for wet season paddy, 730 ha for dry season paddy and 3,500 ha for polowijo crops, respectively. The difference between planted and harvested areas are considered as the areas damaged by various causes like flood, drought, insects and rodents. The average damaged areas for same period, are 1,800 ha for wet season paddy 90 ha for dry season paddy and 100 ha for polowijo crops.

The average planted, harvested and damaged areas of crops, from 1976 to 1980, are summarized as follows:

(Unit: ha)

Crops	Planted area	Harvested area	Damaged area
Wet season paddy	12,600	10,800	1,800
Dry season paddy	820	730	90
Polowijo crops	3,600	3,500	100

The damaged areas are classified as follows:

(Unit: ha)

Crops	Cause of damage			Total area
	Flood	Drought	Insects/ rodents	
Wet season paddy	870	580	350	1,800
Dry season paddy	-	50	40	90
Polowijo crops	-	100	-	100

The extensive agricultural survey has been made over the study area and it has been found that the crop rotation patterns adopted in the study area can be classified into four (4) major types. They are:

Cropping pattern	Cropping intensity (%)	Area (ha)
Paddy - (fallow)	90 - 100	10,000
Paddy - Paddy/Polowijo	100 - 120	700
Paddy - Polowijo	125 - 150	2,800
Paddy - Polowijo - Polowijo	150 - 175	200
Total	124 (Ave.)	13,700

The pattern (1) is predominant in the study area, accounting for about 73% of the paddy field. The pattern (2) is found in the semitechnical and Desa irrigation areas. Due to limited availability of dry season water, very limited areas can be planted with polowijo crops and dry season paddy. Pattern (3) is double cropping of paddy and polowijo crops under some irrigated condition. The cropping intensity is, however, still low. Pattern (4) is found on very limited areas of existing paddy fields around Lake Buaya where enough soil moisture is generally maintained due to higher groundwater level.

The areas under these cropping patterns are summarized and illustrated on Fig. 3.4.

3.5.4 Farming Practices

The paddy cultivation is carried out by labour intensive form from the stage of seeding to harvesting. All the members of family contribute their labour to rice farming. Annimal power, mainly oxen and buffaloes, is extensively used for land preparation. The use of agricultural equipment is not common.

The high yielding varieties have been widely spread over the area. The major varieties are IR42, IR38, IR36, IR28, etc. These new varieties occupy about 88% of the paddy fields, of which about 40% are IR42. The local varieties are still used on about 12% of the paddy fields mainly for home consumption and local marketing.

Paddy seeds are selected from last harvest or are supplied from the seed centers at Tanru Tedong, Bontouse and Sakkoli. Paddy seeds are generally sown at rate of 25 to 30 kg per ha in the nursery which is prepared in the size of about 1/20 to 1/25 of the paddy field to be transplanted. The seedlings are generally grown for 20 to 25 days.

The field preparation, plowing and harrowing, is made before transplanting by using animal power. Transplanting is generally carried out by hand. Mutual exchange of labour among the farmers groups is common for transplanting. The random transplanting is common and the number of seedlings (hills) for transplanting is generally not many, being 10 - 16 per m^2.

The fertilizers and agro-chemical are widely used. The fertilizers being used are urea and triple super phosphate (TSP). The average dosages are 100 kg of urea and 50 kg of TSP per hectare. Potasium fertilizers are not generally used. Use of insecticides and rodenticides is common. Major insecticides are Demecron and Diazinon. They are applied to the field by use of knapsack type sprayers. Zinc phosphate is widely used as rodenticide.

Harvesting is generally carried out by using sickles and the harvested paddy is dried on the ground surface of the paddy field.

The cultivation method of polowijo crops is very primitive. Neither fertilizers nor improved varieties are used.

3.5.5 Crop Yields and Production

The crop yield and production under present condition are estimated on the basis of production data obtained from agricultural offices of 9 Desa. The yield and production largely fluctuate year by year due to wide variation of annual rainfall and unexpected damages caused by floods, insects and diseases. The present crop yields and production are therefore estimated to be the average from 1976 to 1980 as shown in Table 3.2.

The average unit yield of paddy (dried paddy) is 2.97 tons/ha for wet season paddy and 2.84 tons/ha for dry season paddy. The average yield of polowijo crops is 0.73 tons/ha.

The paddy yield survey was carried out during the period of August 12 to August 28, 1981 to identify the defects hampering the increase of paddy yields under present condition. The paddy sampling was made for wet season paddy at 59 sites of paddy fields in total, of which 37 samples were taken from the study area and 22 samples from the Sadang Irrigation area. The variety of paddy sampled is IR42, the dominant variety in the study area. The results of paddy yield survey and analysis are given in ANNEX-V.

The average annual production of paddy and polowijo crops is summarized as shown below.

Crops	Harvested area (ha)	Unit yield (ton/ha)	Production (ton)
Paddy	11,530	2.94	34,000
Wet season paddy	10,800	2.97	32,000
Dry season paddy	730	2.84	2,000
Polowijo crops	3,500	0.73	2,550
Maize	420	0.79	330
Groundnuts	640	0.77	490
Greenbeans	2,385	0.70	1,670
Soybeans	55	1.09	60

3.5.6 Livestock Production

Livestock raising is not a mainline of agricultural activities in the study area. Most of livestocks are grazed on a small scale in and around the paddy fields. The number of livestock animals in the study area are summarized as follows:

(Unit: head)

Livestock	Total number	Per farm household
Cattle	10,730	0.93
Horse	1,460	0.13
Buffalo	5,970	0.52
Goat	2,050	0.18
Chicken	76,330	6.59
Duck	12,090	1.04

The livestock plays an important role in farm operation and transportation as motive power, and also in protein food supplies. Annual income from livestock is, however, of little significance to the project as well as farm economy. It can be excluded from project economy.

3.5.7 Marketing and Prices

In the study area, rice is the main marketing farm product. The paddy field are about 13,700 ha in total and the average harvested area is about 10,800 ha for wet season paddy and about 730 ha for dry season paddy. The total production of paddy is estimated at about 34,000 tons. The total consumption of paddy for the total population of about 83,900, is estimated at about 18,000 tons on the assumption that per capita consumption is 220 kg of dried paddy. The annual surplus amount of rice is estimated at about 16,000 tons.

There are three channels of rice marketing in the study area. The surplus of paddy produced by the farmers is generally sold to KUD and/or middle men through brokers. The paddy collected by KUD is sold to DOLOG after milling, while the paddy collected by middle men is generally transported to outside of the study area, especially to Ujung Pandang and Pare-Pare. About 95% of surplus paddy is marketed through these two channels. The remaining 5% of the surplus paddy is sold at local markets in and around the study area by small brokers and/or directly by farmers.

The present low production of polowijo crops has resulted from poor marketability together with large fluctuation of market prices. Such poor marketability is mainly due to poor quality of products. According to the results of farm economy survey, the best quality products of polowijo crops have no problem for marketing. However, strong government support is necessary for stabilization of market prices of polowijo crops.

The price of rice is generally controlled by the Government through DOLOG. When the market price is down under the floor price, DOLOG purchases the marketed rice and when the price is over the ceiling price, DOLOG sells its stock. The market prices of major crops in 1980 are summarized as follows:

(Unit: Rp./kg)

Crops	Kab. Sidrap	Kab. Wajo
Milled rice	173.0	179.7
Dry paddy	117.6	122.2
Maize	83.0	92.0
Groundnuts	502.1	572.9
Greenbeans	275.7	302.8
Soybeans	247.4	247.5

The present farm gate prices of the farm products and the farm inputs in the project area are estimated based on the data obtained from the agriculture offices and through the farm economy survey. The present farm gate prices of major farm products in 1980 are summarized as follows:

(Unit: Rp./kg)

Crops	Prices	Crops	Prices
Dried paddy	90	Groundnuts	400
Maize	66	Greenbeans	217
		Soybeans	212

3.5.8 Crop Production Cost and Value

The studies on the farming costs were made on the basis of data obtained from agricultural offices of Kab. Sidrap and Wajo and confirmed through the farm economy survey carried out in and around the study area.

The present average production costs are estimated at about Rp.139,600 per ha for paddy and at about Rp.60,400 per ha for polowijo crops. The detailed estimates are given in ANNEX-V.

The gross production value under present condition in the study area is estimated at Rp.3,652 million as shown below.

Crops	Annual production (ton)	Unit price (Rp./kg)	Production value (10^6Rp.)
Paddy	34,000	90	3,060
Wet season paddy	32,000	90	2,880
Dry season paddy	2,000	90	180
Polowijo crops	2,550	232	592
Maize	330	66	22
Groundnuts	490	400	196
Greenbeans	1,670	217	362
Soybeans	60	212	12
Total	-	-	3,652

The crop production cost under present condition totals Rp.2,110 million, and are summarized as follows:

Crops	Planted area	Unit production cost	Total production cost
	(ha)	(Rp./ha)	(10^6Rp.)
Paddy	13,420	-	1,877
Wet season paddy	12,600	139,900	1,763
Dry season paddy	820	139,300	114
Polowijo crops	3,600	-	233
Maize	432	33,300	14
Groundnuts	658	81,500	54
Greenbeans	2,453	66,200	162
Soybeans	57	60,700	3
Total	-	-	2,110

Tha annual net production value under present condition in the study area is then calculated at Rp.1,542 million in total, by deducting the total production costs from the total gross production value.

3.5.9 Farm Economy

At present, the average size farmer in the study area cultivates 1.54 ha of farmland comprising 1.29 ha of paddy field and 0.25 ha of upland field. Farmers in the study area get their income mainly from farming activities particularly the paddy production, partly supplemented with sales of polowijo crops.

Total annual gross farm income is estimated at Rp.427,700 for the average size farmer. The farming expenses are estimated at Rp.68,800 on the average size farm. Accordingly, net farm income is estimated at Rp.358,900.

According to the results of farm economy survey, the annual family living expenses are estimated at Rp. 358,400 in total for the average size family of 5.5 persons. The net reserve of the average size farmer is generally negligibly small as shown in Table 3.3.

3.6 AGRICULTURAL SUPPORT SYSTEM

3.6.1 General

The South Sulawesi Province, one of 27 provinces in whole Indonesia, is administratively divided into 21 Kabupaten (Districts) and 2 Kota Madya (Municipalities), headed by "Bupati" and "Wali Kota"

respectively nominated by the Governor of the Province. These Kabupaten and Kota Madya are subdivided into 169 Kecamatan (Sub-districts) headed by "Camat" nominated also by the Governor. Under the Kecamatan, there are 1,136 Desa (Villages) which are the basic units of administrative structure in Indonesia.

The Kabupaten Sidrap and Wajo, within which the study area are entirely covered, have 8 and 7 Kecamatan and 48 and 32 Desa, respectively. In the study area, 4 Kecamatan and 9 Desa are included.

3.6.2 BIMAS/INMAS and INSUS Program

The agricultural intensification programs so called "BIMAS" and "INMAS" have been promoted by the Indonesian Government in order to facilitate the crop production increase with coordination of all the "package" of agricultural inputs to the farmers since 1963. For further development of BIMAS/INMAS program, the Government has initiated to organize a village unit (Wilayah Unit Desa) as the lowest executive unit of the Program since 1973. In general, each village unit comprises 2,000 farmers with 600 to 1,000 ha of irrigated paddy field and has the following agricultural support services:

(1) Extension services by PPL (Field Extension Worker)

(2) BIMAS credit services by village unit branch of Indonesia People's Bank (BRI)

(3) Farm inputs supply services by village unit KIOSK, and

(4) Coöperation processing and marketing by village unit cooperative (KUD)

In the study area, there are 14 village units with 7 KUD and 5 KIOSK. The average hectarage of the paddy fields and the average number of farm household per a village unit are about 700 ha and 830 farm households, respectively. As compared with the said general standard of village unit, those in the study area are far intensified in size.

Under these executive units, the BIMAS and INMAS progrms have been steadily developed. The areas served by the BIMAS and INMAS programs in the study area are estimated to be about 1,280 ha and 7,740 ha, respectively. In order to further promote the BIMAS program, Special Intensification Programs (Intensifikasi - Khusus) so-called "INSUS" has been launched since 1979. The INSUS program is the special form of BIMAS for farmer's groups which are voluntarily organized by the progressive farmers. There is no special BIMAS package for the farmers groups under INSUS program. Each farmer's group can decide and apply any form of package with the advice of PPL, who visits the farmer's group once a week. In the study area, about 240 farmer's groups have been organized and about 30% of farmer's are served by the INSUS program.

3.6.3 Research

The agricultural research work in Indonesia is undertaken by the Central Research Institute of Agriculture (CRIA) at Bogor in Java. There are 6 branch research stations in whole Indonesia, namely, East Java, West Java, South Kalimantan, West Sumatra, North Sumatra and South Sulawesi.

The South Sulawesi Branch Research Station of CRIA is located at Maros about 40 km north from Ujung Pandang. The Branch Research Station has 146 ha of experimental fields of which 110 ha are for rice experimental fields. There are two sub-stations under control of this station. One is located at Langrang, Kab. Sidrap and is mainly carring out rice experiment with 44 ha of irrigated paddy field.

3.6.4 Extension Service

In order to promote and accelerate the agricultural extension activities by separating the extension service from general agricultural administrative services, the Agricultural Extension Service Development Program has been launched in Indonesia since 1974. In the Central Government, the Agency for Agricultural Education, Training and Extension was established as one of the extra-ministerial bureaus under the Ministry of Agriculture. In the provincial level, the establishment of the Agricultural Development Centers has been promoted with the provision of functions of adaptation tests of new recommended agricultural techniques recommended by research institutions and in-services training for field extension workers. In the Kabupaten level, several Rural Extension Centers have been established as a base camp for extension education activities with functions of preparation of extension program, dissemination of agricultural information and training for leading farmers at the local level.

In the study area, there are two Rural Extension Centers, B.P.P. Tanru Tedong and B.P.P. Anabanua, and total numbers of PPM and PPL are 3 and 13 respectively and cover 14 village units.

3.6.5 Seed Multiplication

The Provincial Seed Center located at Maros is only one institute which produces stock seeds of new recommended varieties of paddy in the South Sulawesi. The foundation seeds supplied from the Central Research Institute of Agriculture (CRIA) are multiplied to the stock seed at the Center. The Seed Center distributes these stock seeds to 37 Seed Stations managed by each Kabpaten office. There are 3 seed stations in Kab. Sidrap and Wajo, and are located at Tanru Tedong, Bontouse and Sakkoli. These seed stations produce the extension seeds and distribute them to seed growers. The seed growers produce paddy seeds and supply them to the farmers through BUUD/KUD according to the

BIMAS/INMAS program. New variety of IR42 was first introduced to Kab. Sidrap in 1978 and Kab. Wajo in 1979, then this variety is used on greater than 40% of the total paddy fields. This has evidenced good performances of the seed multiplication program.

3.6.6 Agricultural Credit

The Indonesia People's Bank (BRI - Bank Rakyat Indonesia) is the state bank specialized in agricultural credit covering whole country and has a broad network composed of many regional offices, branch offices and sub-branch offices (village unit BRI). The bank is authorized to finance BIMAS package credit for farmers. There are several kinds of BIMAS packages. The credit amount is fixed for each BIMAS package. The loan condition is fixed at the interest rate of 1% per month and the repayment period of 7 months. In the study area, there are one branch office and 4 sub-branch offices. The loan amount for BIMAS package has steadily increased and it exceeds Rp.400 million in 1980/81.

3.6.7 Farm Inputs Supply

Distribution of fertilizers is handled by P.T. PUSRI and agrochemicals is handled by P.N. PERTANI, the government enterprise in the South Sulawesi Province. According to the BIMAS/INMAS program, fertilizers and agro-chemicals are supplied to 4 sub-distributors appointed by P.T. PUSRI at Ujung Pandang and then the necessary amounts of such farm inputs are transported by sub-distributors to the retailers and/or KUD at the local level. The distribution prices of these agricultural inputs are controlled by the Government. Distribution prices of Urea and TSP to the farmers are fixed at Rp.70/kg at present.

3.6.8 Farmers Cooperatives

Farm inputs supplies and processing and marketing of farm products are primarily made through the establishment of cooperatives which have been promoted by the Government through the Cooperative Office in each Kabupaten since 1945 when the Cooperative Acts in Indonesia was enacted. In spite of government efforts, however, the cooperative movement has not been well developed mainly because of weakness in management and shortage of operational fund.

In order to improve such stagnant condition of cooperative movement, establishment of Village Unit Cooperative (KUD) has been promoted since 1973 when the President Decree for Village Unit was enforced, as previously mentioned.

In the study area, 7 KUD have been organized so far. These KUD presently cover about 70% of the study area. The total number of KUD members including candidates is about 2,200, which corresponds to about 19% of total farm households in the study area.

CHAPTER IV PROJECT FORMULATION

4.1 GENERAL

There exist two approaches to the Bila irrigation project formulation as mentioned in Section 1.2 and Section 1.3. In order to make the optimal formulation of the project development plan, the investigation and study were conducted in accordance with the Scope of Works presented in Section 1.4. The investigation disclosed more detailed technical and economical features around the Project area, and revealed the differed conditions from those for the existing two plans. The above findings necessitate the review and updating of the existing plans.

In due consideration of the above-mentioned requirements, the project formulation was elaborated based on the following study:

(1) Determination of potential irrigable area,

(2) Assessment of water resources,

(3) Review of existing plans and,

(4) Determination of the optimal development plan.

4.2 POTENTIAL AREA FOR IRRIGATION DEVELOPMENT

4.2.1 General

The Master Plan indicates that the Bila river will serve the irrigation area 10,500 ha with the Bila river flow. The irrigation plan prepared by DOI also aims at irrigation over an area of 9,288 ha with the Bila river flow. There exists difference in the geographical extent of the irrigation area between both plans. The Master Plan intends to cover somewhat high elevated paddy fields starting from EL. 35 m (intake weir level EL. 35 m) to lowlying areas with an elevation of 9.0 m. The irrigation area of the DOI plan, on the other hand, is selected over the rather lower areas between 30 m to 7 m in elevations.

The field investigations and studies cover an area of about 20,000 ha in gross relevant to the Project study particularly making study on land suitability for irrigation development and the present drainage condition for proper planning of drainage improvement.

In selecting the most suitable irrigation development area, the following principal factors are taken into consderation: (1) land use, (2) soil condition, (3) irrigability, (4) drainability, (5) regional socio-economic conditions and (6) optimum project scale in terms of economic viability.

The present conditions on the major factors are revealed as follows:

4.2.2 Factors Affecting Selection of Irrigation Area

(1) Land use

The land use pattern in the study area is closely correlated to topographic condition, soil condition and availability of water sources. In paticular, development of the paddy fields mainly extending over the alluvial plains is well correlated to the above conditions. The paddy fields have been presently developed to the possible maximum extent, even over the undulating lands as far as the above conditions allow paddy cultivation. There exist about 13,700 ha of paddy fields in the study area (for details, vide ANNEX-V).

(2) Soil condition

The existing paddy fields are developed on the two soil units, Eutric Fluvisols and Eutric Gleysols. These soils extend over the flat alluvial plain and have suitable characteristics for paddy cultivation like flat topography, deep surface soils, heavy soil texture, easy water availability, etc. Other soil units observed in the study area are Ferric Acrisols, Plinthic Acrisols and Eutric Regosols which extend on the hilly regions and along the river stretches, and are not suitable for rice cultivation due to shallow soil depth, stoniness and undulating topography. This means that existing paddy fields have been developed to the possible maximum extent and there is no unused arable land to be newly reclaimed under the project (for details, vide ANNEX-II).

(3) Irrigability

The irrigability is assessed through engineering studies on intake structures and canal systems. The possible maximum height of intake water level has been determined at 35 m in elevation in the Master Plan, in view of topographic conditions of intake site, and the available water. The possible alignment of irrigation canal is then laid out from 35 m intake water level down to the existing paddy fields, with a view to inclusion of more existing paddy fields.

(4) Drainability

The drainability of lands is evaluated in relation to river flows and lake water level fluctuations. Lake Buaya collects the run-offs and/or drain water from the Bila and Kalola rivers and other small streams. The land locating around Lake Buaya is presently put under poor drainage condition in the wet season due to the stagnation of the raised lake water. The field investigation on the inundation condition for the area around Lake Buaya revealed that lowlying area with ground levels less than 10 m was inundated for long period in the wet season.

The existing paddy fields lying above 10 m in elevation are classified into 2 groups, i.e., (1) well drained and (2) moderately well drained. This condition could be economically improved by provision of drainage system.

4.2.3 Potential Area for Development

The study area is classified by superimposing the above study results.

The potential area for irrigation development is selected to be 11,200 ha as shown in the following table:

Present land use	Main factor of land evaluation	Land capability class	Extent of area (ha)
I. Potential area for development			
1. Existing paddy field	well drained	I	5,900
2. "	moderately well drained, affected with surface water	IIa	3,000
3. "	moderately well drained, affected with ground water	IIg	1,500
4. "	moderately well drained, affected with both surface and ground water	IIga	800
Sub-total			11,200
II. Exclusion from potential development area			
1. Existing paddy field	high permeable soil above possible canal line	IIIe	1,600
2. "	poorly drained due to Lake Buaya water	IIIa	900
3. Upland, orchard and village area	high permeable soil	IIIi	2,500
4. Forest	shallow soil	IIItdf	900
5. Grass land	heavily shallow soil	IVd	2,900
Sub-total			8,800
Total			20,000

4.3 ASSESSMENT OF WATER RESOURCES

4.3.1 Water Sources

The main source of irrigation water to be used for the Project will be the Bila river judging from the geographical distribution of the irrigable area and the water occurrence in volume, time and location of the Bila river flow.

4.3.2 Irrigation Water Requirement

The study on the irrigation water requirement is made based on the empirical prediction method using climatological data making crosschecking of the predicted values by actual field measurement of water consumption. The estimate of irrigation water requirement is made for a series of eight years from 1973 to 1981 to make assessment of the available irrigation water by means of seasonal water balance.

