determined to be 600 m in maximum. A tertiary canal, from which water is supplied to distribution canals will be provided for every three to five distribution canals.

The proposed irrigation system is shown in Fig. 14.

6.5.2 Drainage system

Drainage canals are not as important as irrigation canals, because the rainfall is as little as about 500 mm/year and the period requiring drainage is normally limited to two months; March and April. Thus major drainage canals only are proposed so as to remove excess water from five-year probable four-hour rainfall within four hours. Drainage requirement is estimated at 6.4 lit/sec/ha.

6.5.3 Rural Infrastructure

Domestic water and power supply systems are not available on the Sanya plain. Roads are very poor and difficult to drive on the rainy season. The development of infrastructures is, therefore, indispensable to maintaining the Project and successfully attaining intensive irrigation farming. Infrastructures such as road networks, domestic water supply system and electricity supply facilities have to be improved or constructed.

(1) Domestic water and residential area

The proposed tubewells are proposed to be used for domestic use as well as for irrigation. From the viewpoint of traffic and access to their own fields, the proposed sites of tubewells are assessed as the best places for the residential areas of farmers, since the

tubewells will be located along the main roads and main irrigation canals. The interval between the tubewells ranges from 500 m to 1,000 m, which means that the distance between the communities and their farms will be mostly less than 1 km. Taking the above consideration into account, the places where tubewells will be installed are designated as residential areas.

As for the upstream area of the Sanya plain, most of the people are living in areas extending to the south along the Arusha-Moshi railway and near the Sanya Chini Station. The north side of the Sanya Chini Station is nominated for industrial development in accordance with "Hai Township Master Plan" prepared by the Capital Development Authority for Ministry of Lands, Natural Resources and Tourism, December, 1987 and is expected to be developed soon. Therefore the area south of the Station is important for people working for the industrial zone as well. For domestic water supply, two tubewells in total; one tubewell each to the west and east of the Sanya river are proposed to be provided.

(2) Road networks

An existing road connecting the Sanya plain through Sanya Chini railway station with Boma Ng'ombe will play an important role for transportation of agricultural products to Moshi, Arusha, and other areas. Accordingly the road will be widened and paved with marrum.

In the Project area roads will be provided along the irrigation canals for transportation of agricultural products and inputs as well as for operation and

maintenance of the irrigation facilities. These roads will connect small communities established around the tubewell sites. All the roads provided along canals will be paved with marrum materials.

For crossing the Sanya river and to approach Boma Ng'ombe by the shortest route from the right bank area of the Sanya river, three causeways will be provided.

(3) Electricity

There is a 33 kV transmission line across the Sanya plain, from which energy for operation of tubewells will be supplied through a transformer and low tension line, three phase, 400 V. Therefore, the electrification of small communities to be formed at tubewell sites will be easily realized.

As for the Sanya Chini village, the distance from the 11 kV line is about 2.5 km and so the 11 kV line will be branched off to near the village about 2 km, from which low tension lines will be installed for distribution of electricity.

7. PROJECT WORKS

The Project works consist of the Boloti dam and the related structures, irrigation and drainage facilities, tubewells, and road networks. The main features of the Project works are summarized in Table 2.

7.1 Boloti Dam and the Related Facilities

7.1.1 Boloti reservoir and dam

Based on the capacity required for the reservoir estimated by the water balance study and the rating curves, the features of the reservoir were determined as follows :

(1)	Effective storage capacity	:	7.5 MCM
(2)	Dead storage capacity	:	0.6 MCM
(3)	Water surface area at HWL	:	1.7 km^2
(4)	Low water level (LWL)	:	1,072.6 m
(5)	High water level (HWL)	:	1,078.0 m
(6)	Flood water level (FWL)	:	1,078.4 m

The crest elevation of the dam is determined at EL. 1,080.4 m so as to be more than the flood water surface plus a free board consisting of wave height and some allowance.

The dam type is determined to be homogeneous earthfill type from the technical and economic view points considering the availability of construction materials and also the geological and topographical conditions. The embankment material will be obtained at the shoulders of and along the dam site. On the upstream slope, rock riprap

protection will be provided. The thickness is determined to be 50 cm. Features of the Boloti dam are shown in Fig. 16. The upstream and downstream slopes are determined to be 1 : 2.2 and 1 : 2.0, respectively on the basis of the results of a stability analysis.

7.1.2 Spillway

An ungated overflow type concrete weir is adopted so as to naturally release excess water whenever the reservoir water level exceeds the normal high water level. The proposed spillway is designed on the left side of dam and consists of an overflow section, chute section, and stilling basin. The crest of the overflow section is decided to be EL. 1,078.0 m, the same as the high water level of the reservoir. The length of the overflow section is determined to be 10 m.

7.1.3 Lawati diversion weir and diversion canal

The diversion weir is proposed at about 800 m upstream from the bridge on the Lawati river crossing Sanya Juu road, where the depth of the river is about 5 m from both banks and the bottom width is about 6 m. On both banks and the river bed, weathered tuff is partly exposed.

The diversion works consist of a weir and an intake structure. The weir is a fixed overflow type having a weir crest length of 16 m and a height of 2.3 m. The intake structure will of an inlet equipped with two slide gates, a rectangular-shaped channel, and sand settling basin.

As for the diversion canal, a concrete block lined canal type is adopted in the upstream half where the ground surface slope is gentle and a chute of a rectangular flume type

in the downstream half where the ground surface slope is rather steep. The total length will be 2.7 km.

7.1.4 Outlet Works

Two outlet works will be provided in the proposed dam. One is the outlet to the Sanya river through the outlet canal for water diversion to the downstream irrigation systems, and the other is the outlet to the Boloti irrigation area located immediate downstream of the proposed dam site.

The outlet structure will consist of a gated inlet, a conduit and an outlet. The conduit will be made of precast concrete pipe of 0.8 m diameter wrapped with reinforced concrete. The outlet will be furnished with a measuring device. The upstream half of the outlet canal will be trapezoidal lined canal and the downstream half, which will be steep in longitudinal section, is designed as a rectangular chute. The total length will be about 1.5 km.