The consumptive use of water is estimated as a product of potential evapotranspiration with crop coefficients relating to crop growth stages. The modified Penman method is employed in predicting potential evapotranspiration for the reason of the accuracy and the data available for it. The average values determined by the climatological data of Sengkang and Kanyuara are applied.

Percolation loss is measured in the fields of wet season cropping by cylindrical instruments and the data obtained range from 1.0 mm/day in the southern area to 2.0 mm/day in the northern area. In the study, the percolation loss of 2.0 mm/day is incorporated both for the wet season and dry season cropping. The nursery water requirement is estimated at 240 mm for a period of 20 days.

The puddling water requirement is assessed at 220 mm, under the condition that the puddling water is gradually supplied for 10 days referring to the presently applied irrigation method around the Project area.

Effective rainfall is estimated by applying the daily water depth balance method using the rainfall data at Tanru Tedong, under the following conditions; (1) water consumption rate in the field is the sum of percolation and the consumptive use of water, (2) continuous rotational water supply method is applied, (3) average water holding capacity in the field is assumed at 40 mm, and (4) intercepted loss rainfall of 2 mm is taken into account for every rainfall.

Conveyance and application losses are set at 20% respectively, which result in 64% of the total irrigation efficiency.

The seasonal irrigation water requirements for the above-mentioned period are estimated on 10-day basis. The unit diversion water requirement is determined with the dependability level of four (4) out of five (5) years. The design value determined is 1.65 l/sec/ha. The details are given in ANNEX VI.

4.3.3 Irrigation Area with the Bila Natural Flow

The irrigation water requirements vary from year to year, and throughout the year. The discharge records of the Bila river made available for eight (8) years since April, 1973 indicate the large fluctuation of the discharges. There is difference in time of occurrence between the abundant flows and the peak irrigation water requirement. In order to assess the available irrigation water of the Bila river and to estimate the irrigable area guaranteed by the river flow, the seasonal water balance study between the supply and the requirement is conducted for the above-mentioned period.

The balance calculation is made by means of dividing the river discharge by the diversion water requirement on the daily basis. In determination of guarantee irrigation area, it is assumed that the reduced water supply for a short period will not affect the successful crop yield within the extent of available water standing in the fields. In order to estimate the irrigable area, the critical low flow periods for every growing season are selected and the average values for such low critical period of ten (10) days are taken as irrigable areas guaranteed by the Bila river.

Based on the above, the irrigable areas with irrigation dependability level of four (4) out of five (5) years are estimated at 4,600 ha and 2,600 ha for the wet season and dry season cropping respectively.

4.4 REVIEW OF EXISTING PLANS

4.4.1 General Features of the Existing Plans

(1) General

Different approaches to the development of the Bila Irrigation Project have been made, i.e., Master Plan and DOI Plan as mentioned in SECTION 1.3. In order to formulate the most optimum development plan of the Bila area, both plans are reviewed and updated based on the present conditions revealed so far.

The irrigation development plan in the Master Plan was formulated, aiming at the efficient and economical utilization of the resources with principal development conception that the Project area should cover the possible maximum extent of endowed irrigable land of 10,500 ha to be served with the Bila river flow through the Bila intake having an intake water level 35 m.

The Government has commenced the study and investigation for the Bila Irrigation Project since 1975 in response to the strong request on the early implementation of the project from the local inhabitants. The investigation covers topography, geology, soil mechanics and hydraulic model test of intake structure. The detailed design of the intake structure and main irrigation system commanding an area 9,288 ha has been completed. The general plans of both plans are as shown in Fig. 4.1.

(2) General features of DOI Plan

With the natural flow of the Bila river through the Bila intake to be constructed approximately 8 km upstream of the junction of the Boya river, an area of 9,288 ha is irrigated. The Bila intake is constructed with so-called coupure method on meanders of the Bila river, having an intake water level 30 m. The irrigation area lies from 30 m in elevation at the head of the area to 7 m in elevation around Lake Buaya.

The irrigation area extends for 7,608 ha over the left bank and for 1,680 ha over the right bank of the Bila river. The maximum irrigation water diverted at the head of main canals is 12.11 m^3/sec for the left bank area and 2.53 m^3/sec for the right bank area.

(3) General features of Master Plan

The irrigation plan was formulated to serve the land lying on the left bank and a bit of sandwitched area by the Bila and the Boya rivers similarly to DOI Plan. With the natural flow of the Bila river, an area of 10,500 ha is irrigated. The intake structure is constructed with a multiple stage diversion method at the site about 3 km upstream from the intake site proposed by DOI, having an intake water level 35 m.

The irrigation area extends for 9,300 ha over the left bank and for 1,200 ha over the right bank. Irrigation water of 13.8 m^3/sec at maximum is diverted from the Bila intake, consisting of 12.2 m^3/sec for the left bank area and 1.6 m^3/sec for the right bank area.

4.4.2 Review of the Existing Plans

Both plans intend to stabilize the irrigation in the rainy season and to supply irrigation water supplementally in the dry season by use of the Bila river flow for the respective development areas. The water balance study based on the accumulated Bila river discharge, however, indicates that the Bila river flows are far short to irrigate either of the project areas of the DOI Plan and the Master Plan, resulting in 4,600 ha and 2,600 ha in the wet and dry season with dependability level of 80%. This means that the stable and adequate irrigation would not be ensured for either of envisaged development areas of 9,288 ha and 10,500 ha of the DOI Plan and the Master Plan respectively.

The investigation on the low-lying area around Lake Buaya disclosed the severe inundation and poor drainage up to elevation of 10 m in the wet season. For the sake of efficient and safety irrigation farming and efficient water resources utilization, such inundated area should be excluded from the development area. Then the project areas will be 8,500 ha and 10,000 ha for the DOI Plan and the Master Plan respectively.

There exists the difference in the results of the facilities designs. The design in the Master Plan is prepared on the preliminary basis. On the other hand, the DOI Plan is presented in the detaled design. In order to make the review and comparison, the preliminary design of the intake and irrigation canal system is carried out based on the results of the topographic, soil mechanic and geological investigation.

In making assessment of the present economic situation of both plan, the economic evaluation is made on the following conditions:

(1) The construction cost of the facilities proposed in the Master Plan is estimated on the basis of the abovementioned preliminary design. The construction cost of the facilities for the DOI Plan is estimated based on the results of the present design inclusive of additional improvement.

(2) The irrigation benefits for both plans are estimated based on the result of water balance study which indicates in the irrigation areas of 4,600 ha and 2,600 ha in the wet season and dry season cropping respectively.

The economic feasibility of both plans is examined by calculating the internal rate of return (IRR) on the following assumptions:

Description	Master plan	DOI plan
Project area	10,000 ha	8,500 ha
Irrigation area		
- Wet season	4,600 ha	4,600 ha
- Dry season	2,600 ha	2,600 ha
Project life from 1983	50 years from 1983	50 years from 1983
Total economic cost (x 10^6Rp.)	27,531	21,864
Construction period (Years from 1983 inclu. design and tender)	7	7
Annual net incremental benefits (x 10^6Rp.)	3,759	3,759
Build-up period (Years from 1983)	7 (12)	7 (13)
Internal Rate of Return (IRR)	8.9%	10.3%

The internal rate of return is calculated at 8.9% for Master Plan 10.3% for DOI Plan, indicating the rather low economic viability of both plans. The main reason for such low economic feasibility is the low rate of irrigation areas to the total area under the project; in other words, the project scale proposed in both plans is too large compared to the available water of the Bila river.

4.5 SUPPLEMENTAL WATER RESOURCES

4.5.1 Necessity of Reservoir Plan

The review of the existing plans indicates that both plans would not be economically justified under the present project formulation. There would be two ways to improve the low economic aspect of the plans. One is to reduce the scale of the development area to suit the available irrigation water of the Bila river. The other one is to incorporate an additional water resources or to regulate the Bila river flow by constructing a reservoir in the Bila river. Selection of the optimal way to improve both plans, however, should be made to the latter for the reasons of; (a) the water resources endowed in the Bila area are abundant to irrigate either of the irrigation areas envisaged by both plans if regulated and (b) reducing of the development scale will not be desirable from the socio-economic situation of the Bila area. Therefore the development plan formulation is made for selecting and devising the most optimum reservoir plan.

4.5.2 Possible Reservoir Plans

The possible alternative sites for constructing storage reservoirs are revealed in the Bila river and the Kalola river which is one of the tributaries across the Bila area, in view of hydrology, topography and geology at the hydraulic structure site.

An alternative Bila dam site is located in the middle reaches near the Bila intake site proposed in the DOI Plan having a catchment area of 376 km^2. The Kalola dam site is situated near the devouchment with a catchment area of 122 km^2.

The irrigation system incorporating the above reservoir plans would be as follows: (1) the irrigation system incorporating a Bila reservoir plan will be a dam irrigation system to use the regulated flow of the Bila river and to be served directly from the reservoir, (2) the irrigation system incorporating a Kalola reservoir plan will be a combined system to use the Bila river and the Kalola river flows through the Bila intake and with the storage of the Kalola river flow.

The Bila river is the main water source in the Bila area having the largest catchment area among the rivers to be utilized. It supplies the abundant water during the year for irrigation of the envisaged area. Topography of the dam site, however, is not suitable for dam construction.

The advantages of the Kalola reservoir plan are the narrow topography of the dam site and the rather small requirement of storage compared with the Bila reservoir plan because of utilizing the Kalola river natural flow. On the contrary, two head works structures, Bila intake and Kalola dam, are necessary.

The Bila reservoir plan is first studied by varying the size of the storage requirement with the different irrigation dependability levels to assess the development potential and the economic aspect of the Bila reservoir plan. The study on the Kalola reservoir plan is made for the assessment of water resources of the Kalola river and for the irrigation layout to be able to supplement the water deficit consisting of the layout of canal system, Bila intake and Kalola dam.

In order to determine the optimal reservoir plan between the above, the economic comparison was carried out for the construction cost of the Bila dam and the combined cost of the Bila intake, Kalola dam and the relevant facilities. The result indicates that the Kalola reservoir plan is more economically desirable than the Bila reservoir plan mainly due to economical construction of the Kalola reservoir. The details is presented in ANNEX-VI.

4.6 DETERMINATION OF DEVELOPMENT PLAN

4.6.1 Alternative Study on Development Plans

The land capability study identifies the possible irrigable land endowed in the area of about 10,000 ha in net. The water balance study indicates that the irrigation water for the above possible irrigation area will be sufficiently enough with incorporating the Kalola riverflow by constructing the Kalola reservoir. The review and updating of the existing plans show that the Master Plan will command the possible largest extent of the irrigable land but the construction of canal and intke will fall expensive, on the other hand the DOI Plan will serve irrigation of somewhat smaller area but the selected canal route and intake site will economize on their construction.

The development plans on the basis of the existing plans will result in the different sizes of development of water and related land resources. In order to select the optimal development plan of the Project, elaborate technical and economical comparison is made for the following alternative cases:

(1) Case-1 (Proposed Plan) : This aims to serve the large irrigation area of 9,800 ha with the irrigation system based on the built-up DOI design of the intake and canals including additional canal starting from the Kalola dam for commanding the southern elevated area.

(2) Case-2 (Alternative-1) : This aims to serve the possible largest area of 10,000 ha with the irrigation system proposed in the Master Plan incorporating the Kalola dam.

(3) Case-3 (Alternative-II) : This aims to serve the irrigation area of 8,500 ha with the irrigation system agreed with the built-up DOI design of the intake and canals incorporating the Kalola dam.

The general features of the above plans are determined based on the preliminary design and are summarized in the following table. The details of the facilities features are presented in ANNEX-VI.

Description		Proposed plan	Alternative plan I	Alternative plan II
Project area	(ha)	9,800	10,000	8,500
Project facilities				
- Bila intake Basic plan		designed by DOI	proposed in Master Plan	designed by DOI
Intake WEL	(m)	30.0	35.0	30.0
- Kalola dam				
Total storage	(10^6 m^3)	43.0	44.0	35.0
Effective storage	(10^6 m^3)	37.0	38.0	29.0
Max. dam height	(m)	42.5	42.5	41.0
Crest length	(m)	230.0	230.0	210.0
- Irrigation canal				
Main canal	(km)	46.1	45.7	27.5
Secondary canal	(km)	98.3	74.2	103.3
Tertiary system	(ha)	9,800	10,000	8,500
- Drainage canal	(km)	86.5	92.5	81.0
- Road	(km)	28.0	29.0	28.0

4.6.2 Determination of Proposed Development Plan

The economic evaluation was carried out to select the most optimum plan for the Project among the above three alternatives in terms of the internal rate of return. The calculation condition of comparison and the result are as shown below. The details of the comparison are presented in ANNEX-VI.

Description		Proposed plan	Alternative plan I	Alternative plan II
Project area				
- Development area	(ha)	9,800	10,000	8,500
- Irrigation area				
Wet season	(ha)	9,800	10,000	8,500
Dry season	(ha)	9,800	10,000	8,500
Conditions of comparison				
- Project life (years from 1983)		50	50	50
- Construction period (years from 1983 incl. design and tender)		7	7	7
- Build-up period to full development stage (year from 1983)		5 (11)	5 (11)	5 (11)
Economic cost and benefit				
- Total economic cost	(10^6Rp)	35,178	37,836	31,829
- Annual net incremental benefit	(10^6Rp)	9,552	9,756	8,278
Internal rate of return (IRR) (%)		15.3	15.0	15.0

The economic evaluation indicates that the proposed Plan shows the highest IRR of 15.3% followed by Alternatives-I and II. Besides the Proposed Plan will ensure the irrigation for approximately possible maximum land of 9,800 ha. This means that the proposed plan will largely contribute to the regional socio-economic development in the Project area.

Consequently, the Bila Irrigation Project would be implemented successfully with the Proposed Plan which is based on the built-up DOI design with incorporation of Kalola dam for irrigation of 9,800 ha.

4.7 FLOOD CONTROL PLAN

4.7.1 General

The Master Plan identified the flood control effect of the Bila and Boya areas in the downstream area of the Bila river with the

improvement of the Bila river system under the conditions that the irrigation projects for the Bila and the Boya areas have been implemented and the worth of the land in both areas had been raised.

The flood control plan of the Bila river system selected in the Master Plan consists of the improvement of the main stream of the Bila river, the Boya river, the Lancirang river and the provision of the floodway to pass the flood water of the Kalola river and some of the Bila river.

In this feasibility study on the Bila Irrigation Project, the frame work of the Bila river flood control project was reviewed and updated since the Master Plan proposed the flood controlling works as the Bila - Boya irrigation/flood control compound Project for development and protection of these areas.

In this flood control planning, the following four frameworks of the improvement plan have been established and studied;

Plan 1: Improvement of the main stream of the Bila river, the Boya river, the Kalola river and the Lancirang river.

Plan 2: Improvement of the above-mentioned existing river channels with shift of the Kalola river toward downstream of Tanru Tedong.

Plan 3: Construction of floodway along the route as proposed in the Master Plan.

Plan 4: Construction of floodway along the Ate drainage stream running on the east side of the Bila river.

With the elaborate technical and economical comparison for the above, Plan 2 is selected at the most economical flood control plan mainly due to:

(1) Complicated and expensive alignment of channels in Plan 1.

(2) Expensive construction of floodway to cross the Bila irrigation project area in Plan 3 and Plan 4.

The detailed layouts of each plan are as shown in Figs. 4.1 to 4.4 of ANNEX-IX.

4.7.2 Flood Control Plan

As mentioned in Section 4.7.1, the improvement of the existing river channel with shift of the Kalola river toward downstream of Tanru Tedong was selected as the optimum plan for the flood control in the Bila and Boya areas. The above plan will include the improvement of the Bila, the Boya, the Kalola and the Lancirang rivers. The extent of river channel improvement is as shown below.

(Unit: km)

Name of river	Section	Length
Bila river	Near bifurcation to about 2 km upstream from confluence of Boya river	20
Boya river	Confluence of Bila to hilly districts	7
Kalola river	Confluence of Bila to hilly districts	10
Lancirang river	Confluence of Bila to Desa Ajubissue	8
Total		45

In order to examine the feasibility of the above flood control plan in the Bila and Boya areas, the economic evaluation was carried out by applying the different dependability levels of flood control of 5-year and 20-year both under the present condition and under the future irrigated condition. (for details, vide ANNEX-IX).

The results show that the internal rate of returns (IRR) of the flood control plan under the present condition are 3.7% and 3.8% for 5-year and 20-year level river channel improvement respectively. Further the results indicate that the IRRs under the future irrigated conditions in both Bila and Boya area are 12.2% and 13.1% for 5-year and 20-year level river channel improvement respectively. In consideration of the fact that most of the flood affected area belong to the Boya area and the large amount of investment is required for the whole works, the flood control plan under the future irrigated condition only in the Bila area is not economical.

Consequently, the river improvement plan selected as above is not economically justifiable under the currently expected situation of less flood control effect as a whole. The flood control plan, therefore, is not incorporated in the Bila irrigation Project. After completion of irrigation Projects in both Bila and Boya areas, however, the agricultural production would increase and the economic values to be protected by the flood control measures would become large. Under such future irrigated condition in both areas, the flood control plan would become economically justifiable as the Master Plan concluded.

CHAPTER V THE PROJECT

5.1 BASIC CONCEPT FOR DEVELOPMENT

5.1.1 Agricultural Constraints

Most of the project area are covered with well developed paddy fields. However, paddy cultivation is generally made under rainfed condition. Irrigation facilities are quite limited in this area. Although there are some Desa irrigation areas, most of the areas are not actually irrigated due to shortage of irrigation water. The cultivation pattern is, therefore, directly affected by seasonal distribution of rainfall. Paddy cultivation is concentrated in the wet season (April/May - August/September) and is very limited in the dry season. The areas under paddy cultivation fluctuate year by year, depending on available rainfall. The Bila area is surrounded with the existing irrigation areas like Sadang and Boya. Only the Bila area has been left behind for irrigation development. The development of the Bila water resources has long been desired by local inhabitants in this area.

There exist about 5,300 ha of moderately well drained paddy fields affected by surface and sub-surface water in the Project area as mentioned in Section 4.2.3. Most of them are located in the southwestern part of the project area, near Lake Buaya and the Bila river. Although paddy is grown in such land, the unit yields are generally low. In the wet season, road condition becomes muddy and it makes transportation of farm inputs and products so difficult. The present poor road condition also hampers agricultural activities in this area.

As far as cultivation technique is concerned, there is much room for improvement. In the study area, agricultural extension services are not so active. The farmers are not well aware of modern rice farming.

All these constraints keep the present crop yields at low level, with an average unit yield of 2.97 tons/ha for wet season paddy and 2.84 tons/ha for dry season paddy.

The average size of farm in the project area is estimated at 1.54 ha of which 1.29 ha are paddy fields. Although the farm size is not so small compared with the provincial average of 1.13 ha of paddy field per farm household, the study on present farm economy shows present crop income is not sufficient to maintain the livelihood of the farmers, mainly due to low cropping intensity and low crop yields.

There is no additional arable land to be newly reclaimed. It means that the farm size of average farmer can not be expanded, and even it tends to become smaller with population growth. Under such circumstances, the crop income should be increased through the improvement of land productivity.

The constraints which hinder the improvement of land productivity, are manifold as mentioned above. The decisive constraint among them is, however, lack of infrastructural facilities like perennial irrigation and drainage systems and farm road network.

5.1.2 Basic Concept for Development

The project aims at the increase in agricultural production and thereby improvement of the farmer's living standard in the Bila project area through exploitation of new water resources from the Bila and Kalola rivers as well as provision of prerequisite facilities for irrigation and drainage purposes. The project should also contribute to the realization of the government policy for equalization of social welfare in the Bila area and to saving of foreign exchange for imported rice. With this in view, the major concept for agricultural development in the Bila area would be as follows:

(1) Unit yield and production of wet season paddy should be stabilized and improved through establishment of new irrigation system and introduction of irrigation farming practices.

(2) Planted area of dry season paddy should be increased with year-round irrigation system and thereby total production of paddy be maximized.

(3) Special attention should be given to the increase in irrigation area upto the potential maximum area of 11,200 ha in gross in conformity with Government policy for equalization, as well as for maximum total benefits.

(4) Present drainage condition should be improved to assure the healthy growth of paddy under irrigated condition.

(5) Present farm road network should be improved and the agricultural activities be made more active.

(6) Agricultural institutions, which support agricultural development, should be strengthened, especially in the field of agricultural extension services.

5.2 AGRICULTURAL DEVELOPMENT PLAN

5.2.1 General

The Project area is a considerably matured area for agricultural production under the rainfed condition with a fixed crop rotation system. Under such condition, the agricultural economy of the area is rather stable and no significant improvement is made unless large scale irrigation project is implemented.

The future agricultural economy of the Project area is forecasted on the conditions reflecting the changes attributable to the Project. Although the agricultural productivity in the Project area may gradually increase to a slight extent even under future without project condition, such changes are disregarded in the analysis of agricultural benefits.

5.2.2 Change in Land Use

With the Bila Irrigation Project, all the paddy field in the Project area will be fully irrigated and more intensive use of the farmland will become possible. There are no additional arable lands to be newly reclaimed under the Project. In view of the unavailability of additional arable land and population growth, the size of farm can not be expanded. In this context, the most effective way to attain the objectives of the Project is to increase the cropping intensity together with the unit yield. The Project would provide the farmers with good opportunities to expand the volume of their farm business.

The present condition of the paddy fields will change with the Project as follows:

(Unit: ha)

Description	Without Project	With Project
Gross project area	10,900	10,900
Irrigation/drainage canals and farm roads and field borders	600	1,100
Paddy fields	10,300	9,800
Net irrigation area	-	9,800
Area planted	10,300	9,800
Area harvested	9,490	9,800

5.2.3 Proposed Cropping Pattern

In selecting the proposed crops and cropping pattern to be adopted by the Project, the following basic principles are established:

(1) The crops and cropping pattern must create maximum benefits for the farmers as well as the nation as a whole,

(2) The crops and cropping pattern must make optimum utilization of water to be supplied by the project,

(3) The crops and cropping pattern should be practical with the limited number of family labour, and

(4) The crops and cropping pattern must conform with the existing social tradition and be acceptable to the farmers.

In making study on alternative cropping patterns, rice and polowijo crops including greenbeans, groundnuts, maize and soybeans are tentatively selected. In order to determine the most optimum cropping pattern, 5 alternatives are formulated. They are:

(1) Pattern A: Two crops of paddy a year, cropping intensity 200% (early - matured varieties)

(2) Pattern B: Two crops of paddy a year, cropping intensity 200% (medium - matured varieties)

(3) Pattern C: Four crops of paddy and one crop of polowijo in 2 years, cropping intensity 250%

(4) Pattern D: Three crops of paddy and two crops of polowijo in 2 years, cropping intensity 250%

(5) Pattern E: Paddy - Polowijo - Paddy, cropping intensity 300% (3 crops a year)

These alternative cropping patterns are examined on the basis of profitability, labour requirement and waer requirement. The results of the comparative studies are summarized as follows (for detail, vide ANNEX-V):

Alternative	Cropping intensity	Profitability	Labour requirement	Water requirement
	(%)	(10^3Rp./ha)	(man-day/ha)	($10^3 m^3$/ha)
Pattern A	200	1,400.8	292.1	14.7
Pattern B	200	1,400.8	292.1	17.7
Pattern C	250	1,482.8	331.8	18.3
Pattern D	250	1,217.3	296.7	14.4
Pattern E	300	1,565.9	371.4	18.7

Cropping patterns with high cropping intensity ensure the high profitability, but limit the scale of the development area due to the limitation of the available labour force in the Project area. Only pattern A allows the cropping over the potential maximum area of 10,000 ha in net. In order to confirm the adoptability of pattern A, unit profitability for each pattern is calculated with respect of net production value per man-day of labour and per volume of water consumed.

The pattern A will create the largest economic returns from unit irrigation water to be supplied by the Project and also from the unit labour to be spent for farming works under the Project.

The possible annual net production values for each alternative pattern are also calculated on the basis of the maximum adoptable areas mentioned above.

The pattern A will also bring the largest value as shown below.

Alternative	Profitability	Maximum adoptable area	Annual net production value
	(10^3Rp./ha)	(ha)	(10^6Rp.)
Pattern A	1,400.8	10,000	14,008
Pattern B	1,400.8	8,500	11,907
Pattern C	1,482.8	5,700	8,452
Pattern D	1,217.3	9,200	11,199
Pattern E	1,565.9	5,000	7,830

In the light of the basic principles for the future cropping pattern, the Pattern A is most applicable to the project among the possible alternative patterns. The proposed cropping pattern, together with agroclimatic data, is illustrated on Fig. 5.1.

5.2.4 Proposed Farming Practices

Based on the analysis of paddy yield survey, the proposed cropping pattern A (double cropping of paddy) is studied and the proposed farming practices are determined as shown in Fig. 5.2. They are also summarized as follows (for details, vide ANNEX-V).

Early-matured high yielding varieties like IR28, IR36 and IR50 are proposed. The seed requirement is 30 kg per ha. The nursery has to be prepared as flat as possible. The size of nursery is about 1/20 of the paddy field to be transplanted. Fertilization is essential. The recommendable dosage is 5 kg of Urea per ha . The nursery period is 20 days after seeding. The field preparation is carried out by animal power, at least 10 days before transplanting. Harrowing and puddling works are also required after plowing. The puddling is carried out by animal power such as oxen and buffaloes.

Transplanting is made by manual labour with a spacing of 30 cm x 15 cm, which makes the number of hills per m^2 to be 22.2, and planting 2 to 3 seedlings per one hill is recommendable. In due consideration of the close correlation between numbers of panicles per m^2 and unit yield for dry season paddy, more dense planting is recommendable for the dry season paddy. The irrigation water has to be drained just before transplanting so that transplanting in shallow depth is enfoced for accelerating vigorous tillering.

The total fertilizer requirement for sustaining the target yields would be 200 kg/ha of urea, 50 kg of T.S.P. and 50 kg/ha KCl. The basic fertilizer application is 65 kg/ha of urea, 50 kg/ha of T.S.P. and 50 kg/ha of KCl when field preparation is practiced. Top dressing is made in 2 times. The amount of fertilizer to be applied per ha is about 65 kg of urea at each top dressing time. In the paddy fields where the percentage of ripened grains is low, top-dressing with the same dosage of urea at the full heading stage is often quite

effective. After transplanting, weeding is carried out in 3 times, depending on the conditions of weed growth, by manual operations. For effective operation of weeding, it is recommended that the rotary weeder, being widely used in Java, be introduced in the Project area.

As regards the plant protection, intensive application of insecticide is required for control of plant hoppers, stem borers, etc. Considering the life-cycle of these insects, 3 to 4 lit/ha of insecticides are required for 3 to 4 times application during one cropping season. In addition, it would be necessary to apply one lit/ha of fungicides for control of diseases and 100 gr/ha of rodenticide for ratting, for each cropping season.

Harvesting is carried out by manual labour. The harvested paddy is dried on the ground. In future, artificial dryers will have to be considered because much volume of harvested grains is damaged by unexcepted rains. For threshing, use of tredle thresher, instead of traditional hand threshing, is recommendable.

5.2.5 Anticipated Crop Yield and Crop Production

With the project, the present paddy yields (wet season paddy: 2.97 tons/ha, dry season paddy: 2.84 tons/ha) are stabilized and gradually increased. The anticipated crop yields are estimated at 5.0 tons of dried paddy (gaban) per ha for both wet season paddy and dry season paddy under future with project condition. These unit yields are rather conservatively estimated on the basis of statistical data on crop yield obtained from the Department of Agriculture, Sulawesi Selatan and the results of paddy yield survey carried out by the Team. The paddy yield survey shows that the average unit yield of paddy in the Sadang irrigation area is 5.97 tons per ha. The unit yield for the past 7 years from 1974 to 1980 in the Kecamatan Dua Pitue where the Bulu Cenrana irrigation project exists, averages 5.11 tons per ha over the total area of about 55,000 ha. It is also reported that in the whole Sulawesi Selatan, the average unit yield of paddy under INSUS program where irrigation facilities are provided, was 5.90 tons per ha in 1979/80.

Based on the proposed cropping pattern, the cropped area, crop yields and total crop production under both "with project" and "without project" condition are estimated as follows:

Crops	Without	With	Increment
Harvested area (ha)			
Wet season paddy	9,490	9,800	310
Dry season paddy	590	9,800	9,210
Polowijo crops	2,720	-	-2,720

(to be continued)

Crops	Without	With	Increment
Unit yield (tons/ha)			
Wet season paddy	2.97	5.00	2.03
Dry season paddy	2.84	5.00	2.16
Polowijo crops	0.73	-	-
Production (tons)			
Wet season paddy	28,190	49,000	20,810
Dry season paddy	1,680	49,000	47,320
Polowijo crops	1,990	-	-1,990

The annual paddy production at full development stage would amount to 98,000 tons of dried paddy. The expected annual increment of paddy production would be about 68,000 tons.

5.2.6 Marketing and Price Forecast

Indonesia is still rice import country. In the recent six years, about 1.5 million tons of rice were imported on an average as shown below:

(Unit: 10^3 ton)

1974	1975	1976	1977	1978	1979	Average
1,132	693	1,301	1,973	1,842	1,922	1,477

Considering the growth rate of population, per capita consumption and increase rate of rice production, the shortage of rice in Indonesia is continued as a whole. It is reported, however, that the South Sulawesi Province continuously remains a rice supply region.

The South Sulawesi Province is one of the largest rice surplus provinces in Indonesia. Total production of paddy in the Province is estimated at about 2,395,000 tons in 1979/80, and on the contrary the total consumption is about 1,333,000 tons with the surplus of 1,062,000 tons. It is reported that the rice surplus conditions increasingly continue in the Province. The Project area is also one of the rice surplus regions in the province. The annual surplus is estimated at around 16,000 tons of dried paddy in total, 1.4% equivalence of the surplus rice of the province. Most of these surplus rice are distributed to the rice-deficit regions, and even other provinces.

There are 7 provinces under the jurisdiction of South Sulawesi DOLOG, among which only the South Sulawesi Province produces the surplus rice; other provinces are subject to serious deficits of rice. The total deficit in all the jurisdictions of DOLOG is estimated at about 780,000 tons. With the completion of the project, about 72,000 tons of paddy would be marketed to these rice-deficit regions; this marketable amounts are equivalent to about 7% of the surplus rice of the province.

The projected price of dried paddy to 1981 is calculated by using the past 5 years data. The projected prices of dried paddy are Rp.124,000/ton in Kab. Wajo, Rp.124,040/ton in Kab. Sidrap and Rp.143,480/ton in whole Sulawesi Selatan. For financial evaluation, the average projected farm gate price of dried paddy at Rp.93,000/ton for Kab. Wajo and Sidrap in 1981 will be used. The market prices of polowijo crops largely fluctuate year by year. The financial farm gate prices of polowijo crops are estimated based on the past 5 years data at Rp.66,670/ton for maize, Rp.443,840/ton for groundnuts, Rp.262,550/ton for greenbeans and Rp.197,780/ton for soybeans at 1981 level.

The economic farm gate prices of farm products and farm inputs are calculated based on the projected international market prices forecasted by IBRD in the long term range for the period of 1981 to 1990. The increased production of paddy after the completion of the project would be marketed in domestic markets in Indonesia, as the substitute of import rice. In this meaning, import substitution price of paddy is forecasted for the economic evaluation. The economic farm gate price of dried paddy is thus estimated at Rp. 200,000/ton. The economic farm gate prices of polowijo crops are estimated at Rp.113,400/ton for maize, Rp.357,000/ton for groundnuts, Rp.339,800/ton for greenbeans and Rp.285,800/ton for soybeans. The details of the calculation are given in ANNEX V.

5.2.7 Crop Production Cost

The crop production costs of paddy and polowijo crops are estimated for both future with and without project conditions. The present agricultural condition would not be changed significantly unless a new irrigation project could be implemented. For the estimate of production cost under without project condition, therefore, only unit prices of production expenses are forecasted by using the economic farm gate prices of farm inputs, without changing the unit requirement for farm inputs and labour. The estimated crop production costs without project condition are about Rp.224,500 per ha for wet season paddy, Rp.205,400 for dry season paddy and Rp.90,900 for polowijo crops.

After implementation of the Bila Irrigation Project, the crop production cost would increase upto about Rp.294,500 per ha for wet season paddy, Rp.304,700 for dry season paddy and Rp.165,900 for polowijo crops. This anticipated increase is primarily attributable to the increase of expenses for fertilizers, agro-chemicals and labour.

5.2.8 Net Production Values per Ha without and with Project

The annual net crop production value without project is estimated at about Rp.390,000 per ha on the basis of the forecasted unit yields and prices of crops and production costs aforementioned. After completion of the Project, the annual net crop production value amounts to Rp.1,401,000 per ha at the full development stage. The primary increased production value after the build-up period will be Rp.1,011,000 per ha per annum, and details are given in ANNEX-V.

5.3 IRRIGATION AND DRAINAGE DEVELOPMENT PLAN

5.3.1 General

Selection of the optimal development plan of the Project was made based on the elaborate technical and economical comparison on the varied development scales and the intake sites, as mentioned in CHAPTER IV.

The central features of the proposed Project is to supply irrigation water of 12.71 m^3/sec to the Project area of 9,800 ha from the Bila river with the supplemental water of the Kalola reservoir to be constructed on the Kalola river. The facilities required for the Project includes an intake weir on the Bila, a dam on the Kalola, main and secondary irrigation canals, drainage canals, farm roads their related structures and tertiary systems.

5.3.2 Proposed Project Works

(1) Bila intake

The Bila intake will be constructed approximately 8 km upstream from the junction with the Boya river on the meanders of the Bila river. The Bila intake will consist of a diversion weir, intakes on left and right banks, coupure channel, operation bridge and river closure embankment. The construction method to be introduced will be so-called coupure method. The diversion weir will be of cascade type to be constructed with wet stone masonry.

The crest level of the weir was determined at 30.3 m in elevation so as to provide the water level of 30.0 m in elevation at the head of main canal. The design diversion discharge will be 12.71 m^3/sec which consists of 10.73 m^3/sec for the Left Main Canal and of 1.98 m^3/sec for the Right Main Canal. In order to control sediment discharge, scoring sluices will be provided on both side ends of weir.

The principal features of the Bila intake would be as follows: (See Figs. 5.3 and 5.4)

Diversion weir

- Type of weir	Cascade type
- Material of weir	Wet stone masonry
- Crest elevation	EL. 30.3 m
- Water level at canal head	EL. 30.0 m
- Max. diversion discharge	12.71 m^3/sec
- Design flood discharge (100-year return period)	1,200 m^3/sec
- Total width between side walls on both banks	70.0 m
- Crest length of overflow weir	47.5 m

- Width of scoring sluice including piers	
Left side	7.0 m
Right side	3.5 m
Centre	12.0 m
- Width of intake	
Left side (gate size)	8.5 m (2.0 m x 3 Nos.)
Right side (gate size)	1.3 m (1.3 m x 1 No.)
- Height of weir	
Upstream weir (from stilling basin)	8.65 m
Downstream weir (from stilling basin)	9.85 m
- Bridge	
Total width	5.1 m
Total length	70.0 m

Closure embankment

- Type of embankment	Homogeneous
- Crest elevation	EL. 36.15 m
- Crest width	5.0 m
- Max. height (from riverbed)	12.65 m
- Crest length	60 m

(2) Kalola dam

The purpose of the Kalola dam is principally to supply the irrigation water to supplement the diversion water from the Bila river through the Bila intake. The dam site is located on a gorge on the Kalola river approximately 10 km upstream from the junction with the Bila river, having a catchment area of 122 km^2.

The water requirement of the Project necessitates the Kalola reservoir to have the effective storage of 37 x $10^6 m^3$, a part from the Bila river flow, which ensures successful irrigation with the dependability level of four out of five years (80%).

The Kalola reservoir will provide the above effective storage between the low water level (L.W.L.) at EL. 30 m and the normal high water level (N.H.W.L.) at EL. 36.0 m. The dead storage below the L.W.L. will be 6 x $10^6 m^3$. The main dam will be a rockfill dam having a central impervious earth core. The crest elevation will be EL. 42.5 m and the maximum height of the dam will be 30.5 m from the foundation rock. Foundation treatment including grouting, impervious soil trench cutoff and a drainage system will be provided for the dam foundation.

A double line of diversion tunnels will be constructed at the left bank to regulate the design flood inflow of a 20-year flood with the peak of 485 m^3/sec. Respective length of diversion tunnels will be of 115 m and 90 m length with a diameter of 6.0 m. One of them will be used as an intake for diverting the irrigation water after completion of the dam construction.

A non-gated spillway of a side channel overflow weir type will be constructed on the right abutment of the main dam. The spillway is designed to be capable of releasing the design flood inflow of 800 m^3/sec, which will correspond to a 1,000-year flood or a 200-year flood plus 20% allowance. A chuteway, a stilling basin and an open channel will be constructed in the downstream of the side overflow channel.

An intake facilities will be constructed by use of a diversion tunnel with installation of two sets of sluice gates at the inlet. The intake will have the design capacity of 12.01 m^3/sec including the maintenance release.

The principal features of the Kalola dam are summarized as follows: (See Figs. 5.5 and 5.6)

Kalola dam and reservoir

General

- Catchment area	122 km^2
- Reservoir surface area at F.W.L.	12 km^2
- Storage capacity	
Total storage capacity	43 x $10^6 m^3$
Effective storage capacity	37 x $10^6 m^3$
Dead water volume	6 x $10^6 m^3$
- Water level	
Flood water level	EL. 39.5 m
Normal high water level	EL. 36.0 m
Low water level	EL. 30.0 m

Dam

- Type	Rockfill dam having central impervious earth core
- Crest elevation	EL. 42.5 m
- Dam height	30.5 m
- Crest length	230 m

Spillway

- Type	Non-gated side channel overflow weir
- Design discharge	800 m^3/sec
- Crest elevation	EL. 36.0 m
- Crest length	57.0 m

Diversion tunnel

- Type	Pressured tunnel
- Design diversion discharge	485 m^3/sec
- Diameter	6.0 m
- No. of line	2 Nos.

Intake

- Design discharge	12.01 m^3/sec
- Intake gate	Sluice gate (1.8 m wide x 1.8 m high x 2 Nos.)

(3) Irrigation canal system

Irrigation canal system in the Project area consists of main canals, connecting canal, secondary, sub-secondary canals, tertiary canals and quarternary canals. The irrigation diagram is shown in Fig. 5.7.

(a) Main canals

In the Project area, two main canals; Left Main Canal and Right Main Canal, are required to deliver water from the Bila intake to the Project area.

The Left Main Canal will be constructed to serve an area of 6,500 ha located in the left bank of the Bila river. This canal will run approximately southwards from the intake along the skirts of the eastern hill slopes. The total length will be 30.5 km. The alignment of the canal route is made based on the required water level of 30.0 m in elevation. This canal is designed for the discharge of 10.73 m^3/sec at its head.

The Right Main Canal will be constructed to serve an area of 1,200 ha located in the sandwitched small strip between the Bila and the Boya rivers. This canal will run for about 10.5 km from the intake along the skirts of the western hills. The design discharge at its head is about 1.98 m^3/sec.

All the main canal are designed principally as unlined earth canal with trapezoidal cross section of side slope of 1:1.5 to 1.0.

(b) Connecting canal

Starting from the Kalola reservoir, a connecting canal will be constructed to deliver reservoir water to the Left Main Canal, which joins the connecting Canal after crossing the Kalola river. This canal will run towards the south, then stretch to the west along the Kalola rivercourse. The total length will be about 5.1 km. This canal is designed as unlined earth canal with trapezoidal cross section. The design discharge at its head is about 11.72 m^3/sec.

(c) Secondary and sub-secondary canals

These canals will branch off from the above mentioned main canal to distribute water to the secondary irrigation units of which size will vary from 1,900 ha to 80 ha depending on

topography. About 10 secondary canals and 18 sub-secondary canals with the total length of 98.3 km will be constructed in the Project area. These canals are designed principally as unlined earth canal with trapezoidal cross section of side slope of 1:1.5 to 1.0.

The number and the total length of the main, connecting and secondary canals and the number of their related structures are shown below:

Description		Left bank area		Right bank area	Total
		Main	Connecting		
Main and connecting canals					
- Canal length	(km)	30.5	5.1	10.5	46.1
- Related structures					
Turnout w/check	(nos.)	28	3	11	42
Culvert	(nos.)	2	-	-	2
Spillway	(nos.)	3	-	2	5
Drop	(nos.)	1	3	2	6
Cross drain	(nos.)	45	-	5	50
Syphon		1	-	-	1
Measuring device	(nos.)	1	1	1	3
Secondary and sub-secondary canals					
- Canal length	(km)		93.2	5.1	98.3
- Related structures					
Turnout w/check	(nos.)		67	1	68
Culvert	(nos.)		6	-	6
Spillway	(nos.)		9	1	10
Cross drain	(nos.)		29	-	29
Drop	(nos.)		6	2	8
Syphon	(nos.)		3	-	3

(4) Drainage canal system

The drainage canal system is networked so as to evacuate the excess water in the fields and to transport the stream flows occurred in the outside of the project area to the Bila river, the Kalola river and Lake Buaya. The drainage system will consist of major drains, tertiary drains and quaternary drains. The major drains are designed to collect water from tertiary drains and quaternary drains which are constructed within the tertiary blocks, and to transport collected water inclusive of stream flows to the above rivers and lake. The routes of major drains are generally selected in the natural stream lines and low depressions. For the project, about 49 major drains with total length of 86.5 km will be excavated.

The total required canal length and the number of the related structures are as shown below:

Description		Left bank area	Right bank area
Major drains			
- Canal length	(km)	80.6	5.9
- Related structures			
Drop	(nos.)	121	8
Junction	(nos.)	16	1
Bridge	(nos.)	5	-

(5) Road networks

For the purpose of the smooth execution of the construction works and the proper operation and maintenance, well networked road system will be constructed in the Project area. Four kinds of roads will be constructed in the Project area.

The Project area is presently provided poorly with the village roads or farm roads. For the construction access to the Project area, selected village road will be improved as construction roads, which will be used for the village link roads after completion of the construction works. These roads will be 28 km in length, having a width of 6.0 m to be asphalt-paved.

The irrigation canals will be provided with canal inspection roads. They will be used for the agricultural purpose. The main inspection road to be constructed along the main irrigation canal will have a width of 6.0 m with asphalt pavement. The secondary inspection roads will be 6.0 m in width also to be asphalt-paved. The tertiary inspection roads will be farm roads having a width of 3.0 m and no pavement is provided.

The following table shows the respective road length:

(Unit: km)

Roads	Length
Construction road	28.0
Main inspection road	46.1
Secondary inspection road	98.3
Tertiary inspection road	294.0

(6) Tertiary development

The tertiary system to be constructed in the tertiary block will consist of tertiary irrigation canal, sub-tertiary irrigation canals, quaternary irrigation canals and tertiary drains. The quaternary canals will principally be constructed with dual purposes of irrigation and drainage.

The tertiary system will cover the tertiary block of 100 to 150 ha consisting of sub-tertiary and quaternary blocks (10 ha to 20 ha).

The length of tertiary irrigation canal will range from 2,000 m to 500 m according to topography, and the interval between two tertiary canals will be 750 m at maximum. The quaternary canals will be provided with a length of 750 m at maximum with an interval of 200 m.