The outlet structure to supply water to Boloti area is structurally almost the same as that to the Sanya river.

7.2 Tubewells

Twelve tubewells in total, seven on the west bank and five on the east bank in the downstream of the Sanya plain will be provided along the proposed main and secondary canals. The features of tubewells were determined from the results of electric prospecting, test-drilling, and pump-up tests as summarized below:

(1) Design discharge : 50 lit/sec on an average

(2)	Depth of tubewell	:	70 m on an average
(3)	Drilling diameter	:	500 mm
(4)	Casing diameter	:	350 mm
(5)	Head	:	20 m on an average
(6)	Filter	:	Gravel filling
(7)	Spacing between tubewells	:	500 m at minimum
(8)	Pump type	:	Submersible motor pump

Three transformers, each of 250 kVA capacity, which includes about 50 kVA, for domestic electricity supply, are proposed along the existing 33 kV line. Distribution lines, branched off from these transformers, would be three phase low tension lines of 400 V and about 12 km in total length.

An elevated water tank will be connected to each tubewell by a branch pipe to supply potable water to inhabitants.

7.3 Irrigation and Drainage Facilities

7.3.1 Irrigation System

(1) Sanya Chini headworks

The Sanya Chini headworks will be used as an intake structure after rehabilitation and improvement. The present inlets will be demolished and a scouring sluice with a slide gate will be provided at the present left intake point. A new inlet equipped with a slide gate will be built just upstream of the new scouring sluice at right angles to the river flow direction. Immediate after the inlet, sand trap ponds will be provided. Both banks

will be heightened by about 1.5 m so as to pass floods safely.

(2) Irrigation Canals

All the canals will be open channel type with a trapezoidal cross section. The main canals such as head reaches, main and secondary canals will be provided with concrete block lining. The design discharges of irrigation canals are shown in Fig. 17 "Irrigation Flow Diagram". The total length of the main canals will be 21.5 km. The total length of tertiary and distribution canals will be 92 km.

Various kinds of structures such as night storage ponds, turnouts, checks, drops, culverts, and spillways are to be provided on the main canals for efficient and safe conveyance of irrigation water.

The capacity of the night storage ponds is determined by the need to store water for eight hours a day during the peak irrigation season for 16 hours operation a day in the tertiary blocks. The outlet of the night storage pond will be provided with a gate to keep the downstream water level constant with no effect from fluctuation of the water level in the pond.

Division boxes and culverts will be provided in the distribution system.

7.3.2 Drainage system and flood protection dike

All the proposed drainage canals will be earthen canals, 18.1 km in total length. The design discharge of drains is shown in Fig.18 "Drainage Flow Diagram".

The Sanya river floods every year in the lower reaches and the most downstream parts of the Project area on west bank is affected by this flooding. According to reports from villagers, the flooding water depth is knee-high. Thus, in order to protect the Project area against flooding on the west bank of the Sanya river in the lower reaches, a 2 km long flood protection dike is proposed along the Sanya river.

Drop structures and culverts will be provided for dissipating excess hydraulic head and for road and canal crossings respectively.

7.4 Road

All the roads to be provided in the Project area and an access road to Boma Ng'ombe are planned to have a total width of 6 m and to be paved with marrum material.

Causeways will be provided for river-crossings at three points, since the discharge of the Sanya river is will be very low downstream of the Sanya Chini headworks except in time of flood. It will be protected by concrete against scour and equipped with a pipe culvert to pass river water downstream without submergence of the road surface during low flow.

8. PROJECT ORGANIZATION

8.1 Organization for Project Implementation

For the implementation of the Project, it is proposed to establish an Executing Organization tentatively called the Project Office under the jurisdiction of the Regional Development Director (RDD). To coordinate, guide, and assist the Project Office in the implementation, an Executive Committee will also be organized under the RDD. The Committee will comprise representatives concerned such as Regional Planning Officer, the Regional Administrative Officer, Regional Irrigation Engineer, Regional Agricultural and Livestock Officer, Regional Accountant, District Executive Director and the Village Chiefs of the Project area.

The main functions of the Project Office will be as follows:

(1) Design and construction supervision of the project works such as the Boloti dam, tubewells, irrigation and drainage facilities and road facilities.
(2) Accounting and administrative management of the construction works as well as office operation.

The Project Office will have one main office and two branch offices. The main office will be situated at Boma Ng'ombe adjacent to the District Office. The branch offices will be situated at Boloti dam site and on Sanya plain near the Village Office of Sanya Chini.

The Project Office will have five sections for its working functions: (1) Survey and Design, (2) Construction Supervision, (3) Mechanical, (4) Accounting, and (5) Administration, all under the Project Manager to be appointed by the RDD.

The required number of staff for the design stage and the construction stage are 24 and 17 in total, respectively.

In the project implementation stage, expatriate experts and specialists will be required to assist the Project Office in design and construction supervision in order to cope with the shortage of qualified engineers in Tanzania.

8.2 Organization for Operation and Maintenance

Upon the completion of the construction works of Phase-1, which will consist of the construction works of the Boloti dam and irrigation and drainage facilities for the upper half of the Sanya plain as described in Chapter 9, operation and maintenance (O&M) works for the completed facilities will be commenced. For this purpose, an O&M Office has to be established in the Project Office. Then upon the completion of all the Project works, the O&M Office will be reinforced in its staffing including reorganization of the Project Office. The O&M Office will have five sections for its working functions: (1) Operation, (2) Maintenance, (3) Mechanical, (4) Accounting, and (5) Administration.

The O&M Office will be responsible for operation and maintenance of the Boloti dam and related facilities, tubewells, irrigation and drainage facilities, and road networks. The maintenance of lines and their electric facilities are left to TANESCO. The operation and

maintenance of tertiary blocks will be entrusted to farmer's associations to be organized by the farmers themselves.

The O&M Office will have one main office, two branch offices, and four watching stations. The main office, as in the construction stage, will be stationed adjacent to the District Office in Boma Ng'ombe. Branch offices are proposed at the Boloti dam site and near Sanya Chini Village Office. Watching stations will be built at Lawati diversion weir, Sanya Chini headworks, and in these west and east bank areas of the Sanya downstream area. The proposed organization of the O&M Office is shown in Fig. 19.