The total length of tertiary and quaternary irrigation canals, tertiary drains, and tertiary inspection road are as shown below:

(Unit: km)

Description	Length
Tertiary irrigation canal	224
Sub-tertiary irrigation canal	70
Quaternary irrigation canal	686
Tertiary drain	294
Tertiary inspection road	294

(7) Office and quarters

Offices and quarters are required for the staff to be engaged in the construction and in the operation and maintenance works of the Project facilities. The Offices will consist of one head office and four branch offices. The required number and space of these facilities are estimated as follows:

(Unit: m^2)

Head office	800
Branch office	400
Repair shop	400
Store house	500
Quaters	2,400
Motor pool	10,000

5.4 IMPLEMENTATION SCHEDULE

5.4.1 Basic Considerations

The Project implementation schedule is formulated on the following considerations:

The civil works to be executed by the Project are broadly classified into the main civil works and the tertiary development works. The civil works consist of the main project facilities such as Bila intake structure, Kalola dam, main and secondary canals, major drainage canals, construction roads. The tertiary development works include all the facilities below the tertiary outlets such as tertiary irrigation canals, tertiary drain, farm roads, farm ditches and their related structures.

The main civil works would be executed by a qualified civil work contractor/contractors with assistance of foreign technical services, which should be selected through competitive bidding, and the tertiary canals drains and roads, by the local contractors. The quaternary canal networks in the tertiary system would be constructed by farmers themselves under the guidance of the local government.

As the civil works of the Project include a large volume of earth works, the mechanized construction will principally be introduced in the main civil works. In order to increase the employment opportunity in and around the Project area, however, the manpower construction will be adopted as much as possible. The large scale civil work such as Bila intake, Kalola dam, main and secondary canals, major drainage canals and construction roads will be carried out mainly by heavy construction machinery. The tertiary development works will be carried out by manpower with minor construction equipment.

Taking into account the large scale of the civil works, the Project would be implemented in three stages; (1) review of the existing design and detailed design of the main project facilities (2) construction of the main project facilities and (3) the detailed design and construction of tertiary development works. The tertiary development works would be initiated simultaneously with the main works, so that upon completion of the main works, immediate benefits can be envisaged.

5.4.2 Implementation Schedule

The Project implementation schedule is shown in Fig. 5.8. It includes the Project preparatory works and the construction works. The Project preparatory works will last 22 months including the time necessary for survey and mapping works, review of the existing design and the detailed design works, mobilization, and construction of offices and quarters. The construction works will last 68 months for the main civil works and tertiary development works.

The Project mobilization which includes financing, legalization, establishment of the Project organization would have to be completed by the middle of 1983. In order to facilitate the early commencement of the construction works, the tendering should be made by the end of 1983.

5.4.3 Construction Plan

(1) Preparatory works

The preparatory works such as topographic mapping, detailed design, construction of office and quarters, and land acquisition will be started on March of 1983.

Topographic maps on a scale of 1:5,000 with a contour interval of 0.5 m would have to be prepared for the Project area of 20,000 ha. This map will be used for the design and construction of the tertiary development.

The review and improvement of the existing design of the canals and Bila intake structure will be started on March, 1983. The design of the Bila intake structure will be completed by the end of October, 1983, and the design of the canals, by the end of February, 1984. The design of Kalola dam will be made by use of accumulated hydrological data on the Kalola river and be completed by the end of August, 1984.

The Project office and quarters will be completed prior to the major construction works. This will be started from the beginning of 1984 and completed by the end of 1984. The land acquisition for the Project facilities will be completed at least one year prior to the construction works.

(2) Bila intake

The Bila intake structure consists of various components such as an intake weir, intake, bridge coupure method, closure embankment, etc. The intake weir will be constructed by means of coupure channel. The time required for construction of the intake will be 57 months from the start of the preparatory works.

The construction of the weir will be carried out in the excavated site on the coupure channel in the dry condition. Since the weir consisting of mainly wet stone masonry will be constructed by labour force, the time required for completing the masonry works will be 3 years. The masonry works will be started on the beginning of March, 1985 and completed by the end of February, 1988.

After completing the intake weir, the excavation of coupure channel will be started and completed by the end of December, 1989. Earthfilling of the closure embankment will be carried out by use of excavated material from the coupure channel, so that the embankment will be conducted in parallel with the construction of the coupure channel. Since those works involve a large volume of earthworks, the machinery works will mainly be employed.

(3) Kalola dam

Time required for completing the Kalola dam will be about 56 month from the construction of a coffer dam and pressure diversion tunnel will be starated on the beginning of May, 1985, and completed by the end of October, 1986. Following to the completion of the diversion works, the main dam construction will be started on the November, 1986, and it will be completed by the end of December, 1989.

The concrete work of the spillway will be executed in parallel with the embankment work of the main dam, starting on the May, 1987 and completing by the end of May, 1989. The construction of intake and installation of gates will be executed in 7 months completing by the end of June, 1989.

(4) Canals, drains and construction roads

The construction of main irrigation canal including main inspection road will be carried out for 40 months from January, 1985 through April, 1988. In parallel with construction of the main irrigation canal, the secondary irrigation canals will be constructed in 25 months, starting from June, 1987. The construction of the irrigation canal will be excuted from the upper reaches to the lower reaches. In the rainy season, the earthworks will be suspended and a main effort will be paid to the construction of related structures. The excavated materials from the canals will be used for embankment of canals and inspection roads.

The construction road for access of constructing the Project facilities will be started on January, 1985, parallel with the main canal construction. The inspection roads will also be used for access during the construction. The lack of embankment material of canals and inspection roads will be obtained from excavation in drainage canals. The major drainage canals will be executed for the period from January, 1987 to the end of February, 1990.

The pavement of the inspection roads and construction roads will be made at the final stages of respective construction periods. The construction roads will be transferred as the village link roads.

(5) Tertiary development

The detailed design of the tertiary development will be starated from September, 1984 based on the aerial photo maps and field survey. The construction will be executed in stagewise. The construction will be started on October, 1986 from the upper part of the Project area, and be completed by the end of February, 1990.

5.5 COST ESTIMATE

5.5.1 Construction Cost

The following considerations are taken for the cost estimate of the Project:

(1) The exchange rate used in the estimate is:

US$1.0 = Rp.625 = ¥220

(2) The construction works would be executed on the contract basis; main civil works, such as Bila intake, Kalola dam, main and secondary canals, etc. would be constructed by contractors selected through competitive bidding and the tertiary development work, by local contractors. The construction machinery and equipment required for the construction works would be provided by the contractors themselves. Therefore depreciation cost of the machinery and equipment is considered in the estimate of the construction cost, instead of the procurement cost of machinery and equipment.

(3) The construction cost comprises foreign currency and local currency portions. Local currency portion is estimated on the basis of the current prices in South Sulawesi in 1981 and of the data obtained from the on-going and completed irrigation projects around the Project area. Foreign currency portion is estimated based on the CIF prices at Ujung Pandang. The currency is classified into local and foreign portions according to the following criteria;

Local currency portion

- labour wage
- sand, gravel, stone and wooden materials
- fuel, oil, etc.
- expenses and fees of engineering services for local consultants
- inland transportation charge
- transfer payment for local portions, such as general expenses, taxes and levies
- minor works

Foreign currency portion

- reinforcing steel bars and other structural steel
- cement
- major metal works
- depreciation cost of construction machinery and equipment
- expenses and fees of engineering services by foreign consultants

(4) In the estimate of the construction cost of the quaternary system, only the costs of materials necessary for the construction of the related structures are included, since such works would be executed by farmers themselves under the guidance of the Government.

(5) The physical contingency related to the construction quantities is set at 15% of the direct cost in view of the preliminary nature of the estimate. The price contingency of 7% per annum for the foreign currency portion and 10% for the local currency portion is included in the estimate.

(6) 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.

The construction cost of the Project is estimated at Rp.67,823 million equivalent, comprising Rp.32,926 million of local currency and Rp.34,897 million equivalent of foreign currency. The summary of the cost estmate are as shown in Table 5.1.

The annual disbursement schedule is worked out based on the construction time schedule as shown in Table 5.2. The summary is as shown below:

(Unit: 10^6 Rp)

Year	Foreign currency	Local currency	Total
1983	1,520	960	2,480
1984	1,286	3,928	5,214
1985	3,004	3,343	6,347
1986	3,771	2,836	6,607
1987	5,940	6,176	12,116
1988	10,723	7,380	18,103
1989	6,978	6,186	13,164
1990	1,675	2,117	3,792
Total	34,897	32,926	67,823

5.5.2 Annual Operation and Maintenance Costs

Annual operation and maintenance costs at the full development stage is estimated at Rp.344,840 x 10^3, comprising the costs for; (1) operation and maintenance cost of the project offices including personnel cost, (2) operation and maintenance cost of the project facilities. These costs are shown in Table 2.1 of ANNEX VIII.

5.5.3 Replacement Cost

Some of the project facilities, especially equipment and mechanical works have some shorter useful life than the civil works, and require replacement at a certain time within the Project useful life.

The replacement costs and the useful life of those facilities are listed in Table 3.1 of ANNEX VIII.

CHAPTER VI ORGANIZATION AND MANAGEMENT

6.1 ORGANIZATION FOR THE PROJECT EXECUTION

The Directorate General of Water Resources Development, the Ministry of Public Works would be the executing body for the Bila Irrigation Project. The Directorate General would be responsible for both the engineering works and the construction works of the Project, and it would coordinate all activities of the relevant government agencies and regional administrative organizations in connection with the Project execution.

The Directorate of Irrigation under the Directorate General of Water Resources Development would have the direct responsibility for the Project execution. The Provincial Office of Public Works, South Sulawesi, would coordinate the construction of the Project at the provincial level on behalf of the Directorate of Irrigation.

To smoothly execute the Project, a project office for the Bila Irrigation Project would be established in the Provincial Office of Public Works, South Sulawesi. The Project Office would operate all the field works such as additional survey and investigation, settlement of field quarters, land acquisition, the detailed design and construction supervision.

The Project Office would consist of one head office and four branch offices. It would be proposed to establish the head office at Sengkang. The branch offices would be established at Bila, Tanru Tedong, Kalola and Bola Malimpong in keeping pace with the progress of the project construction works. The organization for the project execution is proposed as shown in Fig. 6.1.

6.2 ORGANIZATION FOR OPERATION AND MAINTENANCE

6.2.1 Project Organization

After completion of the construction works, a regional irrigation office of Wajo would be organized under the Provincial Office of Public Works, and the Project Office would be re-organized into the Project Operation and Maintenance Office under the Regional Irrigation Office of Wajo. The Project O & M Office would be responsible for operation and maintenance of all the Project facilities down to inlets to tertiary blocks. The operation and maintenance of tertiary blocks down to terminal facilities would be entrusted to the water users' associations and farmers themselves.

The O & M Office would consist of one head office and four branch offices. The head office and the branch offices constructed in the construction stage would be used as the Project O & M Offices after completion of the Project construction works.

The Head Office would be responsible for the overall activities necessary for proper operation and maintenance of all the Project facilities including preparation of overall O & M program, design and supervision of repairing and rehabilitation works, budgeting, training of the O & M staff.

The Bila Branch Office would be responsible for the O & M of the Bila intake weir. The Kalola Branch Office would be responsible for the O & M of the Kalola dam and the connecting canal. The Tanru Tedong Branch Office would be responsible for the O & M of the upper parts of the main canal and its commanding area. It would have two field offices (Resort) to operate and maintain the canals and structures. The Bola Malimpong Branch Office would be responsible for the O & M of the lower parts of the main canal and its commanding area. It would have three field offices. The field office would collect the necessary information and field data on water distribution program to be prepared by the O & M Office.

The wireless telephone system is proposed for the communication between the Head Office and the Branch Offices. Total number of the O & M staff required in the full development stage is estimated at about 200 including the Head Office and the Branch Offices. The proposed organization for O & M is as shown in Fig. 6.2.

6.2.2 Farmer's Organization

In the project areas, no farmer's organization for systematic operation and maintenance of tertiary blocks down to terminal facility is organized at present except a few non-active farmer's organizations for village irrigation area.

Before completion of the construction works of the project, it would be recommended to establish and/or reorganize a Water User's Association (P3A) in each tertiary irrigation block so as to cover all the project area for smooth operation and maintenance of the irrigation and drainage system.

It is recommended to that the following principles be considered for establishment of P3A;

(1) The member of P3A should be limited the owner farmers and/or tenant farmers whose cultivating lands would be benefited by the Project.

(2) The boundary of P3A should be demarcated within an adequate irrigation area preferably covering a tertiary irrigation block.

(3) P3A should be an autonomous organization under overall operation and maintenance system.

(4) The tertiary and quaternary irrigation and drainage canals and on-farm related structures should be put under the control of P3A.

(5) The members of P3A should pay the admission fee at the time of registration and annual fee thereafter.

(6) Each P3A should have an advisory group consisting of a chief of village, agricultural extension worker (PPL) and irrigation inspector concerned.

The proposed organization of P3A is shown in Fig. 6.3, together with coordinating organizations.

CHAPTER VII ECONOMIC AND FINANCIAL EVALUATION

7.1 GENERAL

The economic feasibility of the Bila Irrigation Project is evaluated by internal rate of return (IRR). Sensitivity analysis is also made corresponding to changes in accrued benefits, build-up period and project costs. The financial evaluation is also carried out by analyzing typical farm budget of average size farmer and by preparing financial statement of the project as a whole. The farm budget analysis is made for assessment of the net reserve of the average size farm. The analysis of financial statement of the Project is made to evaluate the repayment capacity on the basis of the estimated fund requirement with assumed financial terms of the anticipated loan and the expected revenue from the project. The socio-economic impacts from the implementation of the project which would give the effects on the regional development are also studied briefly.

7.2 ECONOMIC EVALUATION

7.2.1 Irrigation Benefits

The irrigation benefits of the Bila Irrigation Project primarily accrue from the increased crop production due to stable irrigation water supplies. These benefits are estimated as the difference of the annual net production values under future with and without project conditions as mentioned in Section 5.2.

The crop production gradually increases after commencement of the partial operation of the project. The construction work for the whole project area will be completed in 1990. After 5 years of build-up period, the full development stage will be attained in 1994.

The gross direct benefits are estimated at Rp.9,709 million per annum.

The production losses for 400 ha of paddy field due to submergence by the reservoir of Kalola dam are estimated at approximately Rp.157 million per annum, and the losses of farmland for project facilities total about 500 ha. These losses or negative benefits are counted in the estimate of the primary incremental production value by deducting these values from the net production value under future with project condition.

The net direct benefits amount to about Rp.9,552 million at the full development stage, as shown in Table 7.1.

According to the proposed construction plan, the benefits will initially accrue in 1989 with the completion of the Bila intake weir and canals, and will gradually increase up to the full benefits. The

build-up period for full development of paddy production is assumed to be 5 years after completion of the construction works. The annual benefits during the build-up period are considered to be linearly increased to the full benefits amount.

7.2.2 Economic Cost

The financial costs for construction works, replacement of various equipment, and operation/maintenance of the project are estimated at 1981 price level as mentioned in Section 5.5; these include some amount of transfer payment such as direct/indirect taxes and levies. The transfer payment is assumed to be equivalent to 10% of the direct construction cost. The economic cost of the project is obtained by deducting the transfer payment from the financial costs. Price contingency would not be incorporated in the economic cost. The land acquisition cost is not also included in the economic cost.

The total economic cost of the project is estimated to be Rp.35,178 million, consisting of Rp.20,670 million of foreign currency component and Rp.14,508 million of local currency component.

The engineering work for the project will commence in the middle of 1983 and be completed by the beginning of 1990; whole the project works are implemented within 7 years. According to the construction schedule proposed in Fig. 5.8 and the work quantities, the flow of the project costs, O/M cost and replacement cost are estimated as shown in Table 7.2.

7.2.3 Economic Evaluation

(1) Internal rate of return

The project life is assumed to be 50 years from 1983 to 2032. The construction period will be 5.5 years from late 1984 excluding about one (1) year and half for the detailed design. The project benefits will accrue in 1989 and increase year by year to attain the maximum level in 1994.

The O/M cost of the project will be initially disbursed in 1989 when the partial operation will commence. The O/M cost will increase linearly year by year and will reach the full amount in 1990 when the full operation will start for the whole project area of 9,800 ha. The gates and their attachments will be replaced once during the entire period of the project life and the O & M equipment for the irrigation system are replaced every ten (10) years.

The economic internal rate of return (IRR) is calculated based on the economic benefit and cost flows. The economic IRR thus calculated is 15.3%. The result shows that the project is economically feasible.

(2) Sensitivity analysis

Sensitivity analysis is also made in terms of IRR in respect to changes in annual irrigation benefits, project costs and over-run of build-up period. The following five (5) cases to be anticipated are tested:

Case-1: 20% cost increase and benefit as scheduled.

Case-2: 20% benefit decrease and cost as scheduled.

Case-3: 20% cost increase and 20% denefit decrease.

Case-4: 2 year over-run of build-up period.

Case-5: 2 year over-run of build-up period and 20% cost increase.

The results can be summarized below (for details, see ANNEX-XI):

Case-1	13.4%
Case-2	13.0%
Case-3	11.2%
Case-4	14.1%
Case-5	12.4%

The Case-3 (20% increase of cost and 20% decrease of total benefit) indicates the lowest economic internal rate of return but still maintain economical feasibility. The project is insensitive against the anticipated changes.

7.3 FINANCIAL EVALUATION

7.3.1 General

The financial feasibility of the project is evaluated from the viewpoint of farmer's economy. In this connection, the assessment on the amount of water charge to be collected from the water users is made on preliminary basis. The study on the capability of capital cost repayment is also made on the project level by preparing the cash flow table.

7.3.2 Financial Cost

Based on the current market prices and costs as of the end of 1981, the financial cost of the project is estimated to be Rp.67,823 million comprising Rp.32,926 million for the local currency and

Rp.34,897 million for the foreign currency as shown in Table 5.2. In this estimate, the physical contingency of 15%, and the price contingencies of 10% per annum for the local currency and 7% per annum for the foreign currency are considered to the direct cost. Table 5.2 shows the annual disbursement schedule of the said financial cost.

7.3.3 Capacity to Pay

For evaluating the project feasibility from the financial aspect of farmers, average farm budget analyses are made under both the future with project and the future without project conditions as shown in Table 7.3.

The capacity to pay of average size farmer expected under the future with project condition would be Rp.302,810 in 1.54 ha area of average farm.

7.3.4 Water Charge

When the project facilities are completed and water is released to the farmers, but if the water charge is not to be collected, all the costs of the project will have to be born by the Government, and such expenditure will become a heavy burden to the Government. It is generally understood that the water charge is imposed to the water users, and the water charges thus collected is spent for the payment of O & M expenditures incurred to the project and for the repayment of the capital cost of the project. In Indonesia, however, the farmers traditionally do not pay any water charge directly, but contribute indirectly by paying the IPEDA tax.

The recent Government's decree and agreements made with the international lending institutions provide the conditions that the Government shall collect the water charges from the water users and recover the entire O & M cost, and that the rate of water charge shall be reviewed and possibly increased to recover a portion of the capital cost of the project.

As seen in Table 7.4, the annual O & M cost required for the project is estimated at Rp.345 million which is equivalent to about Rp.35,200/ha. This corresponds to about 15% of the capacity to pay aforementioned. On the other hand, the annual scale of amount for the repayment of the capital cost is estimated at about Rp.2,889 million for the foreign currency portion and Rp.2,777 million equivalent for the local currency portion, which are equivalent to Rp.294,800/ha and Rp.283,400/ha respectively. These repayments would not be covered obviously with the capacity to pay from the viewpoint of the farmer's economy.

The water charge to be collected from the water users would have to be within a reasonable range in the capacity to pay that could still give sufficient incentive to the farmers. With this view, the prospective water charge is recommended to be Rp.35,200/ha/annum, i.e., the required O & M cost. This prospective water charge would be the project revenue in the financial evaluation on the project.

7.3.5 Repayment of Project Cost

The financial evaluation of the project is made by examining the repayment capability for the capital cost of the project. For the examination, the cash flow table using the anticipated project revenue and fund requirement.

In the examination of repayment capability, it is assumed that the capital required for the project implementation will be arranged under the following conditions:

(1) For the foreign currency portion plus about 46% of the local currency portion (equivalence to 30% of total loan amount), the capital is financed by bilateral or international organizations with an interest of 3% per annum for a repayment period of 30 years including 10-year grace period.

(2) For the remaining local currency portion, the capital is financed by the budget allocation of the Government with no repayment.

Based on the above conditions, the repayment schedule for the foreign currency portion is prepared as shown in Table 7.4. This table indicates that the direct revenue from the water charge can not cover the annual repayment of the fund, except for the O & M cost, and the repayment of the fund has to be made by the subsidy of the Government.

7.4 SOCIO-ECONOMIC IMPACTS

Various socio-economic impacts are expected from the implementation of the project. They are:

(1) Foreign exchange saving

The rice production in Indonesia is still insufficient to meet the demand. It is reported that annual average import of rice has reached about 1.5 million tons in recent 5 years. With the Project, paddy production would increase to about 98,000 tons of dried paddy per annum from present annual production of about 34,000 tons. The expected annual increment of paddy production would be about 64,000 tons. Out of this increased production, it is expected that the marketable rice would be about 38,000 tons per annum after deducting the increased local consumption of rice. The estimated foreign exchange saving would amount to about US$12 million per annum for substitution of imported rice.

(2) Demonsration effects

With the completion of the project, the farmers in the surrounding areas, as well as those in the project area, become familiar with modern irrigation practices and their incentives for irrigation practices are much enhanced. In the succeeding projects, therefore, the build-up period is possibly shortened.

(3) Increase of employment opportunity

It is expected that the present unemployment in and around the project area is much improved by the project implementation. After completion of the project, the more intensive land use, resulting from a new year-round irrigation system, surely increases the employment opportunity. In addition, the people gains more experience, technical knowhow and skillfulness in the various working fields. These up-graded human resources provide motive power for the future development in the South Sulawesi region.

(4) Improvement of farm products

The quality of rice is improved through sufficient irrigation water supplies which make the crop damages minimum and assure the even maturing of rice. Such improved quality would increase the marketability of farm products.

(5) Environmental effects

The implementation of the project works would certainly lead to changes in rural economy. The domestic water supplies would be much improved through year-round supply of fresh water from the irrigation canals. The local transportation system would also be improved. This would contribute to the improvement of rural economic activities. For land and water conservation, it is recommended that reforestation work should be promoted in the relevant watersheds. The effects of reforestation would be manifold. It would contribute to stabilization of river flow, control of seasonal floods, prevention of soil erosion, etc. The increased crop production in the project area would stimulate the improvement of marketing system and also of agricultural support services.

Table 2.1 Basic Economic Data of Indonesia

Paddy Production in Indonesia

	1975	1976	1977	1978	1979	Average
Harvested area (10^3 ha)	8,495	8,369	8,360	8,929	8,850	8,601
Production (10^3 ton △)	22,331	23,301	23,347	25,772	26,350	24,220
Unit yield (t/ha)	2.63	2.78	2.79	2.89	2.98	2.82

Remark: △ : Dry paddy

Source: Indonesia Statistic Year Book 1981

Paddy Production in the World (1979)

(Unit: 10^3 ton)

Country	Production	%	t/ha	Country	Production	%	t/ha
China	143,400	37.8	3.72	Brazil	7,589	2.0	1.40
India	80,000	18.2	1.79	Philippine	7,000	1.8	2.00
Indonesia	26,350	6.8	2.98	U.S.A.	6,100	1.6	5.14
Bangladesh	19,144	5.1	1.94	Pakistan	4,953	1.3	2.51
Thai	15,800	4.1	1.88	North Korea	4,800	1.3	6.15
Japan	15,800	4.1	6.24	Egypt	2,507	0.7	5.76
Vietnam	10,900	2.8	1.87	Nepal	2,500	0.7	1.98
Burma	10,000	2.6	2.00	U.S.S.R.	2,402	0.6	-
Korea	8,051	2.1	6.58	World Total	379,000	100.0	-

Source: FAO Production Year Book 1979

Rice Import in Indonesia

(Unit: 10^3 ton)

1974	1975	1976	1977	1978	1979	Average
1,130	693	1,301	1,925	1,842	1,922	1,477

Source: Indonesia Statistic Year Book 1981

Rice Import in the World (1979)

(Unit: 10^3 ton)

Country	Amount	Country	Amount	Country	Amount
Indonesia	1,900	Iran	550	Iraq	350
Brazil	711	Saudi Arabia	442	Senegal	262
R.O.K.	631	Hongkong	356	Vietnam	250

Source: FAO Production Year Book 1979

Population in Indonesia

(Unit: 10^3)

	1976	1977	1978	1979	1980
Population	135,190	138,342	141,579	144,912	148,349
Density Person/km² in 1980					77
Population growth rate in 1980					2.33%

Source: Statistical Pocket Book, Indonesia 1979/1980

Economic Active Population in Indonesia

Item	$\times 10^3$	%
Agriculture	35,259	66.0
Mining	44	-
Manufacturing	3,560	6.7
Electricity, Gas & Water Supply	34	-
Construction	1,098	2.1
Trade, Restaurant & Hotel	6,253	11.7
Transport, Storage & Communication	1,112	2.1
Finance & Insurance	74	0.2
Community Service	5,157	9.6
Others	853	1.6
Total	53,444	100.0

Source: Central Bureau of Statistics, Indonesia 1979

GDP of Indonesia by Sector (1979)

Item	Rp. $\times 10^9$	%
1. Agriculture, Forestry & Fishery	9,145	29.8
(1) Farm food crops	5,365	17.5
(2) Non-farm food crops	1,112	3.6
(3) Estate crops	626	2.0
(4) Livestock	550	1.8
(5) Forestry	942	3.1
(6) Fishery	552	1.8
2. Mining	8,172	26.9
3. Manufacturing	2,825	9.2
4. Electric, Gas & Water Supply	130	0.4
5. Construction	1,843	6.0
6. Commerce	5,602	18.3
7. Transport & Information	1,383	4.5
8. Finance	662	2.1
9. Immovable Property	906	2.9
10. Governmental Service	2,240	7.3
11. Other Service	835	2.8
Total	30,662	100.0

Source: Statistical Pocket Book of Indonesia, 1979/1980

Table 3.1 Present Demographic Condition in the Study Area (1980)

Kab. Kec. Desa	Total Population	Population		Population Growth Rate	Area	Average Density	Household		Average Family Size
		Male	Female				Total	Farm	
					(Km^2)	(persons/Km^2)			
Kab. Sidrap									
Kec. Dua Pitue									
Tanru Tedong	16,346	7,590	8,756	1.13	35	467	2,981	2,127	5.5
Bila	9,994	4,773	5,221	1.28	102	98	1,779	1,570	5.6
Kab. Wajo									
Kec. Tanasitolo									
Nepo	11,319	5,284	6,035	1.14	28	400	2,085	1,153	5.4
Tancung	9,276	4,295	4,981	1.47	33	237	1,871	1,638	5.0
Lowa	6,552	3,056	3,496	1.26	48	137	1,257	962	5.2
Kec. Maniangpajo									
Anabanua	8,058	3,758	4,300	1.26	56	146	1,398	1,070	5.8
Kalola	4,647	2,231	2,416	2.20	77	60	726	537	6.4
Kec. Belawa									
Wele	8,083	3,830	4,253	1.23	34	236	1,494	1,076	5.4
Belawa	9,682	4,510	5,172	1.03	31	315	1,794	1,449	5.4
Total	83,957	39,327	44,630	1.23	444	190	15,385	11,582	5.5

Source: Desa offices in the study area.
Bupati offices and Census and Statistics offices, Kab. Sidrap and Wajo.

Remark: The figure include the data in and around the study area.

Table 3.2 Annual Paddy Production in the Study Area (1987 - 1980)

Crops	Planted Area (ha)	Harvested Area (ha)	Damaged Area (ha)	Unit Yield (tons/ha)	Production (tons)
Wet Season Paddy					
1976	12,000	8,410	3,590	2.53	21,280
1977	12,770	9,530	3,240	2.45	23,350
1978	12,870	12,140	730	2.80	33,990
1979	12,330	11,700	630	3.31	38,730
1980	13,040	12,190	850	3.53	43,030
Average	12,600	10,800	1,800	2.97	32,000
Dry Season Paddy					
1975/76	800	680	120	2.57	1,750
1976/77	680	550	130	2.86	1,570
1977/78	990	900	90	2.52	2,270
1978/79	1,190	1,120	70	3.12	3,500
1979/80	430	400	30	3.13	1,250
Average	820	730	90	2.84	2,000
Total	13,420	11,530	1,890	2.94	34,000

Source: Agriculture offices, Kab. Sidrap and Wajo
Kec. and Desa offices in the study area

Table 3.3 Farm Budget of Average Size Farmer under Present Condition

Total Farm Land: 1.54 ha
Paddy field : 1.29 ha
Up-land field: 0.25 ha
Family Size : 5.46 persons

(Unit: Rp.)

Description	Amount
1. Gross Farm Income	
Wet season paddy	264,630
Dry season paddy	15,340
Polowijo crops	56,850
Up-land crops	41,350
Non-farm income	49,540
Sub-total	427,710
2. Gross Out-go	
Farming expenses	
Paddy	47,440
Polowijo crops	8,090
Up-land crops	5,890
IPEDA tax, others	7,370
Sub-total	68,790
3. Net Farm Income	
(1 - 2)	358,920
4. Family Living Expenses	
Food	156,500
Clothing	32,100
Education	13,400
Luxury	58,200
Social expenses	52,600
Miscellaneous	45,600
Sub-total	358,400
Net Reserve (3 - 4)	520

Remark: Family living expenses is estimated based upon the farm economy survey.

Table 5.1 Summary of Construction Cost

(Unit: 10^6 Rp.)

	Item	Total	Foreign Currency	Local Currency
1.	Preparatory Works	1,718	698	1,020
2.	Bila Intake	2,665	1,774	891
3.	Kalola Dam	7,656	5,456	2,200
4.	Irrigation Canals and Roads			
	- Irrigation canals and inspection roads	8,208	4,574	3,634
	- Drainage canals	1,343	1,063	280
	- Construction road	780	491	289
5.	Tertiary Development	4,485	444	4,041
6.	Office and Quarters	640	-	640
	Sub-total	27,495	14,500	12,995
7.	Land Acquisition	2,370	-	2,370
8.	O & M Equipment	992	942	50
9.	Administration Expenses	612	-	612
10.	Engineering Services	4,889	4,529	360
11.	Physical Contingency	5,454	2,996	2,458
	Sub-total	14,317	8,467	5,850
	Total	41,812	22,967	18,845
12.	Price Contingency	26,011	11,930	14,081
	GRAND TOTAL	67,823	34,897	32,926

Table 5.2 Annual Disbursement Schedule

(Unit: 10^6Rp.)

Description	Total		1983		1984		1985		1986		1987		1988		1989		1990	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Preparatory Work	698	1,020	-	-	349	510	349	510	-	-	-	-	-	-	-	-	-	-
2. Bila Intake	1,774	891	-	-	-	-	155	216	183	254	183	254	1,245	162	8	5	-	-
3. Kalola Dam	5,456	2,200	-	-	-	-	208	76	878	303	728	222	1,540	519	1,412	565	690	515
4. Canals & Roads																		
(1) Canals & inspection roads	4,574	3,634	-	-	-	-	597	453	595	453	1,320	1,048	1,442	1,170	622	510	-	-
(2) Drainage canals	1,063	280	-	-	-	-	-	-	-	-	340	90	340	90	340	89	43	11
(3) Construction roads	491	289	-	-	-	-	167	98	162	96	162	95	-	-	-	-	-	-
5. Tertiary System	444	4,041	-	-	-	-	-	-	31	283	129	1,172	129	1,172	129	1,172	26	242
6. Office and Quarters	-	640	-	-	-	640	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	14,500	12,995	-	-	349	1,150	1,474	1,353	1,849	1,389	2,862	2,881	4,696	3,113	2,511	2,341	759	768
7. Land Acquisition	-	2,370	-	570	-	1,300	-	500	-	-	-	-	-	-	-	-	-	-
8. O & M Equipment	942	50	-	-	-	-	-	-	-	-	-	-	471	25	471	25	-	-
9. Administration Expenses	-	612	-	46	-	68	-	88	-	101	-	101	-	101	-	97	-	10
10. Engineering Service	4,529	360	1,155	74	564	48	519	44	489	41	580	49	640	54	549	47	33	3
11. Physical Contingency	2,996	2,458	173	103	137	385	299	298	351	230	516	455	871	494	530	376	119	117
Sub-total	8,467	5,850	1,328	793	701	1,801	818	930	840	372	1,096	605	1,982	674	1,550	545	152	130
Total	22,967	18,845	1,328	793	1,050	2,951	2,292	2,283	2,689	1,761	3,958	3,486	6,678	3,787	4,061	2,886	911	898
12. Price Contingency	11,930	14,081	192	167	236	977	712	1,060	1,082	1,075	1,982	2,690	4,045	3,593	2,917	3,300	764	1,219
GRAND TOTAL	34,897	32,926	1,520	960	1,286	3,928	3,004	3,343	3,771	2,836	5,940	6,176	10,723	7,380	6,978	6,186	1,675	2,117

Remarks: /1; Engineering service of item 10 includes the expenses required for the detailed design.

/2; Price contingency of item 12 is calculated from the standpoint 1981 based on the annual increase rates of 7% and 10% for the foreign currency and local currency portions respectively.

Table 7.1 Irrigation Benefits

Description		Without Project	With Project	Increment
1. Project Area	(ha)	10,900	9,800	-1,100
2. Planted/Harvested Area	(ha)			
Wet season paddy		9,490	9,800	310
Dry season paddy		590	9,800	9,210
Polowijo crops		2,720	-	-2,720
3. Gross Production Value	(10^6 Rp.)	6,518	19,600	13,082
Wet season paddy		5,637	9,800	4,163
Dry season paddy		335	9,800	9,465
Polowijo crops		546	-	-546
4. Total Production Cost	(10^6 Rp.)	2,499	5,872	3,373
Wet season paddy		2,131	2,886	755
Dry season paddy		121	2,986	2,865
Polowijo crops		247	-	-247
5. Net Production Value	(10^6 Rp.)	4,019	13,728	9,709
Wet season paddy		3,506	6,914	3,408
Dry season paddy		214	6,814	6,600
Polowijo crops		299	-	-299
6. Production Loss Value	(10^6 Rp.)	157	-	-157
Wet season paddy		136	-	-136
Dry season paddy		8	-	-8
Polowijo crops		13	-	-13
7. Annual Incremental Benefits	(10^6 Rp.)	4,176	13,728	9,552 (US$1,560/ha)

Table 7.2 Annual Costs and Benefits Flow

(Unit: 10^6Pp.)

Year	Year in Order	Cost			Benefit
		Capital	Replacement	O & M	
1983	1	1,320	0	0	0
1984	2	2,255	0	0	0
1985	3	3,600	0	0	0
1986	4	4,004	0	0	0
1987	5	6,700	0	0	0
1988	6	9,419	0	168	752
1989	7	6,252	0	345	2,536
1990	8	1,628	0	345	4,478
1991	9	0	0	345	6,421
1992	10	0	0	345	8,362
1993	11	0	0	345	9,552
1994	12	0	0	345	9,552
1995	13	0	0	345	9,552
1996	14	0	0	345	9,552
1997	15	0	445	345	9,552
1998	16	0	445	345	9,552
1999	17	0	0	345	9,552
2000	18	0	0	345	9,552
2001	19	0	0	345	9,552
2002	20	0	0	345	9,552
2003	21	0	0	345	9,552
2004	22	0	0	345	9,552
2005	23	0	0	345	9,552
2006	24	0	0	345	9,552
2007	25	0	445	345	9,552
2008	26	0	445	345	9,552
2009	27	0	0	345	9,552
2010	28	0	0	345	9,552
2011	29	0	43	345	9,552
2012	30	0	55	345	9,552
2013	31	0	962	345	9,552
2014	32	0	0	345	9,552
2015	33	0	0	345	9,552
2016	34	0	0	345	9,552
2017	35	0	445	345	9,552
2018	36	0	445	345	9,552
2019	37	0	0	345	9,552
2020	38	0	0	345	9,552
2021	39	0	0	345	9,552
2022	40	0	0	345	9,552
2023	41	0	0	345	9,552
2024	42	0	0	345	9,552
2025	43	0	0	345	9,552
2026	44	0	0	345	9,552
2027	45	0	445	345	9,552
2028	46	0	445	345	9,552
2029	47	0	0	345	9,552
2030	48	0	0	345	9,552
2031	49	0	0	345	9,552
2032	50	0			

Present Worth

Interest (%)	Cost	Benefit
4	35,778	136,858
6	30,758	87,954
8	27,038	53,272
10	24,120	41,540
12	21,738	30,058
14	19,738	22,324
16	18,026	16,937
18	16,539	13,080
20	15,235	10,253

IRR: 15.3%

Table 7.3 Farm Budget of Average Size Farmer under with and without Project

Total Farm Land: 1.54 ha
Paddy field : 1.29 ha /1
Up-land field: 0.25 ha
Family Size : 5.5 persons

Description	W/o Project	W/Project	Increment
1. Gross Income			
Farm income			
Wet season paddy	328,160	521,920	
Dry season paddy	19,560	433,410	
Polowijo crops	58,850	16,880	
Up-land crops	43,200	43,200	
Non-farm income	54,980	-	
Sub-total	504,750	1,015,410	510,660
2. Gross Out-go			
Farming expenses			
Wet season paddy	48,150	87,490	
Dry season paddy	2,440	71,760	
Polowijo crops	8,630	2,480	
Up-land crops	6,280	6,280	
IPEDA tax, others	7,560	18,290	
Family living expenses	430,500	526,300	
Sub-total	503,560	712,600	209,040
3. Net Reserve (1 - 2)	1,190	302,810	301,620

Remark: /1; Out of 1.29 ha of paddy field, 0.92 ha will be put under the project area.

Table 7.4 Cash Flow Statement

(Unit: 10^6Rp.)

Year	Cash Outflow					Cash Inflow					
	Project Cost	O/M Cost	Replacement Cost	Loan Repayment	Total Outflow (A)	F/Loan	Government Budget	Water Charge	Government Subsidy	Total Inflow (B)	Balance (B) - (A)
1983	2,480	-	-	-	2,480	2,180	300	-	-	2,480	0
84	5,214	-	-	-	5,214	1,844	3,370	-	-	5,214	0
85	6,347	-	-	-	6,347	4,308	2,039	-	-	6,347	0
86	6,607	-	-	-	6,607	5,408	1,199	-	-	6,607	0
87	12,116	-	-	-	12,116	8,518	3,598	-	-	12,116	0
88	18,103	-	-	-	18,103	15,377	2,726	-	-	18,103	0
89	13,164	168	-	-	13,332	10,006	3,158	168	-	13,332	0
90	3,792	345	-	-	4,137	2,402	1,390	345	-	4,137	0
91	0	345	-	-	345	-	-	345	-	345	0
92	0	345	-	-	345	-	-	345	-	345	0
93	0	345	-	-	345	-	-	345	-	345	0
94	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
95	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
96	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
97	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
98	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
99	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
2000	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
01	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
02	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
03	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
04	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
05	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
06	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
07	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
08	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
09	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
10	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
11	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
12	0	345	43	4,142	4,530	-	-	388	4,142	4,530	0
13	0	345	55	4,140	4,540	-	-	400	4,140	4,540	0
14	0	345	962	-	1,307	-	-	1,307	-	1,307	0
15	0	345	-	-	345	-	-	345	-	345	0

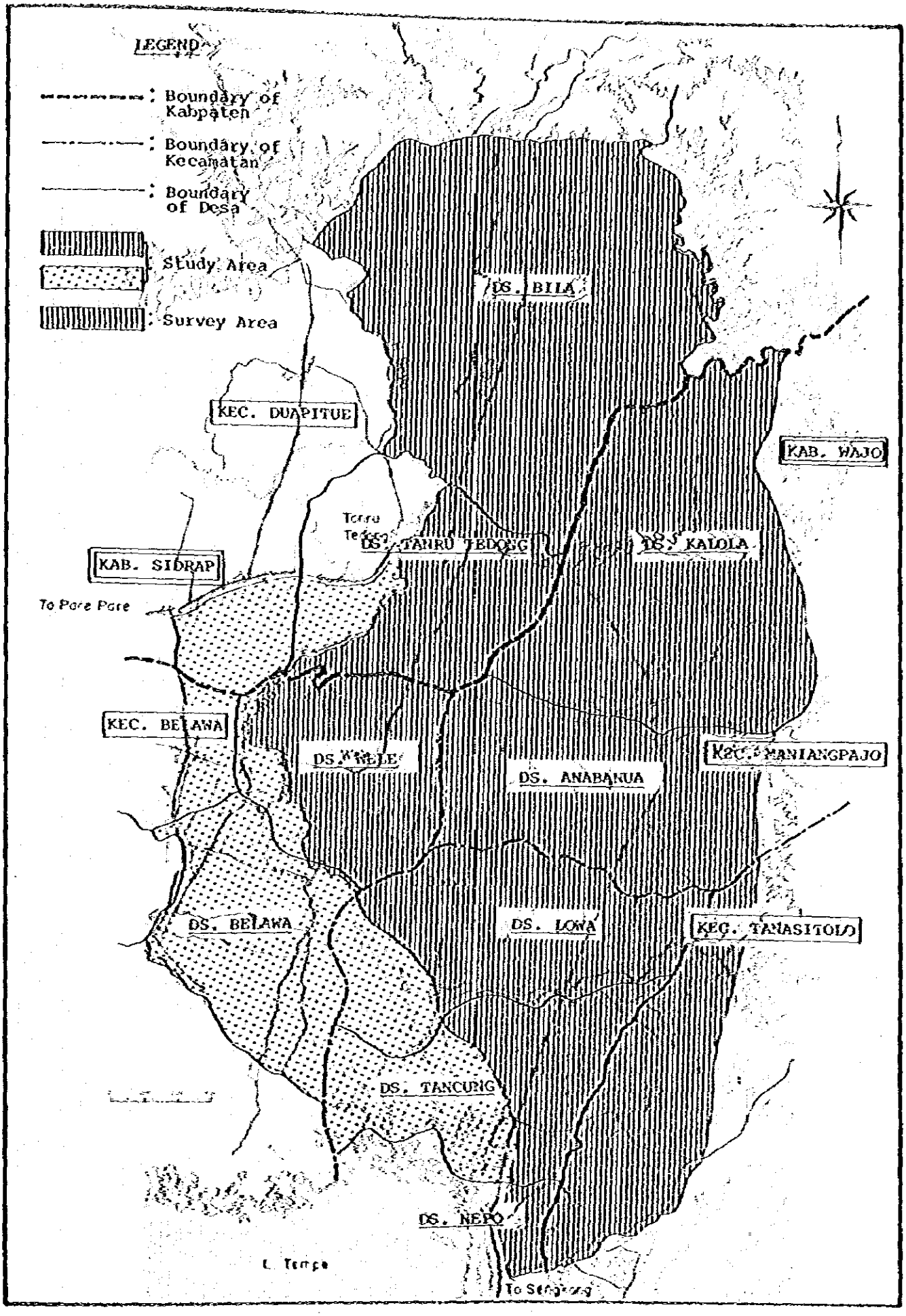
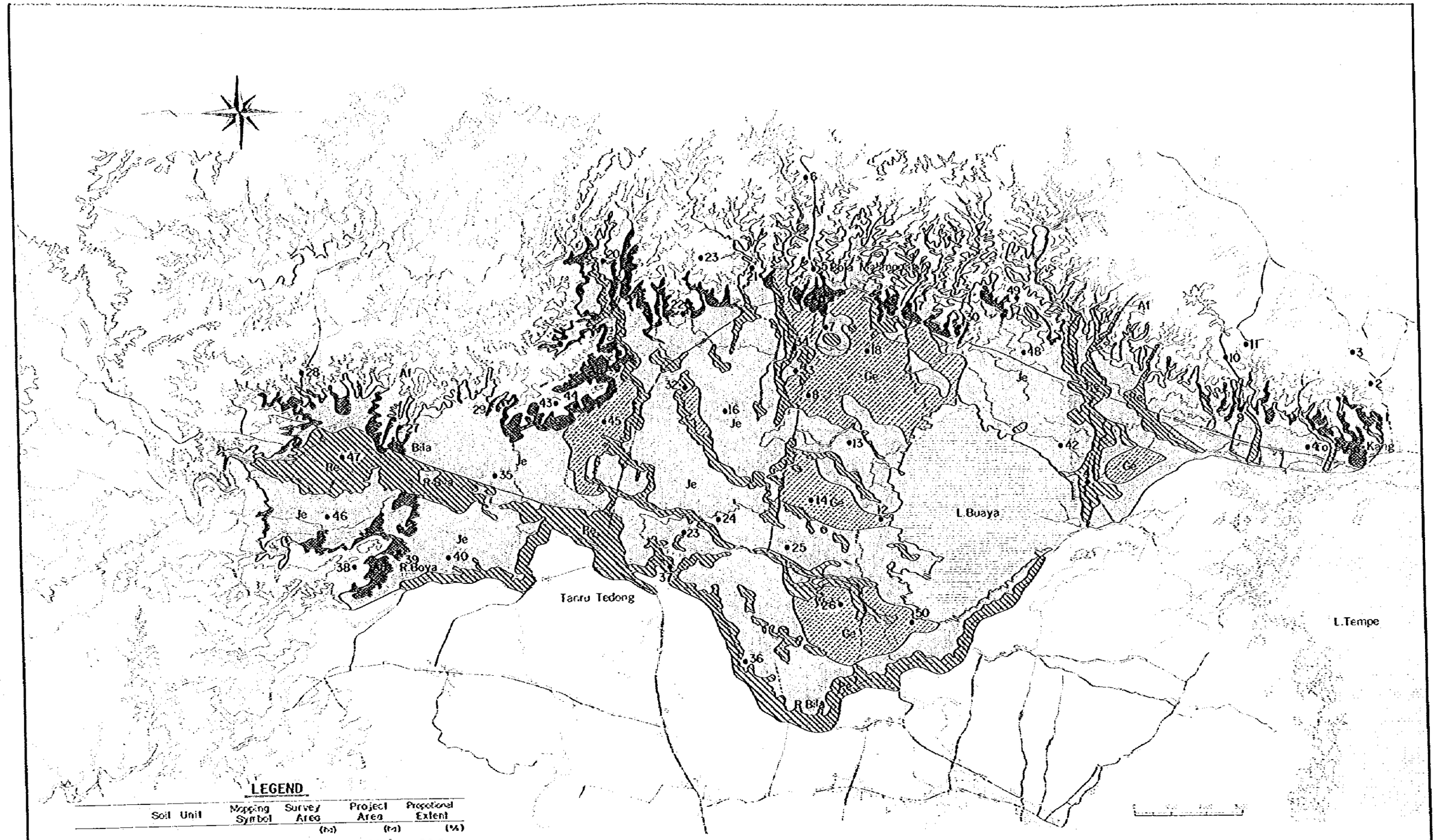