The required number of permanent staff at full development of the Project will be 38 in total including 18 operators of tubewells and gates. In addition, labourer will be seasonably required for maintenance and repair works. It is also necessary to furnish operation and maintenance equipment. The main equipment will be a backhoe, a motor grader, a road roller, a portable mixer, a dump truck, vehicles, a computer, walkie-talkies, etc.

At the farmers' level, a farmer's association will be organized in each tertiary block for operation and maintenance of tertiary systems except from the night storage ponds of which operation and maintenance will be the responsibility of the O&M Project Office as also the tubewells. The farmer's association will function like the existing water committees which carry out operation and maintenance of traditional furrow systems along the Sanya river. The association membership will comprise all the farmers in each tertiary block and the working group will consists of a chief, a canal inspector, a water allocator, an alarm man who calls people for work, and a security guard, who will be elected

every five years. There will be 36 farmer's associations in the Sanya Plain project area.

8.3 Organization for Management of Crop Production

For the realization of full agricultural potential, assurance of proper land preparation, and farm input supply and marketing especially for vegetables to the farmers in the Project area, a solid organization is indispensable. Therefore, it is proposed that the present cooperative societies; KNCU branch office at Boma Ng'ombe, Nkwansira rural cooperative society, Mungushi rural cooperative society, and Sanya and KIA cooperative society, will be reorganized and combine into a single organization to fulfill the function of one cooperative society for the whole of the Sanya river basin. This cooperative, tentatively called Sanya River Basin Cooperative Society (SRBC), would function not only as a rural cooperative society but also KNCU branch office for support of efficient management of crop production and marketing.

The tasks of SRBC to the farmers would be:

(1) to supply farm inputs,
(2) to provide timely tractor ploughing,
(3) to purchase, store and sell the crops, and
(4) to promote the sales of vegetables.

SRBC will require of a main office and three (3) branch offices. For efficient management and marketing, the main office of SRBC should be established at the present KNCU branch office in Boma Ng'ombe adjacent to the Hai district office. The branch offices should be located at the same rural cooperative society offices. The main office should have four (4) sections: (1) Production, (2) Marketing, (3) Accounting,

and (4) Administration. The Production Section will have provide tractor services and the supply of agricultural inputs such as improved seed varieties, fertilizers, agro-chemicals and equipment. The Marketing Section will purchase from farmers and sell to markets the marketable surpluses of crops. The Accounting Section will arrange credits covering the input requirements applied by farmers in a particular season from CRBC and/or NBC. Repayment of these credits to CRBC and/or NBC will be collected by SRBC on behalf of farmers. Repayment of loans to farmers will be undertaken at the end harvesting in cash or in kind. The Accounting Section will also keep the accounts of income and expenditure of SRBC. The Administration Section will perform any other administrative or organizational duties required.

For smooth operation and management, all the farmers having land in the project area will have to be members of SRBC and have to make maximum use of the facilities and equipment which will be established or purchased by SRBC. The proposed organizational structure of SRBC is illustrated in Fig. 20.

9. PROJECT IMPLEMENTATION SCHEDULE AND COST ESTIMATE

9.1 Basic Considerations of Project Implementation

The implementation schedule for the Project has been worked out on the basis of the following criteria:

(1) A mechanized construction methods will be used generally for the dam construction and the main irrigation and drainage facilities including tubewells and roads. Manual construction will be used in the construction of small canals and structures in order to increase job opportunities.

(2) The construction works will be undertaken by qualified contractors selected through international competitive bidding.

(3) The Project is formulated for the conjunctive use of surface and groundwater resources and is a rather large-scale upland irrigation project which will require complicated water management. Therefore stage-wise development is proposed for implementation scheduling to facilitate the training of operation staff and farmers in appropriate water management.

(4) A consultant will assist the Project Office in preparation of the detailed design and tender documents, and in supervision of construction of the project facilities.

9.2 Work Quantities

The quantities of the main works are summarized below:

Work	Unit	Quantity
Boloti Dam and the Appurtenant		
Excavation	m^3	38,400
Earth embankment	m^3	265,000
Rock riprap in upstream face	m^3	35,800
Concrete	m^3	254
Lawati Diversion Works		
Excavation	m^3	21,400
Concrete	m^3	1,600
Outlet Canal		
Excavation	m^3	10,300
Concrete	m^3	1,990
Tubewells		
Number of tubewells	nos	12
Total drilling depth	m	840
Drilling diameter	mm	500
Main Irrigation and Drainage Facilities and Roads		
Excavation	m^3	53,400
Embankment	m^3	93,600
Concrete	m^3	1,250
Concrete block lining	m^3	4,940

9.3 Implementation Time Schedule

The Sanya plain is in two parts: the 440 ha upper half will be served by surface water resources; and the 610 ha the lower half will be served by surface and ground water resources. Water management in the upper half will be easier than that in the lower half. Thus the development of the upper half with Boloti dam construction is proposed in Phase1. Phase-2 will consist of the construction of tubewells and development of lower half. The project implementation schedule is shown in Fig. 21.

The total period required for construction of Phase-1 will be two years from commencement, and for Phase-2 will also be also two years. The detailed design of Phase-2 can be carried out in parallel with the construction of Phase-1. Thus the total period required for the completion of all the works is estimated at three years.

9.4 Construction Equipment

The types and numbers of construction machinery required for the major works have been estimated from the work quantities, construction period, and the physical conditions of the project area and are listed in Table 3.

9.5 Cost Estimate

9.5.1 General

The cost of implementing the project has been estimated from the preliminary design of the project facilities and the following assumptions, taking into account the construction method, productivity of labour and construction machinery

(1) The exchange rate used in the estimate assumes the considering current exchange rate as follows:
US$ 1.00 = Tsh. 195 = Yen 145

(2) The construction machinery and equipment and construction materials will be imported by the contractor(s) which are little available in the local market.