Fig. 3.1 ADMINISTRATIVE BOUNDARIES IN THE STUDY AREA



LEGEND

	Soil Unit	Mapping Symbol	Survey Area (ha)	Project Area (ha)	Proportional Extent (%)
	Eutric Fluvisols	Je	11,200	8,900	79.5
	Eutric Gleysols	Ge	2,500	2,300	20.5
	Eutric Regosols	Re	2,500	—	—
	Plinthic Acrisols	Ap	900	—	—
	Ferric Acrisols	Af	2,900	—	—
Total			20,000	11,200	100.0

Fig. 3.2 SOIL MAP IN THE STUDY AREA

LEGEND

Land Use Category	Study Area (ha)	Project Area (ha)	Proportional Extent (%)
Paddy field	13,700	11,200	
Upland field	700		
Orchard	1,260		
Forest / Grass land	3,800		
Villages / Others	540		
Total	20,000	11,200	100.0

Fig. 3.3 PRESENT LAND USE MAP IN THE STUDY AREA

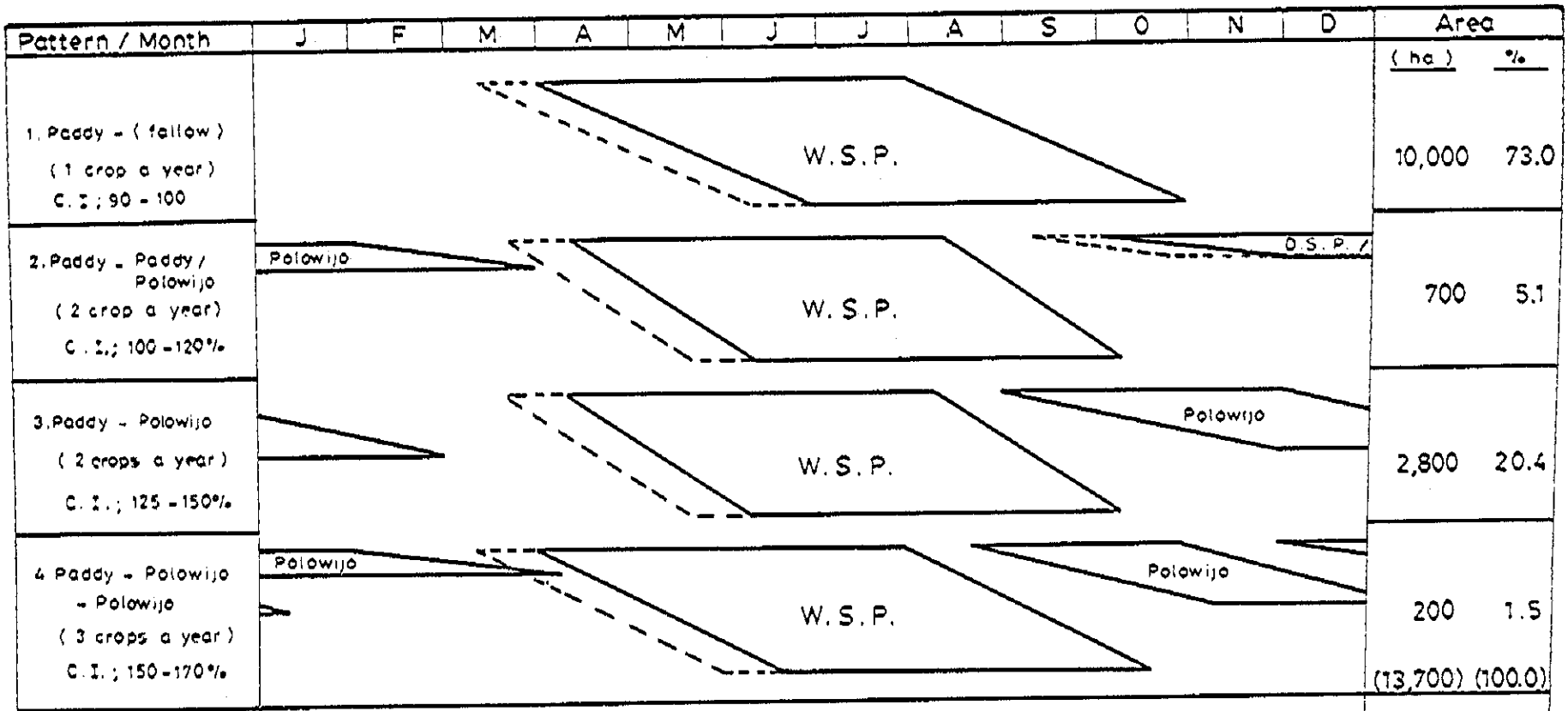


Fig. 3.4 PRESENT CROPPING PATTERNS IN THE STUDY AREA

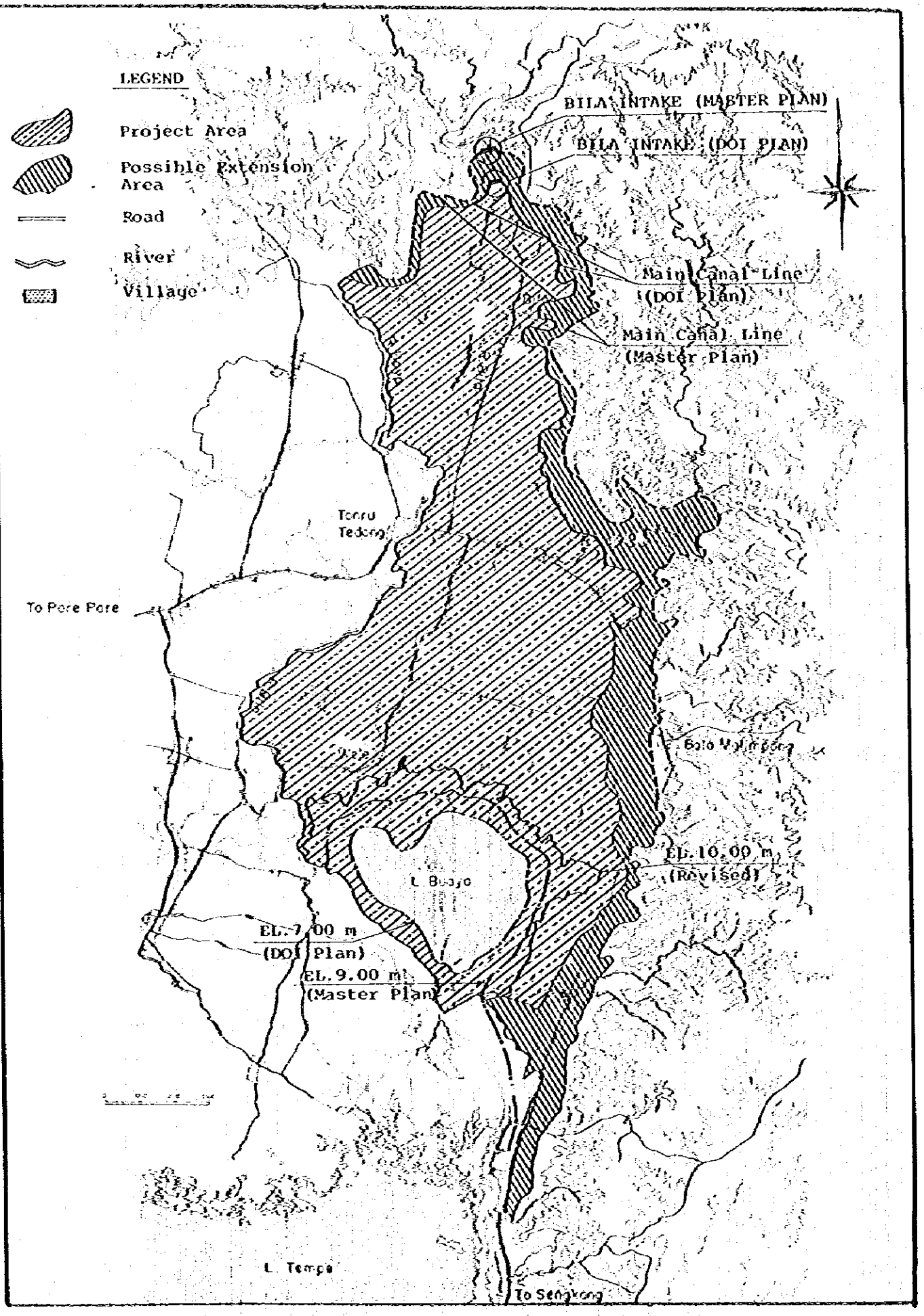


Fig. 4.1 GENERAL MAP OF MASTER PLAN AND DOI PLAN

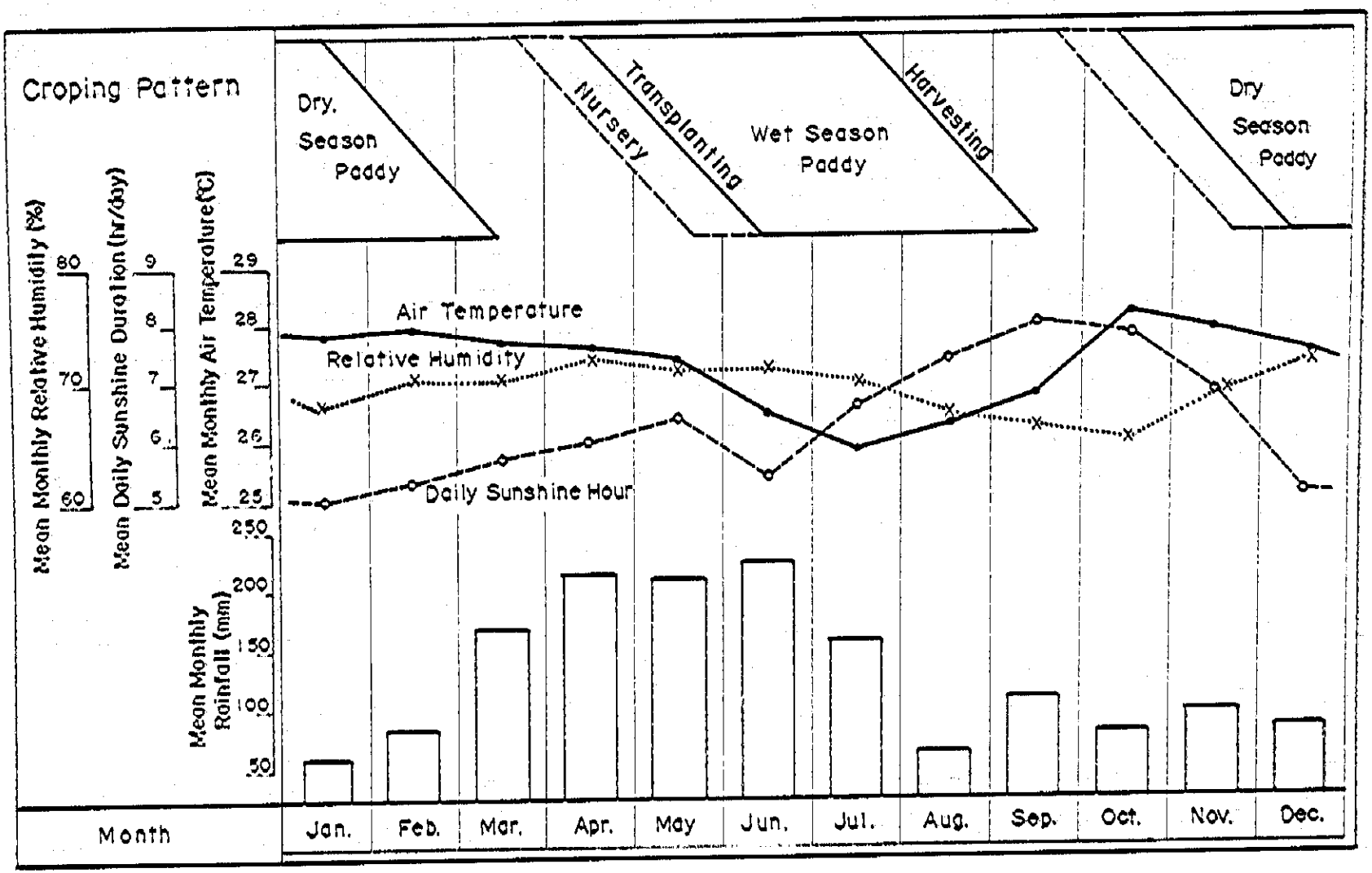


Fig. 5.1 PROPOSED CROPPING PATTERN
(PATTERN A)

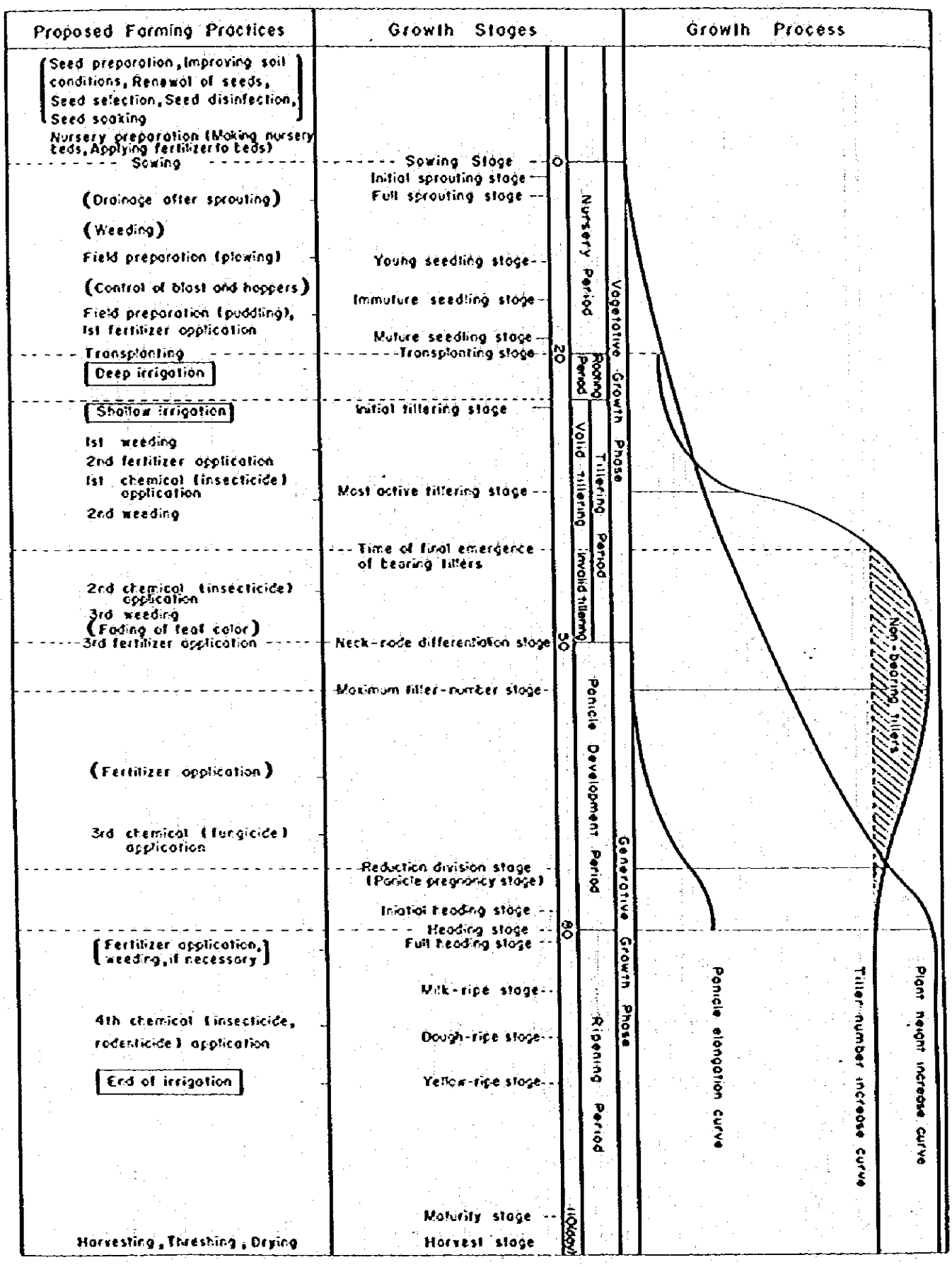


Fig. 5.2 GROWTH PROCESS OF THE RICE PLANT AND PROPOSED FARMING PRACTICES AT EACH GROWTH STAGE

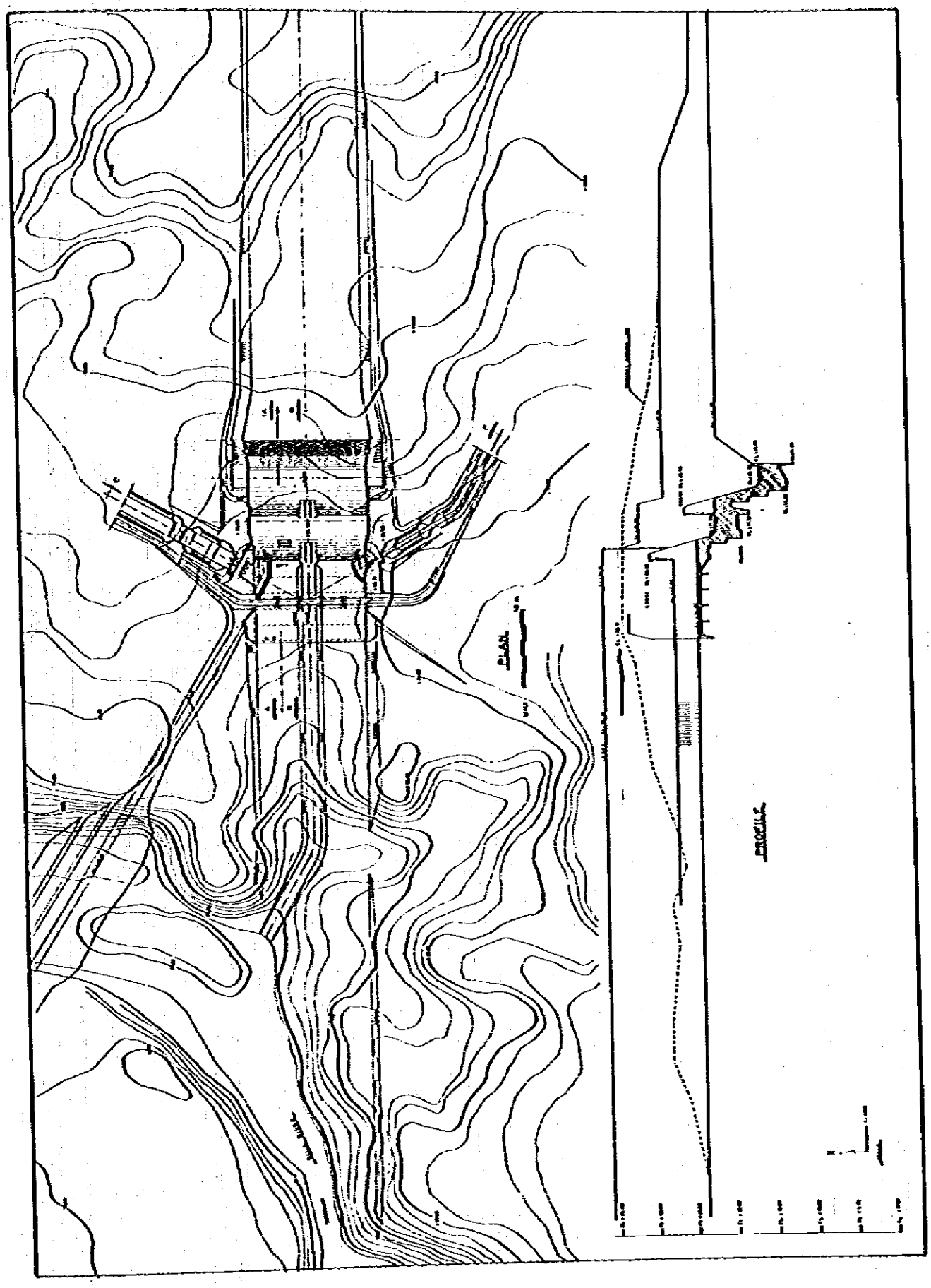


Fig. 5.3 BILA INTAKE, GENERAL

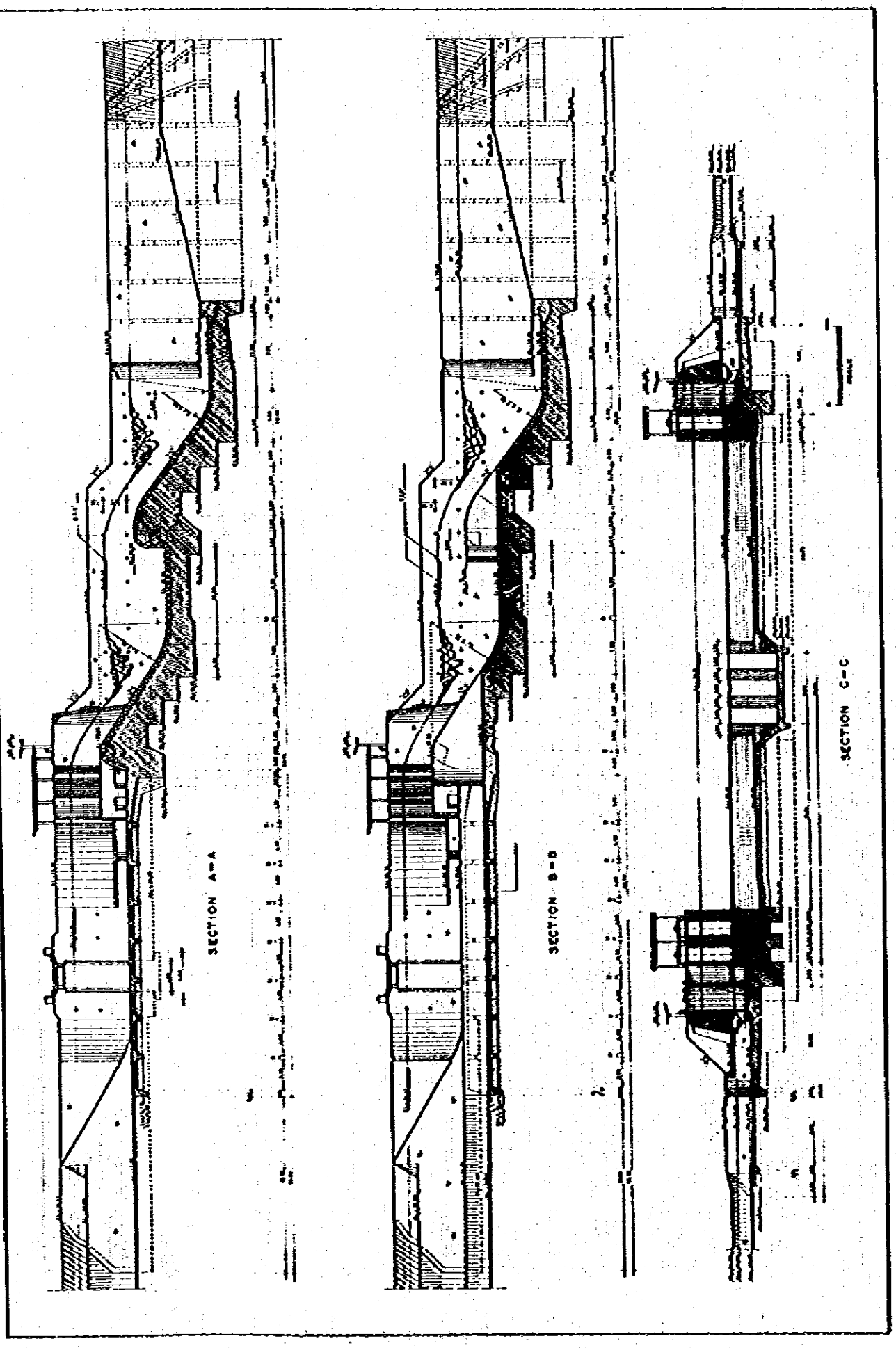


Fig. 5.4 BIDA INTAKE, PROFILE

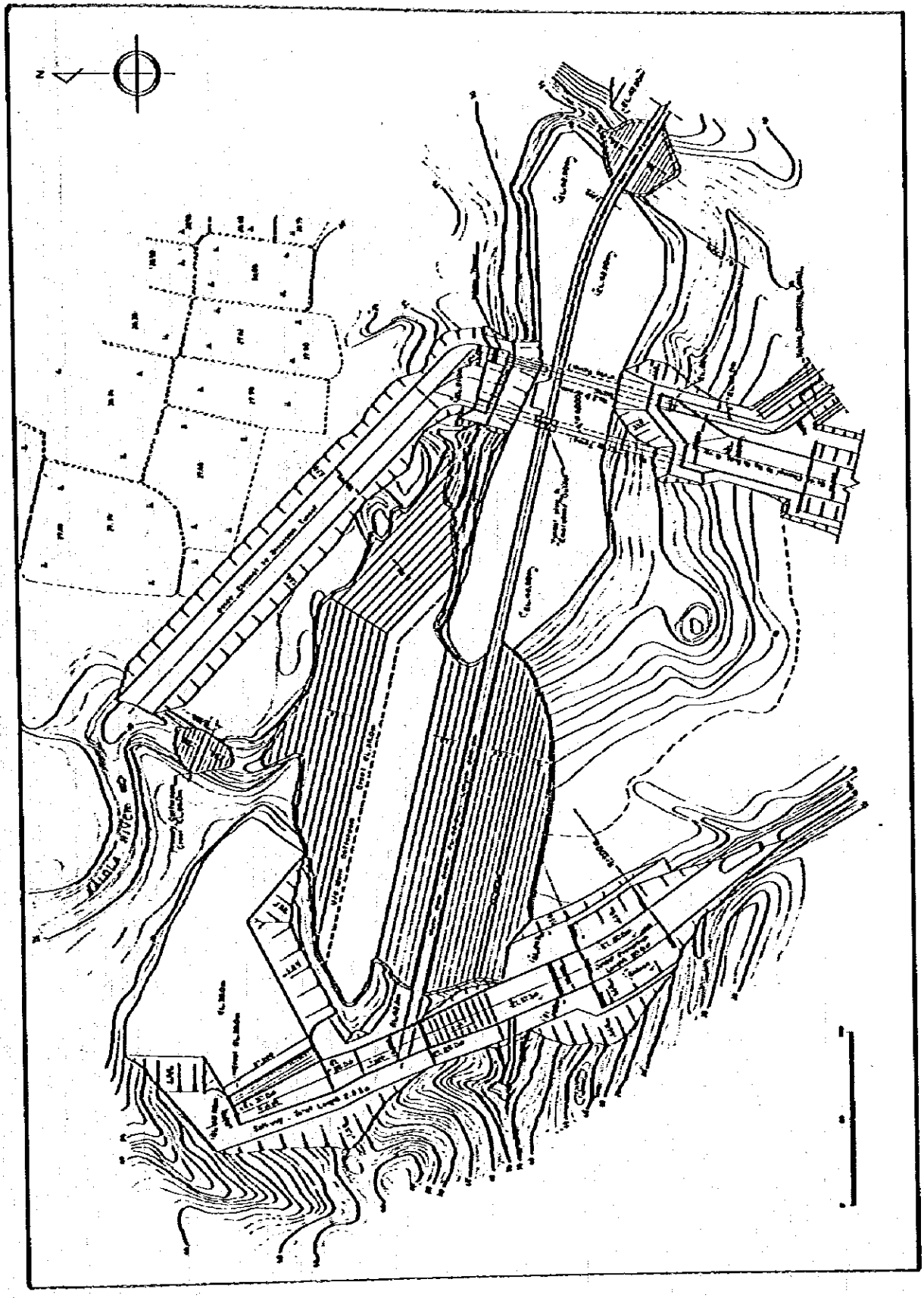


Fig. 5.5 KALOLA DAM, PLAN

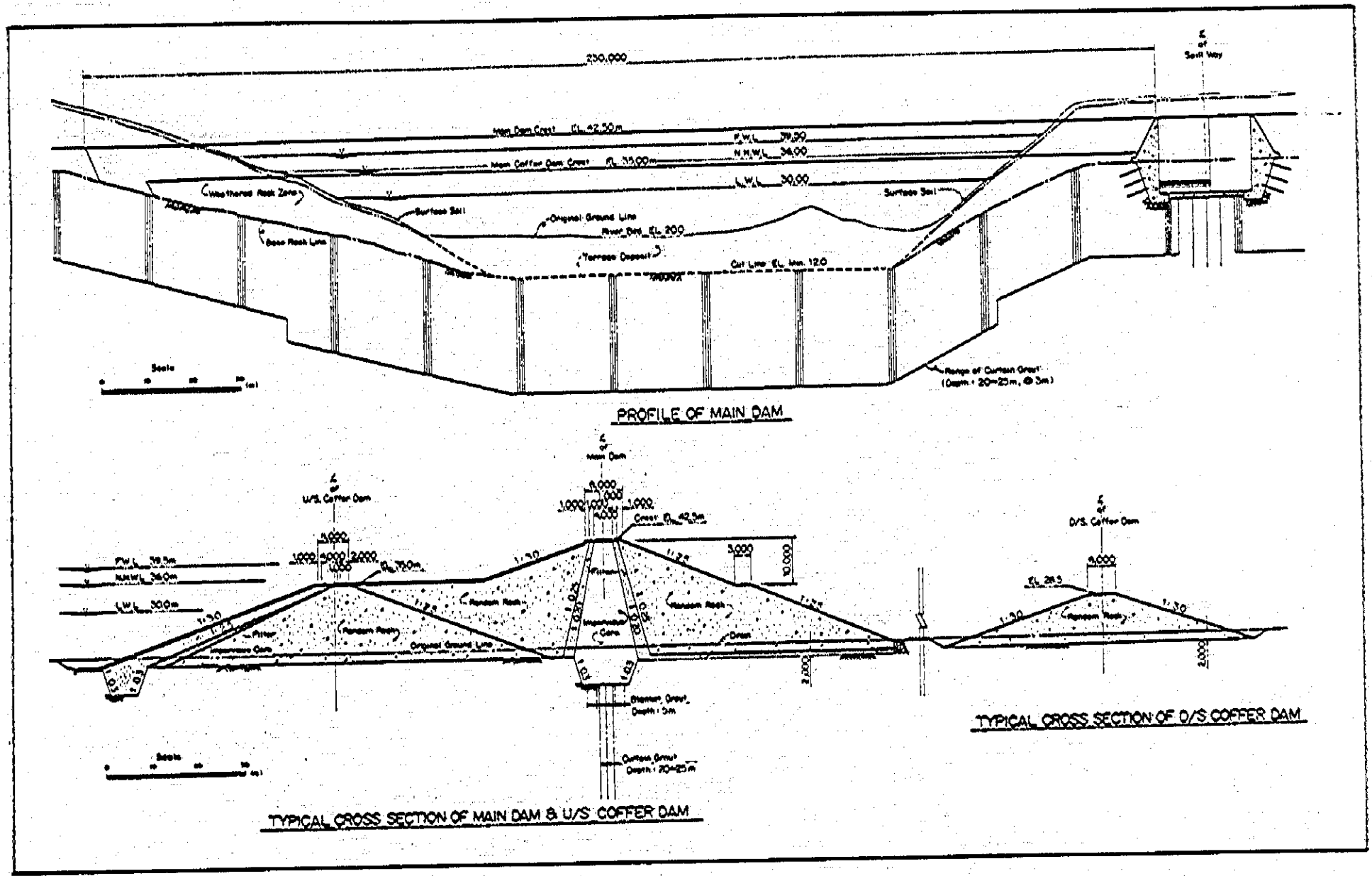
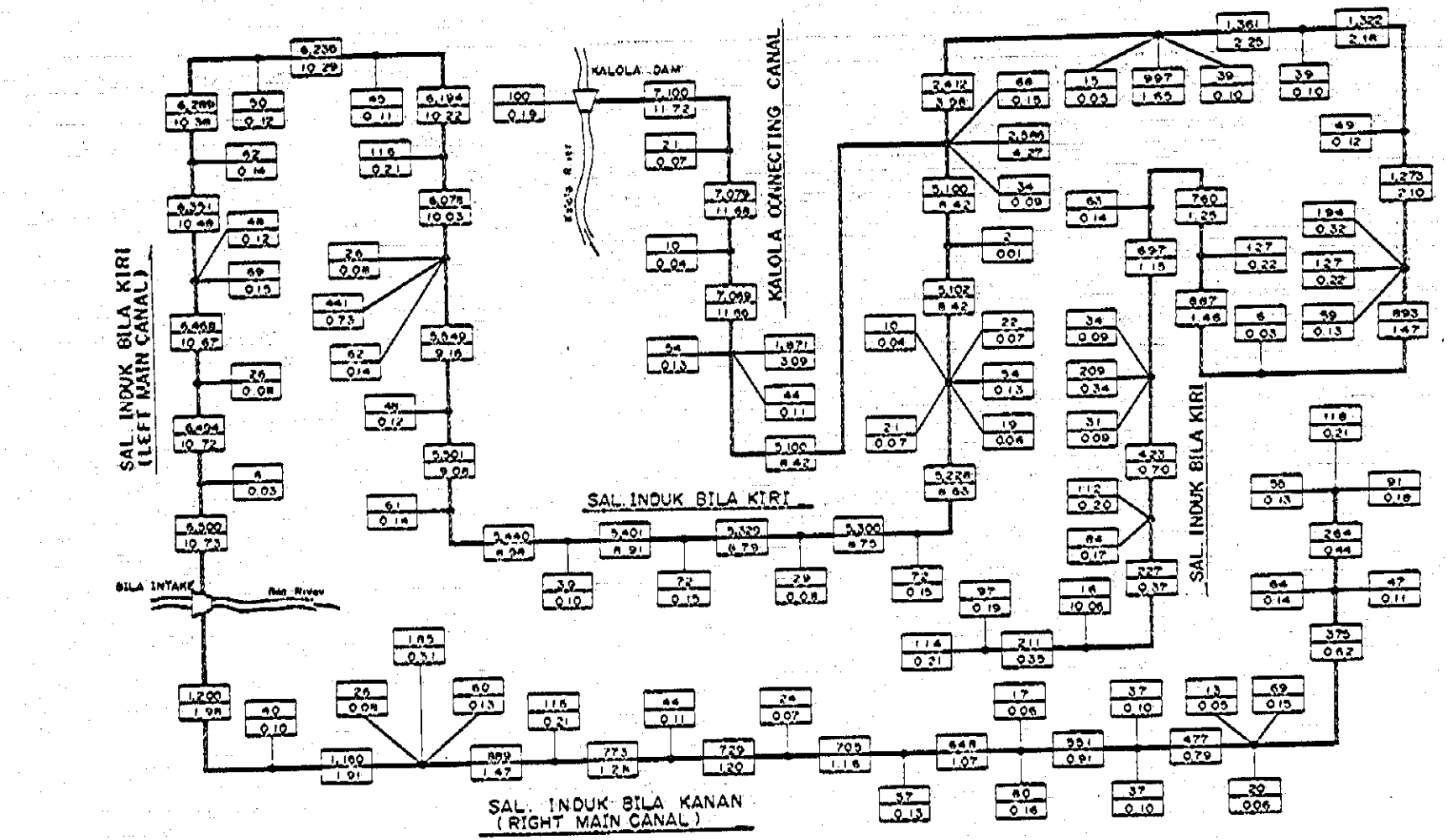