(3) Taxes on the construction materials, construction machinery and equipment to be imported from abroad will be exempted.

(4) The unit prices have been divided into local and foreign currency portions. The local currency portion has been estimated based on current prices in March, 1990 in Kilimanjaro region, and on the cost data of on-going projects. The foreign currency portion has been estimated based on CIF prices at Tanga, by making reference to FOB prices of materials and equipment in Japan in 1989.

(5) Physical contingencies to the variation of work quantities, have been allowed for the extent of 10% of direct construction cost,

(6) Price contingency: 5% per annum for the foreign currency portion and 30% per annum for the local currency portion have been provided for,

(7) No-compensation costs will be provided for the land acquisition and right of way for the project facilities.

9.5.2 Investment cost and annual disbursement schedule

The investment costs of the Project have been estimated at Tsh. 2,950 million consisting of Tsh. 580 million of local currency and Tsh. 2,370 million of foreign currency. The investment costs in Phase-1 and Phase-2 are Tsh. 1,700 million and Tsh. 1,250 million, respectively as shown in Table 4.

The annual disbursement schedule has been worked out on the basis of the construction schedule as shown in Table 4.

9.5.3 Operation and maintenance costs and replacement costs

The annual operation and maintenance costs include the salaries of the project administration and water management staff, the materials and labour costs for repair and maintenance of the project facilities, the costs of operation and maintenance of O&M equipment, and the running costs of tubewells. These are estimated at Tsh. 13.2 million at the full development stage.

Some of the facilities, especially mechanical and electrical facilities have a shorter life than civil works and have to be replaced periodically. The useful lives and costs of replacement of such facilities are listed in Annex H.

9.5.4 Other costs

Well planned agricultural production requires tractors, transportation and storage that will facilitate timely land preparation, easy access to agro-inputs and market outlets. In this connection, it is recommended that the privately owned tractors, transportation and storage be used by the Sanya River Basin Cooperative Society (SRBC) to realize the full agricultural potential of the Project area. The desirable costs of such tractors, transportation and storage for SRBC are estimated at Tsh. 202 million as shown in Table 4.

10. PROJECT EVALUATION

10.1 Economic Evaluation

10.1.1 General

The economic feasibility of the "Lower Hai and Lower Rombo Agricultural Development Project" was assessed through the economic internal rate of return (EIRR). A sensitivity analysis for the project was also made assuming changes in accrued project benefit and project cost.

The economic evaluation was made on the basis of the following basic assumption:

(1) The economic useful life of the project is 50 years.
(2) All prices are expressed in 1990 constant prices.
(3) The exchange rate of US$ 1.0 = Tsh. 195 = Yen 145 is applied.
(4) The construction period is three (3) years in total.
(5) Price contingency (30% for local currency component and 5% for foreign currency component) are excluded from the economic cost.

10.1.2 Economic project costs

The economic project costs are estimated at Tsh. 2,426 million in total consisting of local currency of Tsh. 314 million and foreign currency of Tsh. 2,112 million at 1990 price level. In addition, the annual operation and maintenance (O&M) costs and the replacement costs for

irrigation facilities, pumping and O&M equipment were included in the economic project costs.

10.1.3 Economic project benefits

The economic Project benefits will mainly accrue from increased crop production. These benefits are estimated as the difference between the annual net economic production value under "with project condition" (the condition of the proposed development) and "without project condition" (the present conditions projected into future) assuming that they reached maximum in the 9th year of project implementation. The full economic Project benefits are estimated at Tsh. 482.96 million/year after deducting negative benefits of Tsh. 29,000/year induced by the submergence of 15 ha of upland fields in the Boloti reservoir from the benefits of Tsh. 482.98 million anticipated in the Project area.

10.1.4 Economic evaluation

The economic internal rate of return (EIRR) is estimated at 15.1% from the economic project benefit and cost flows as given in Table 5. Therefore, the Project is economically feasible.

A sensitivity analysis was made to evaluate the soundness of the project against possible adverse changes in the future for following three (3) conditions:

(1) Cost overrun by 10%,
(2) Reduction of irrigation benefit by 10% due to unexpected decrease in forecast prices of agricultural products, and

(3) Combined effect of (1) and (2)

The results are summarized below:

Conditions	EIRR (%)
(1)	13.9
(2)	13.7
(3)	12.6

It is indicated that the Project is insensitive to the adverse changes in the project benefits and costs.

10.2 Financial Evaluation

10.2.1 General

The financial feasibility of the project was evaluated from the viewpoint of farmer's economy. In this connection, the assessment of the amount of water charge to be collected from the farmers was made on provisional basis. Assessment of capital cost repayment capability was also made at project level by preparing cash flow tables.

10.2.2 Capacity to pay

In evaluation of project feasibility from the financial viewpoint of farmers, average farm budget analyses for each area were made under "with project" condition and present condition as shown in Chapter 5 and 6, respectively and summarized as follows:

(Unit: Tsh.)

	Boloti	Mungushi	Sanya
Farm Size (ha)	1.1	0.8	1.9
Net reserve			
With Project condition	30,700	17,460	1,020,890
Present condition	2,560	1,450	420

As clearly recognized in the above table, the project will bring about a great improvement in farm economy and these increased net reserves will offer incentives to farmers in each area. In addition substantial capacity to pay will enable them to pay an irrigation fee. Therefore, the project could be justified from the farmer's viewpoint.

10.2.3 Water charge

It is desirable that a water charge be imposed on farmers to cover operation and maintenance (O&M) costs including running costs of tubewells and O&M equipment and the replacement costs of the equipment, gates, and pumps. The annual O&M cost of the project is estimated to be Tsh. 13.2 million.

It is recommended that the water charges to cover all O&M costs of the Project should be paid by the farmers in Sanya plain, since the most of the project benefits will be experienced in the Sanya plain and the farmer's capacity to pay in the Sanya plain is considerably larger than those in Boloti and Mungushi areas. In this case, annual water charge is estimated at Tsh. 12,560/ha or Tsh. 23,860 per an average farmer, which corresponds to only 2.3% of the farmer's net reserve.

10.2.4 Repayment of the project cost

For the repayment capability analyses, it is assumed that the capital required for project implementation would be arranged under the following conditions:

(1) Foreign currency portion

The capital will be financed by the Government through a financing institution at an assumed interest rate of 1.0% per annum for a repayment period of 30 years including a grace period of 10 years.

(2) Local currency portion

The capital will be financed by the Government from its own resources with no repayment.

A repayment schedule for the foreign currency portion was prepared as shown in Table 6. This indicates that the loan repayment amount by the Tanzanian Government is about Tsh. 140 million/year.

10.3 Socio-Economic Impacts

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

(1) Increase in employment opportunities

The project will generate employment opportunities for laborers during the construction period. Most of the manpower will be supplied from the farmers in and around the project area. Furthermore, employees will be able to gain experience and skills in the various working fields. This accumulation of experience and skills will be very useful for O&M work of the Project. The project will create a demand for farm labour arising from the increased farming activities due to intensive use of the land resulting from year-round irrigation.

(2) Increase of production of agricultural crops

The project will increase agricultural production of staple food which will play an important role in self-sufficiency in the project area, Hai district and Kilimanjaro region. Furthermore, increased crop production will stimulate improvement in the marketing system and agricultural support services.

(3) Increase of farmer's income

The farmer's income will be expected to improve considerably due to the increase in crop production. The increase in net farm income will function to provide motive power in improvement of living standards of the farmers as well as of regional economic development.

(4) Improvement of local transportation

Local transportation will be much improved by the construction of operation and maintenance roads along the irrigation canals. The expanded road system will not only enhance economic activities such as transportation of the agricultural products, inputs, cattle and other commodities but will also contribute to inter-regional accessibility and communication.

(5) Secondary direct benefits

Increased economic activities in the Project area will increase the business of millers, merchants, and transporters with respect to processing, marketing, and transportation.

(6) Mitigation of floods

Upon completion of Boloti dam, the flood discharge of Mungushi river will be considerably reduced by the regulation effects of Boloti reservoir, and therefore the lower reach areas along the Mungushi river will be totally relieved from the dangers of floods.

(7) Improvement of domestic water supply

Tubewells and water supply tanks to be constructed in Sanya plain by the Project will provide drinking water is local inhabitants and this will greatly improve the public health on the Sanya plain.

(8) Improvement of water supply to cattle grazing

Shortage of water during the dry season is a serious problem for cattle grazing carried out by Masai people in the Masai steppe around the project area. Upon the completion of the Project, a stable water supply will be expected throughout the year from the drainage canals running along the border of project area. Furthermore, the crop residues after harvesting, and by-products of crops from the project area will increase the availability of fodder for cattle especially during the dry season.

(9) Introduction of fish farming

The Boloti reservoir will give the residents living around the Boloti reservoir the chance to introduce fresh water fish farming in the reservoir. Fish farming in the Boloti reservoir will contribute not only to improving the economy but also to improving the nutritional status of residents around the Boloti reservoir.

(10) Demonstration effects

With completion of the project, farmers in other agricultural areas as well as those in the project area will become familiar with modern irrigation and drainage practices and the incentive for adopting improved irrigation and drainage practices will be greatly enhanced. Enthusiasm generated from this success may even shorten the development period of other projects.

All the project benefits will serve to improve the standards of living and the quality of life of the local people in and around the project area and will contribute substantially to strengthening the economy of Hai district, Kilimanjaro region and Tanzania as a whole.

10.4 Environmental Impacts

Environmental impacts from implementation of the project and their effects were studied. Various environmental impacts are expected to result from the implementation of the project. There are:

(1) Impacts on groundwater resources

There is a hydropower station at the confluence point of the Kikuletwa and the Kware rivers. This hydropower station largely relies on the spring water coming out at Chemka, Ngulu, Rundugai, etc. The annual available discharge at the hydropower station is approximately 350 million m^3 and the seasonal variation of discharge is very small. The Sanya groundwater development area is located about 7 km upstream of the hydropower station. The annual groundwater demands in the Sanya downstream area are estimated at only 5.2 million m^3, of which some would recharge the groundwater. The amount to be consumed in the Sanya plain, thus, will account for only about 1.3% of annual discharge at the hydropower station. It can be, therefore, said that the groundwater development in the Sanya plain will have little negative impact on the groundwater resources of the hydropower station.

(2) Impact on soil salinity

The water quality of groundwater in the Sanya plain shows low to medium salinity. However, the project is planned for conjunctive use of surface and groundwater resources and/or sole use of surface water resources to avoid any salinity problem. However, poor management of irrigation water application may could cause water logging and salinity problems which would result in reduced productivity. Accordingly, irrigation water should be applied properly in accordance with the irrigation manual, and further, whenever saline contamination is observed, the field concerned should be given extra watering for leaching salt. The best leaching season is May and June, when river water will be usually abundant and the evaporation rate is very low.

(3) Impact on wildlife animals

Many kind of wildlife animals can be seen in and around the project area. Because the dosage of agro-chemicals will increase due to introduction of improved farming practices, the use of agro-chemicals must be carefully made under proper guidelines so as to minimize impacts on wildlife. In this connection, the use of herbicides is not recommended and organophosphorus and organochlorine insecticides such as Metacid, Thimet, Dimecron, Sedrin, Chlordane and BHC having high toxicity would be replaced by insecticides of low toxicity.

(4) Bilharzia

The Boloti swamp has a standing water all the year round, but bilharzia is not present according to farmers living nearby. Therefore, after completion of the Boloti dam, these conditions can be expected to continue. Because of upland field irrigation, no bilharzia will be expected in the project area as compared with paddy field irrigation. However, continuous monitoring in the Boloti reservoir and periodic drying of irrigation canals in the project area is to be recommended for prevention of the breeding of snails.