Fig. 5.6 KALOLA DAM, PROFILE AND CROSS SECTION



LEGEND

: Main and Connecting Canal

: Turn out

6,500 : Commanding Area in ha

10.73 : Discharge in m³/sec

Fig. 5.7 IRRIGATION DIAGRAM

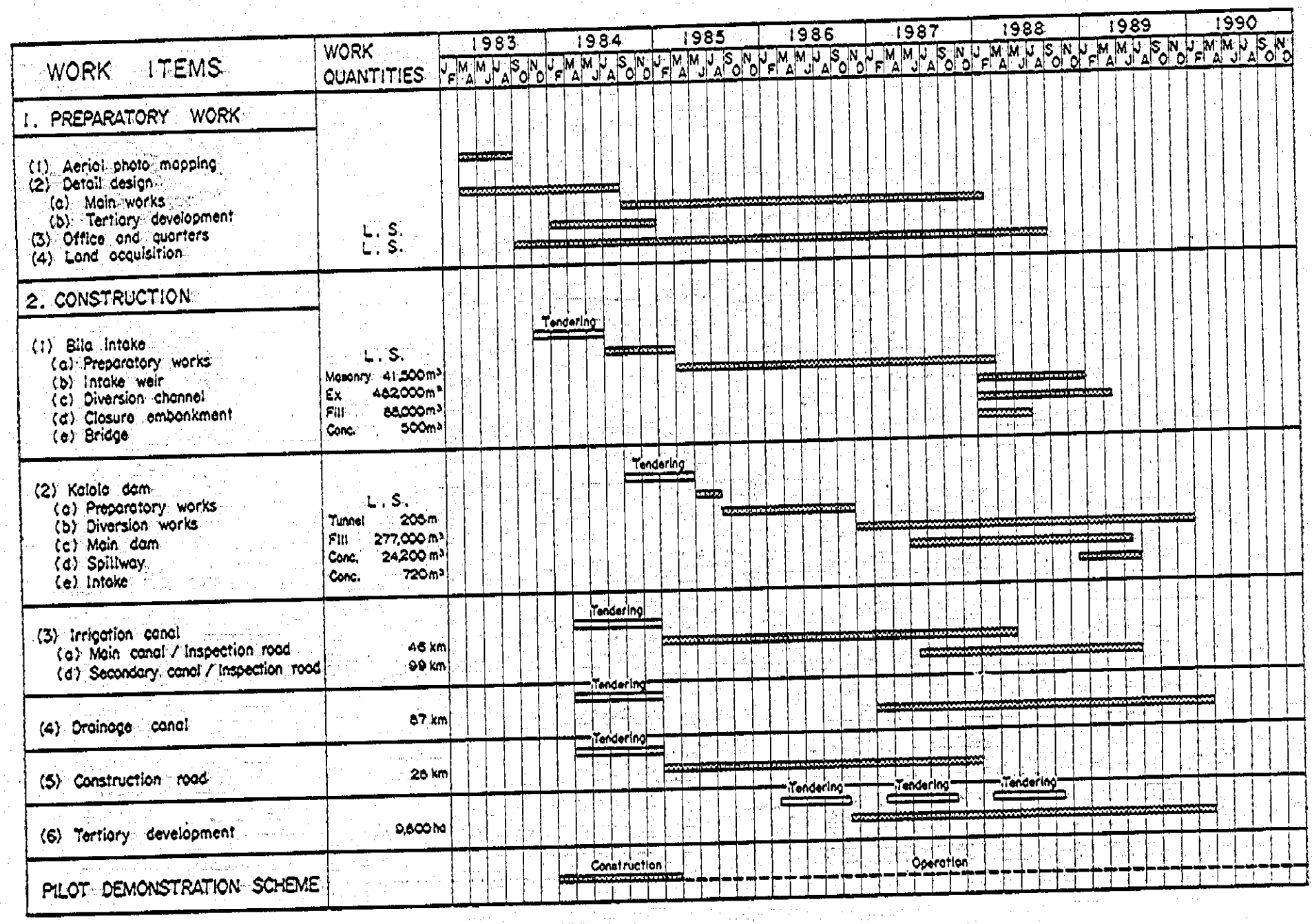


Fig. 5.8 PROJECT IMPLEMENTATION SCHEDULE

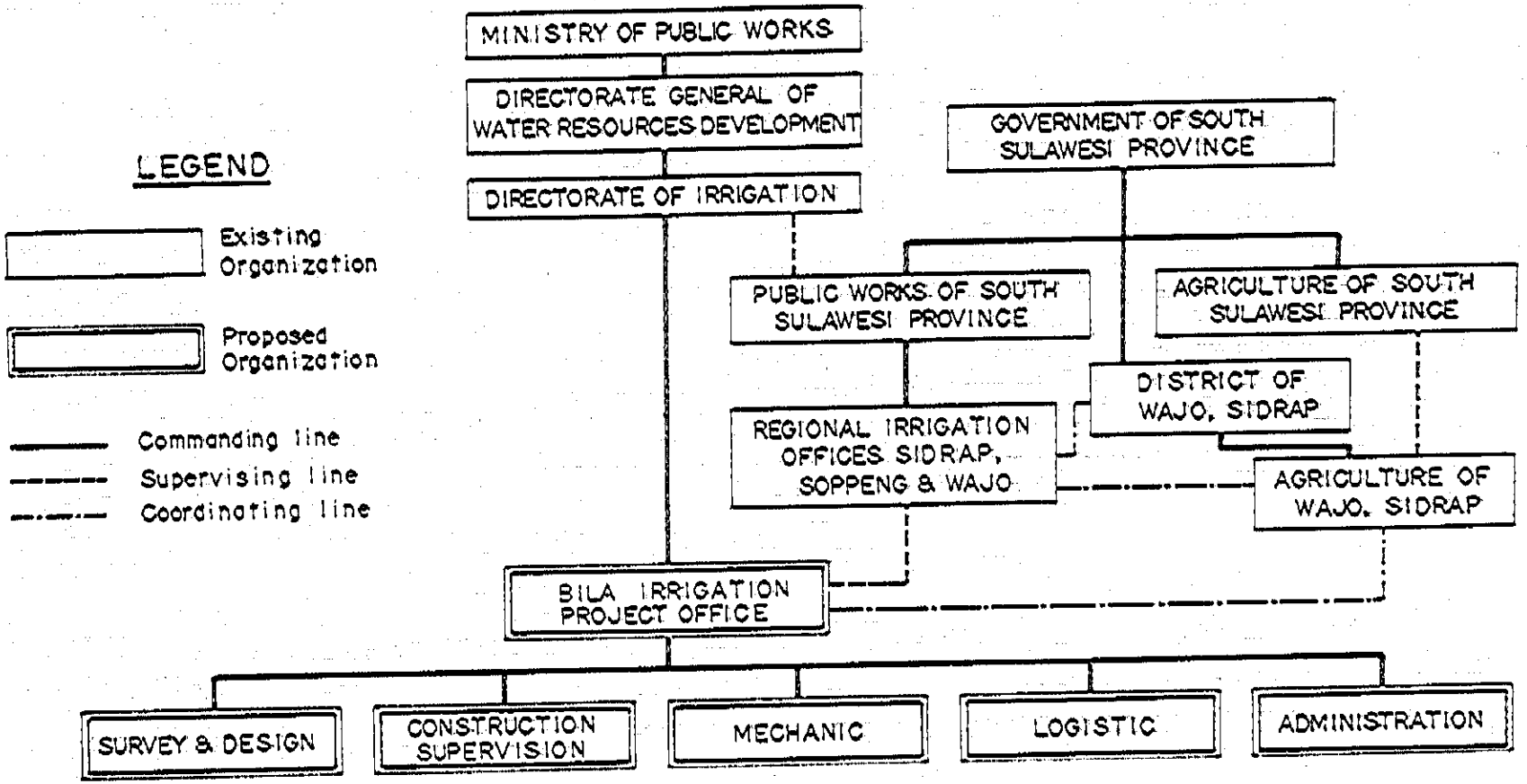


Fig. 6.1 ORGANIZATION FOR PROJECT EXECUTION

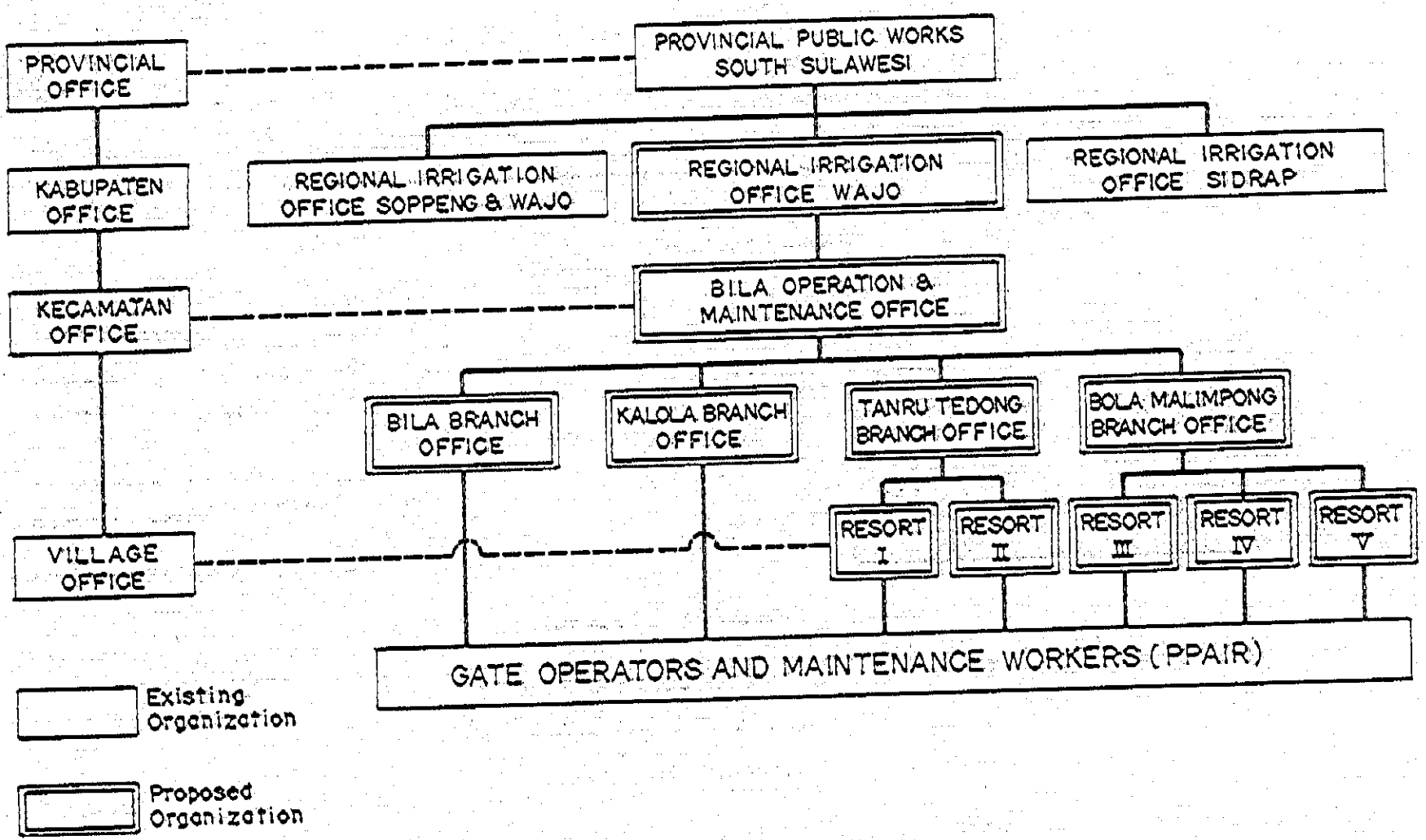


Fig. 6.2 ORGANIZATION FOR OPERATION AND MAINTENANCE

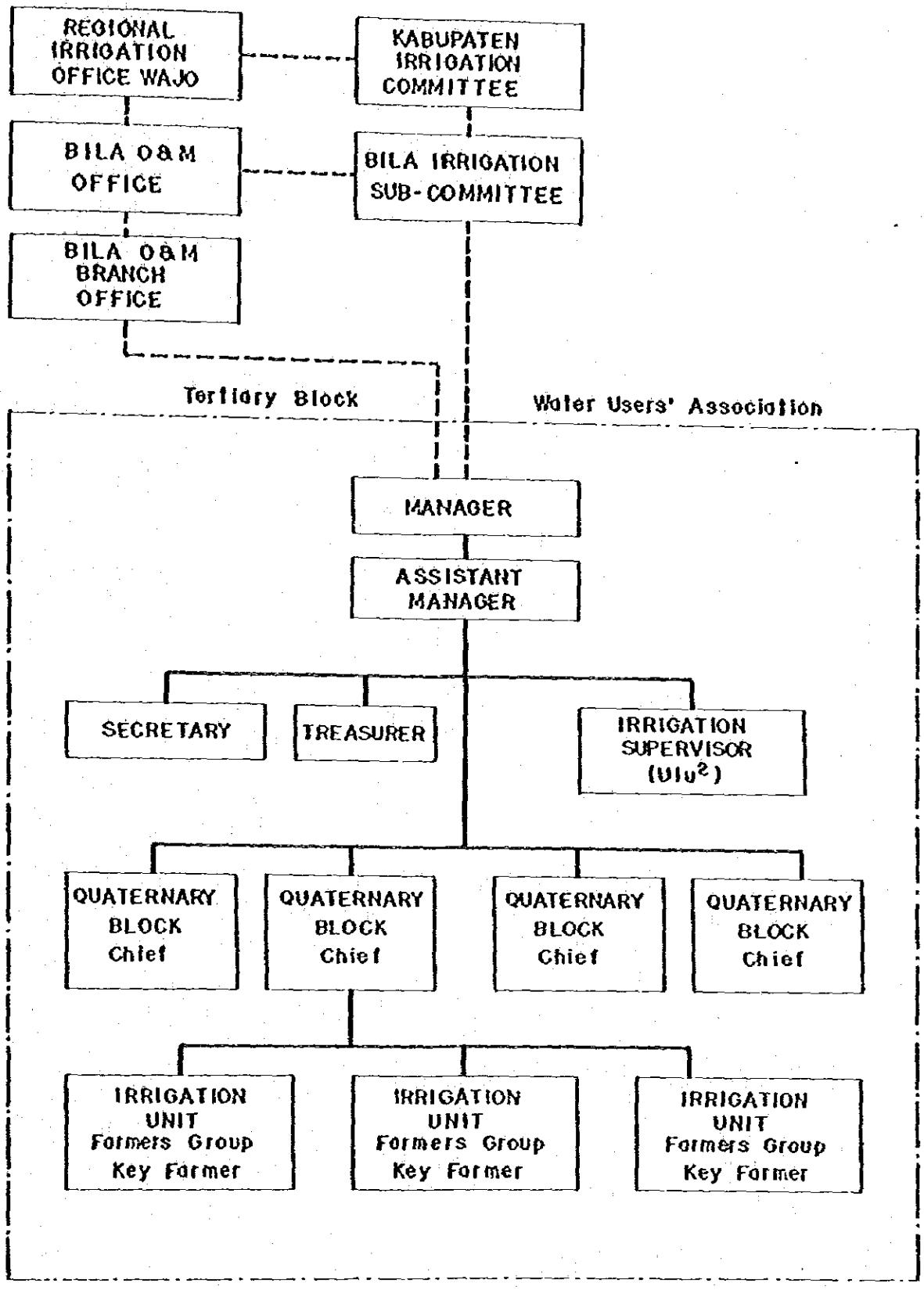


Fig. 6.3 WATER USER'S ORGANIZATION

ATTACHMENT-I WATERSHED MANAGEMENT

1. BASIC MEASURE

The water sources for the Bila irrigation project would depend on the Bila and Kalola rivers. The watershed areas of these rivers are about 37,900 ha and 12,200 ha respectively. About 65% of the Bila river watershed are covered with forest. The forest resources are, however, gradually depleted because of cutting of trees for planting cengkeh (clove tree) especially in the upper reaches of the Bila river. Grassland is dominant in the Kalola watershed and only 32% is covered with forest. In addition to the lumbering by local people, over-grazing of livestock animals has exerted an aggravating influence on the land and soil conservation in these watershed areas.

The basic concept for watershed management would be as follows:

(1) Soil and water conservation will have to be made through overall watershed management including reforestation and erosion control works.

(2) In due consideration of existing conditions of watershed areas the first priority must be given to reforestation.

(3) The present unrestricted cutting of trees in the forest areas will have to be controlled by the Department of Forestry. In particular, the trees on the ridges will have to maintained. Once such trees are cut, natural regeneration is very difficult because of limited availability of soil moisture.

(4) Since over-grazing of livestock animals in the bush and grassland will cause damage to the newly-planted trees, animal grazing will also be controlled by the local government official.

(5) The erosion control works will be necessary in the seriously affected areas. The establishment of sand prevention forest and hillside wicker work will be recommendable for this purpose.

On the basis of basic concept mentioned above, the reforestation plan would be given the first priority for the measure of watershed management.

2. REFORESTATION PLAN

2.1 Tree Species

The species of trees for reforestation should meet the following conditions at least:

(1) Seedlings are easily multiplicated and low costed,

(2) Seedlings are multiplicated in short term, and

(3) Seedlings are easily growable under unfavourable natural conditions.

In due consideration of these basic requirements, Eucalyptus sp, Acasia auriculiformis, and Pinus merkusii would be selected for the reforestation in the Bila and Kalola watershed areas.

2.2 Objective Areas

The reforestation work will be necessary both in the Bila and Kalola watershed areas. The government already aware of this matter and has paid attention to the Bila - Walanae watershed management. Since PELITA I reforestation areas so far covered are about 15,200 ha in the Bila and Kalola watershed areas and the cost amounted to about Rp.180 million.

Although this reforestation has been progressed upto the present condition, the forest area both in the Bila and Kalola watershed is still less than 60% of entire watershed areas. It is proposed that forest area should be expanded up to 85% of total watershed areas. Therefore the total area to be envisaged for reforestation will be about 14,400 ha.

2.3 Preliminary Cost Estimate

About 72 nurseries will be needed for 14,400 ha of reforestation area. According to the past experience of the Ministry of Forestry as the executor for implementation of the reforestation work, cost per unit nursery amounts to Rp.3,585,000 per ha. The unit cost for transplanting work per ha is estimated at about Rp.40,000.

The total cost required for the envisaged reforestation covering 14,400 ha is roughly estimated at Rp.835 million (US$1.3 million) and the per-hectare cost is about Rp.58,000 (US$93).

2.4 Organization

All the reforestation plan would have to be carried out by the Project for Planning and Establishment of Reforestation in watershed area (P3RPDAS) which was enforced by Presidential Decree No.8 in 1976. In 1981/1982 this project aims at reforestation of about 968,100 ha all over the country in 35 watershed areas as mentioned in Table 2.1 of ANNEX-X. In South Sulawesi Province, there are 3 branch offices of P3RPDAS, i.e. Jeneberang - Kelara, Saddang, and Bila - Walanae. The total area of reforestation envisaged by these branch offices are about

51,000 ha of which 11,000 ha belong to Bila - Walanae branch office. The watershed areas under present study is managed by the P3RPDAS Bila - Walanae branch office. Further detailed studies are given in ANNEX-X (WATERSHED MANAGEMENT).

ATTACHMENT-II PILOT DEMONSTRATION SCHEME

1. GENERAL

The major objectives of the Bila Irrigation Project are to increase the agricultural production through the irrigation development and thereby to raise the level of living standard and welfare of the inhabitants. For this purpose, the Project will provide with necessary infrastructures such as irrigation and drainage facilities, and road network for agricultural development of the area. However, for smooth realization of the project objectives, there would remain many ancillary works which should be carried out mainly by farmers themselves, in parallel with the project construction. The Bila project area is mostly covered with rainfed paddy field at present and most of the farmers have no experiences on modern irrigation rice farming as well as construction of on-farm irrigation facilities. Such being the situation, the realization of the project objectives would be delayed unless strong support services and guidance could be given to the farmers.

In order to lead the Project up to the final goal smoothly, it would be inevitable to establish a guidance organization responsible for promoting, guiding and assisting the farmers in various fields concerning the modern irrigation rice farming and on-farm development. In this view, it is recommended that a pilot demonstration scheme be established within in the framwork of the said guidance organization as a key progras for the successful implementation of the Project.

The pilot demonstration scheme would aim at:

(1) Demonstration and guidance of on-farm development (construction of on-farm irrigation facilities),

(2) Demonstration and guidance of systematic water management at tertiary, quaternary and on-farm level, and

(3) Demonstration and guidance of proper irrigation and farming practices for double cropping of paddy.

The experiences and technical results obtined through the pilot scheme operation, would be fully utilized for the guidance of the large scale implementation.

2. MAIN ACTIVITIES OF PILOT DEMONSTRATION SCHEME

The main activities undertaken by the Scheme are as follows:

(1) Preparation of land ledger and cadastral map

The accurate land ledger and cadastral maps in the project area will be required for detailed design of irrigation facilities as well as for land acquisition of the proposed canal and road routes. In

addition, these data will also be essential for organizing farmers groups and Water User's Associations. These data are not well mapped at present. The pilot scheme will give a good example for consecutive survey and mapping in the whole project area.

(2) Establishment of Water User's Association

In the Bila area, there is no systematic farmers organization such as Water User's Association (P3A) at present. In order to establish an executive body of construction and management of on-farm irrigation facilities in each tertiary irrigation block, the Water User's Association should be organized according to the construction schedule. The member of the Association should be decided so as to include all the land owners and/or the cultivators whose lands are located in each same irrigation block. The pilot scheme will take a leading role for organization of P3A, by demonstrating the representative model of P3A and also by offering the technical guidance to the farmers.

(3) Organizing the farmers group

The extension service in Indonesia is usually made through the farmers groups comprising about 10 - 20 farmers per each group as the contact unit for extension activities. These farmers groups should be organized so as to be unified with sub-branch units of Water User's Association for effective and efficient guidance of both cultivation techniques and O & M of irrigation facilities. The pilot scheme will demonstrate the collective irrigation rice farming to the farmers, with the assistance of the extension workers.

(4) Construction of on-farm irrigation facilities

In many cases of irrigation projects in Indonesia, irrigation water is not fully utilized even several years after completion of construction works of the project, because of inadequate on-farm irrigation facilities constructed by farmers themselves. This shows the need of pilot demonstration on construction of on-farm facilities together with strong guidance and supervision for construction works in the newly developed area.

The pilot Demonstration Scheme will provide strong guidance and supervision on construction of on-farm irrigation facilities with financial assistance if any.

(5) Strengthening of extension service

After completion of construction works of the Bila Irrigation Project including on-farm development, effective field guidance of cultivation technique on right time is essential together with adequate water management for achievement of the objective of the Project.

For carrying out such effective field guidance, the field extension workers (PPL) would be requested to have more scientific knowledges on the agricultural basic data and field observation results, more competent and practical technique of modern irrigation rice farming, and more systematic approaches to the seasonal cultivation program in each irrigation block and also to the extension program which will be prepared by the Rural Extension Center concerned. However, in the Rural Extension Center concerned agricultural basic data are not fully available. The feasibility reports and/or detailed design reports in which many referred data, figure, drawings and maps related agricultural condition are compiled, are not distributed to the Rural Extension Center concerned. The extension workers are not generally aware of on-going irrigation development.

In this sense, it is recommended that the coordination relationship between irrigation development authorities and agricultural extension offices should be strengthened in the execution of the irrigation development. The Pilot Demenstration Scheme will provide the extension workers with a good opportunity for on-the-job training in the irrigation development.

3. SELECTION OF SCHEME AREA

The selection of the scheme area is made taking into account the following factor:

(1) Scale of scheme area

One tertiary irrigation block should be selected for making the successful attainment of the guidance of water management practice. In addition to the factor of the irrigation system, the scheme area should belong to one administrative unit (village unit) for simplification of farmers' organization to be established in the scheme area.

(2) Irrigation water availability

The pilot scheme area should be supplied stably and easily with irrigation water with temporary facilities at the beginning stage. After completion of the main irrigation system of the Project, the scheme area should be efficiently incorporated into and supplied with the project irrigation system.

(3) Drainage condition

So as to control the drainage water without constructing the large scale drainage measures, the scheme area should be located in the somewhat elevated area.

(4) Access

Due attention should be paid to the access from the trunk road and all weathered rural road to the scheme area for ensuring smooth transportation and communication.

(5) Soil and topography

The soils in the scheme area should be representative for the Project area. The scheme area should have flat and gentle topography for successful demonstration of the water management.

Taking into account the above factors, the proposed site of the pilot demonstration scheme area is selected near the Village Pallae in the northern part in the Project area, as shown in the Irrigation Drainage and Road System attached in the DRAWINGS ANNEXES VOLUME III. The scheme area is located in the Village Pallae 3 km north of Tanru Tedong, and extends on the east of the rural road which branches off from the national road at Tanru Tedong. The upper part of the scheme area is adjacent to the Bila river, 200 m apart from the river. At the beginning stage, irrigation water will be supplied from the Bila river with installation of small scale low head pumping equipment near the river. The scheme area selected is a tertiary block of 156 ha which is branching from Pallae Secondary Canal-I at its middle reaches in the Proposed Project irrigation system. The scheme area would be incorporated in the Project irrigation system after completion of the project construction.

ATTACHMENT-III MEMBER OF ADVISORY GROUP, STUDY TEAM AND COUNTERPARTS

1. Advisory Committee

(1)	Leader	Mr. Yasuo Maeda	(Tokai Regional Administration Office, Ministry of Agriculture, Forestry and Fisheries)
(2)	Irrigation/ Drainage	Mr. Kisaku Kimura	(Agricultural Structure Improvement Bureau, Ministry of Agriculture, Forestry and Fisheries)
(3)	Hydrology	Mr. Norikazu Tsuzii	(Tokai Regional Administration Office, Ministry of Agriculture, Forestry and Fisheries)
(4)	Agriculture	Mr. Shigekazu Kooma	(Agricultural Land Development Public Corporation)
(5)	Agricultural Economy	Mr. Akio Ito	(Kanto Regional Administration Office, Ministry of Agriculture, Forestry and Fisheries)
(6)	Finance	Mr. Yoshiyuki Ban	(The Overseas Economic Corporation Fund, Japan)

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(3)	Agronomy/Pedology	Mr. Naoki Ariga
(4)	Irrigation/Drainage Design	Mr. Kiyotaka Mizushima
(5)	Hydrology	Mr. Kazuhiko Takebayashi
(6)	River Plan	Mr. Shigeaki Hisajima
(7)	Structural Design	Mr. Shigeo Ando
(8)	Agricultural Economy	Mr. Fumihiro Nagao
(9)	Soil Mechanic	Mr. Hideki Shimohara
(10)	Geology	Mr. Susumu Satoh
(11)	Construction Plan	Mr. Yoshimitsu Yukawa
(12)	Survey/Design	Mr. Toshikazu Honma
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3. Counterparts

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(8)	Administration	Mr. A. P. Ridwan

P.T. DACREA

(1)	Team Leader	Mr. H. M. Singgih
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(3)	Agronomy	Ir. M. Dien/Ir. Z. Razak
(4)	Pedology	Ir. D. Agnes R.
(5)	Irrigation/Drainage Design	Mr. B. Rahim
(6)	Hydrology	Mr. G. Ticoalu
(7)	River Plan	Mr. R. Sjarief
(8)	Structural Design	Mr. A. Parabang
(9)	Agricultural Economy	Ir. S. T. Djudawi
(10)	Soil Mechanics	Mr. Margiyant D.
(11)	Construction Plan	Ir. Lambertus T.
(12)	Survey	Mr. T. Awie
		Mr. Ading S.
		Mr. Hengky
		Mr. Usman