Tables

Table 1 MEMBER LIST (1/2)

Name	Designation or Position
I. Advisory Commitee	
K. Momikura	Agricultural Structure Improvement Bureau, Ministry of Agriculture, Forestry and Fisheries
M. Wada	- do -
T. Sugahara	- do -
T. Tachibana	Water Resources Development Corp.
M. Tabata	Agricultural Production Bureau, Ministry of Agriculture, Forestry and Fisheries
K. Sawada	- do -
Y. Ban	Agriculture, Forestry and Fisheries Research Council
II. Study Team	
S. Yano	Team Leader
H. Nishimoto	Hydro-geologist
M. Yamaguchi	Meteo-hydrologist
K. Yasumura	Electric Prospecting Expert
Y. Ishiguro	Survey Engineer
H. Matsuura	Irrigation and Drainage Engineer
Y. Sekiguchi	Agronomist/pedologist
K. Okuwa	Design Engineer
T. Fukushima	Agro-economist
III. Counterpart Personnel	
KADP	
C.P Nyangala	Director of Construction and Development, KADP
G.S Ngalisoni	Assistant Executive Engineer, KADP
Zonal Irrigation Office	
C.K. Chiza	Zonal Irrigation Engineer
P.J. Lyamuya	Duputy Zonal Irrigation Engineer/Agronomist
P.J.L. Shayo	Assistant/Executive Engineer
S.N. Moshi	Soil Scientist
R. Ramboa	Soil Scientist
G.N. Ngaka	Agricultural Field Officer
S.I. Lema	- do -
B.S. Tesha	- do -
J. Munisi	Surveyor

Table 1 MEMBER LIST (2/2)

Name	Designation or Position
Maji Office, Kilimanjaro	
E.J. Damball	Regional Water Engineer
J.D. Sarmet	Regional Hydrological Officer
M. Kanyawana	Regional Hydro-geologist
C. Lyimo	Senior Technician
I.J.M Macha	Technician
F. Peter	- do -
E. Kisanga	- do -
P.L Kimaro	- do -
V. Tumbotele	- do -
M. Kinyaia	- do -
I. Shaban	- do -
G. Machange	- do -
E. Sadikiel	Head of Drilling Team
W. Masunga	Driller
T. Silayo	- do -
L. Chirwa	- do -
Hai District Office	
Kiondo	District Irrigation Engineer
Silas	Irrigation Technician

Table 2 MAIN FEATURES OF PROJECT FACILITIES (1/2)

1. Lawati Diversion Weir and Diversion Canal	
1.1 Lawati diversion weir	
(1) Catchment area	: 41 km^2
(2) Design discharge	: 56 m^3/sec
(3) Weir type	: Fixed overflow type concrete weir
(4) Weir height x crest length	: 2.3 m x 16.0 m
1.2 Lawati diversion canal	
(1) Canal type	: Trapezoidal concrete lined canal
(2) Design discharge	: 3.0 m^3/sec
(3) Canal length	: 2.7 km
(4) Related structure	
a) Chute	: 1 nos.
b) Drop	: 3 nos.
c) Culvert	: 3 nos.
2. Boloti Reservoir	
2.1 Boloti dam	
(1) Catchment area	: 14 km^2
(2) Effective storage capacity	: 7,500,000 m^3
(3) Dead water capacity	: 600,000 m^3
(4) Maximum dam height x crest length	: 7.8 x 2,450 m
(5) High water level	: 1,078.0 m
(6) Low water level	: 1,072.6 m
(7) Crest elevation	: 1,080.4 m
2.2 Spillway	
(1) Spillway type	: Ungated overflow concrete type
(2) Design flood discharge	: 4.6 m^3/sec
(3) Crest length	: 10.0 m
2.3 Outlet works	: 2 nos.
2.4 Outlet Canal	
(1) Canal type	: Trapezoidal concrete lined canal
(2) Design discharge	: 0.7 m^3/sec
(3) Canal length	: 1.4 km
(4) Related structure	
a) Chute	: 2 nos.
b) Drop	: 2 nos.
c) Culvert	: 4 nos.
3. Sanya Irrigation System	
3.1 Sanya Chini intake weir (Rehabilitation)	
(1) Design discharge	: 170 m^3/sec
(2) Weir type	: Fixed concrete weir
(3) Weir height x crest length	: 1.6 m x 26.9 m

Table 2 MAIN FEATURES OF PROJECT FACILITIES (2/2)

3.2 Headreach and main canal	
(1) Canal type	: Trapezoidal concrete lined canal
(2) Design discharge	: 1.05 - 0.17 m^3/sec
(3) Canal length	: 13.9 km
(4) Related structure	
a) Siphon	: 1 nos.
b) Drop	: 42 nos.
c) Culvert	: 10 nos.
d) Check	: 15 nos.
e) Turnout	: 21 nos.
f) Spillway	: 4 nos.
3.3 Secondary canal	
(1) Canal type	: Trapezoidal concrete lined canal
(2) Design discharge	: 0.207 - 0.054 m^3/sec
(3) Canal length	: 7.6 km
(4) Related structure	
a) Drop	: 23 nos.
b) Culvert	: 5 nos.
c) Check	: 8 nos.
d) Turnout	: 19 nos.
3.4 Tubewell (12 nos.)	
(1) Design discharge	: 50 lit/sec on an average
(2) Depth of tubewell	: 70 m on an average
(3) Head	: 10.1 - 30.5 m (20 m on an average)
(4) Pump type	: Submersible
(5) Motor output	: 30 kW
3.5 Night storage pond (32 nos.)	
(1) Effective capacity	: 1,740 - 340 m^3
3.6 Drainage canal	
(1) Canal type	: Trapezoidal unlined canal
(2) Design discharge	: 1.65 - 0.23 m^3/sec
(3) Canal length	: 18.1 km
(4) Related structure	
a) Drop	: 22 nos.
b) Culvert	: 7 nos.
4. Road Network	
4.1 Length x width	: 38.0 km x 6 m
4.2 Pavement	: Marrum pavement
4.3 Related structure (Causeway)	: 3 nos.
5. Flood Dike	
5.1 Length	: 2.0 km
5.2 Crest width	: 3.0 m

Table 3 REQUIRED MAJOR CONSTRUCTION EQUIPMENT

Equipment	Specification	Required Number
1. Bulldozer	32 ton	3
2. Bulldozer	21 ton	3
3. Bulldozer with ripper	21 ton	2
4. Bulldozer	15 ton	4
5. Backhoe	0.7 m^3	4
6. Backhoe	0.4 m^3	3
7. Wheel loader	1.7 m^3	2
8. Dozer shovel	1.2 m^3	3
9. Motor grader	3.1 m	2
10. Tamping roller	15 ton	1
11. Vibration roller	10 ton	1
12. Vibration roller	2.5 ton	1
13. Road roller	10 ton	1
14. Tire roller	8 ton	2
15. Dump truck	11 ton	7
16. Dump truck	8 ton	5
17. Fork lift	3 ton	1
18. Water tanker	6 klit	3
19. Tamper	80 kg	6
20. Hydraulic breaker (attachment for backhoe)	400 kg	1
21. Butcher plant	15 m^3/hr	1
22. Crashing plant	20 ton/hr	1
23. Sand washing plant	10 ton/hr	1
24. Lining block plant	1,000 nos/day	1
25. Concrete mixer	0.4 m^3/hr	2
26. Mortar mixer	0.08 m^3	1
27. Concrete vibrator	38 mm	4
28. Agitator truck	1.6 m^3	3
29. Truck crane	25 ton	1
30. Truck with crane	4/2.9 ton	3
31. Ordinary truck	4 ton	5
32. Trailer	32 ton	1
33. Fuel tanker	4 klit	2
34. Micro bus	25 person	2
35. Jeep	4 WD	10
36. Maintenance car	6 ton	1
37. Air compressor	15 m^3/min	1
38. Air compressor	2 m^3/min	1
39. Generator	175 kVA	1
40. Welding machine	11.2 kW	1
41. Submersible pump	50 mm	3
42. Truck mounted drilling machine		1
43. Testing and survey equipment	lot	1
44. Repair shop equipment	lot	1

Table 4 ANNUAL DISBURSEMENT SCHEDULE OF CONSTRUCTION COST

(Unit : 1,000 Tsh.)

	Work Item	Investment			1st Year			2nd Year			3rd Year		
		LC	FC	Total	LC	FC	Total	LC	FC	Total	LC	FC	Total
I. PROJECT COST													
Phase-1	1. Preparatory Work	9,130	43,310	52,440	-	-	-	9,130	43,310	52,440	-	-	-
	2. Boloti Reservoir	80,070	562,540	642,610	-	-	-	80,070	562,540	642,610	-	-	-
	3. Sanya Chini Irrigation System	71,400	256,050	327,450	-	-	-	71,400	256,050	327,450	-	-	-
	4. Office and Quarter	30,900	47,500	78,400	-	-	-	30,900	47,500	78,400	-	-	-
	5. O & M Equipment	-	46,200	46,200	-	-	-	-	46,200	46,200	-	-	-
	6. Administration Expences	3,200	-	3,200	1,800	-	1,800	1,400	-	1,400	-	-	-
	7. Engineering Services	-	157,100	157,100	-	79,500	79,500	-	77,600	77,600	-	-	-
	Sub-total	194,700	1,112,700	1,307,400	1,800	79,500	81,300	192,900	1,033,200	1,226,100	-	-	-
	8. Physical Contingency	19,300	111,300	130,600	200	8,000	8,200	19,100	103,300	122,400	-	-	-
	Sub-total	214,000	1,224,000	1,438,000	2,000	87,500	89,500	212,000	1,136,500	1,348,500	-	-	-
	9. Price Contingency	147,000	121,000	268,000	600	4,400	5,000	146,400	116,600	263,000	-	-	-
	Total	361,000	1,345,000	1,706,000	2,600	91,900	94,500	358,400	1,253,100	1,611,500	-	-	-
Phase-2	1. Preparatory Work	4,140	30,600	34,740	-	-	-	-	-	-	4,140	30,600	34,740
	2. Tubewell, 12 Nos.+3 Nos.	13,140	326,700	339,840	-	-	-	-	-	-	13,140	326,700	339,840
	3. Sanya Chini Irrigation System	68,620	283,000	351,620	-	-	-	-	-	-	68,620	283,000	351,620
	4. Office and Quarter	1,800	3,000	4,800	-	-	-	-	-	-	1,800	3,000	4,800
	5. O & M Equipment	-	46,200	46,200	-	-	-	-	-	-	-	46,200	46,200
	6. Administration Expences	3,200	-	3,200	-	-	-	1,800	-	1,800	1,400	-	1,400
	7. Engineering Services	-	117,300	117,300	-	-	-	-	39,700	39,700	-	77,600	77,600
	Sub-total	90,900	806,800	897,700	-	-	-	1,800	39,700	41,500	89,100	767,100	856,200
	8. Physical Contingency	9,100	81,200	90,300	-	-	-	200	4,000	4,200	8,900	77,200	86,100
	Sub-total	100,000	888,000	988,000	-	-	-	2,000	43,700	45,700	98,000	844,300	942,300
	9. Price Contingency	119,000	138,000	257,000	-	-	-	1,400	4,500	5,900	117,600	133,500	251,100
	Total	219,000	1,026,000	1,245,000	-	-	-	3,400	48,200	51,600	215,600	977,800	1,193,400
Total	1. Preparatory Work	13,270	73,910	87,180	-	-	-	9,130	43,310	52,440	4,140	30,600	34,740
	2. Boloti Reservoir	80,070	562,540	642,610	-	-	-	80,070	562,540	642,610	-	-	-
	3. Tubewell, 12 Nos.+3 Nos.	13,140	326,700	339,840	-	-	-	-	-	-	13,140	326,700	339,840
	4. Sanya Chini Irrigation System	140,020	539,050	679,070				71,400	256,050	327,450	68,620	283,000	351,620
	5. Office and Quarter	32,700	50,500	83,200	-	-	-	30,900	47,500	78,400	1,800	3,000	4,800
	6. O & M Equipment	-	92,400	92,400	-	-	-	-	46,200	46,200	-	46,200	46,200
	7. Administration Expences	6,400	-	6,400	1,800	-	1,800	3,200	-	3,200	1,400	-	1,400
	8. Engineering Services	-	274,400	274,400	-	79,500	79,500	-	117,300	117,300	-	77,600	77,600
	Sub-total	285,600	1,919,500	2,205,100	1,800	79,500	81,300	194,700	1,072,900	1,267,600	89,100	767,100	856,200
	9. Physical Contingency	28,400	192,500	220,900	200	8,000	8,200	19,300	107,300	126,600	8,900	77,200	86,100
	Sub-total	314,000	2,112,000	2,426,000	2,000	87,500	89,500	214,000	1,180,200	1,394,200	98,000	844,300	942,300
	10. Price Contingency	266,000	259,000	525,000	600	4,400	5,000	147,800	121,100	268,900	117,600	133,500	251,100
	Total	580,000	2,371,000	2,951,000	2,600	91,900	94,500	361,800	1,301,300	1,663,100	215,600	977,800	1,193,400
II. OTHER COST		16,240	185,600	201,840	-	-	-	7,060	90,540	97,600	9,180	95,060	104,240
III. GRAND TOTAL		596,240	2,556,600	3,152,840	2,600	91,900	94,500	368,860	1,391,840	1,760,700	224,780	1,072,860	1,297,640

Note : Price contingency is estimated based on the annual increse rate of 5 % and 30 % for foreign currency portion and local currency portion respectively.
Cost of Tubewell includes electric low tention lines and rural water supply facilities and Sanya irrigation system includes construction cost of roads.

Table 5 ECONOMIC COSTS AND BENEFITS FLOW

IRR 15.1 %
B-C (10%) 1,156 million Tsh.
B/C (10%) 1.55

(Unit: 1,000 Tsh.)

Year	Cost				Benefit			Balance
	Capital	Replacement	O&M	Total	Irrigation	Negative	Total	
1	89,500	0	0	89,500	0	0	0	-89,500
2	1,394,200	0	0	1,394,200	0	0	0	-1,394,200
3	942,300	0	7,822	950,122	84,009	-29	83,980	-866,142
4	0	0	13,183	13,183	224,697	-29	224,668	211,485
5	0	0	13,183	13,183	297,145	-29	297,116	283,933
6	0	0	13,183	13,183	369,592	-29	369,563	356,380
7	0	0	13,183	13,183	442,040	-29	442,011	428,828
8	0	24,100	13,183	37,283	482,984	-29	482,955	445,672
9	0	0	13,183	13,183	482,984	-29	482,955	469,772
10	0	0	13,183	13,183	482,984	-29	482,955	469,772
11	0	0	13,183	13,183	482,984	-29	482,955	469,772
12	0	0	13,183	13,183	482,984	-29	482,955	469,772
13	0	92,400	13,183	105,583	482,984	-29	482,955	377,372
14	0	0	13,183	13,183	482,984	-29	482,955	469,772
15	0	0	13,183	13,183	482,984	-29	482,955	469,772
16	0	0	13,183	13,183	482,984	-29	482,955	469,772
17	0	0	13,183	13,183	482,984	-29	482,955	469,772
18	0	24,100	13,183	37,283	482,984	-29	482,955	445,672
19	0	0	13,183	13,183	482,984	-29	482,955	469,772
20	0	0	13,183	13,183	482,984	-29	482,955	469,772
21	0	0	13,183	13,183	482,984	-29	482,955	469,772
22	0	0	13,183	13,183	482,984	-29	482,955	469,772
23	0	92,400	13,183	105,583	482,984	-29	482,955	377,372
24	0	0	13,183	13,183	482,984	-29	482,955	469,772
25	0	0	13,183	13,183	482,984	-29	482,955	469,772
26	0	0	13,183	13,183	482,984	-29	482,955	469,772
27	0	0	13,183	13,183	482,984	-29	482,955	469,772
28	0	192,900	13,183	206,083	482,984	-29	482,955	276,872
29	0	0	13,183	13,183	482,984	-29	482,955	469,772
30	0	0	13,183	13,183	482,984	-29	482,955	469,772
31	0	0	13,183	13,183	482,984	-29	482,955	469,772
32	0	0	13,183	13,183	482,984	-29	482,955	469,772
33	0	92,400	13,183	105,583	482,984	-29	482,955	377,372
34	0	0	13,183	13,183	482,984	-29	482,955	469,772
35	0	0	13,183	13,183	482,984	-29	482,955	469,772
36	0	0	13,183	13,183	482,984	-29	482,955	469,772
37	0	0	13,183	13,183	482,984	-29	482,955	469,772
38	0	24,100	13,183	37,283	482,984	-29	482,955	445,672
39	0	0	13,183	13,183	482,984	-29	482,955	469,772
40	0	0	13,183	13,183	482,984	-29	482,955	469,772
41	0	0	13,183	13,183	482,984	-29	482,955	469,772
42	0	0	13,183	13,183	482,984	-29	482,955	469,772
43	0	92,400	13,183	105,583	482,984	-29	482,955	377,372
44	0	0	13,183	13,183	482,984	-29	482,955	469,772
45	0	0	13,183	13,183	482,984	-29	482,955	469,772
46	0	0	13,183	13,183	482,984	-29	482,955	469,772
47	0	0	13,183	13,183	482,984	-29	482,955	469,772
48	0	24,100	13,183	37,283	482,984	-29	482,955	445,672
49	0	0	13,183	13,183	482,984	-29	482,955	469,772
50	0	0	13,183	13,183	482,984	-29	482,955	469,772

Table 6 CASH FLOW STATEMENT

(Unit: Tsh. 1,000)

Year	Capital Cost		Cash Outflow					Cash Inflow					
in			Loan Repayment		O & M	Replacement	Total	Fund		Revenue	Total	Repayment	Balance
Order	FC	LC	Interest	Principal	Cost	Cost		FC	LC				
1	91,900	2,600	919	0	0	0	95,419	91,900	2,600	0	94,500	919	0
2	1,301,300	361,800	13,932	0	0	0	1,677,032	1,301,300	361,800	0	1,663,100	13,932	0
3	977,800	215,600	23,710	0	7,822	0	1,224,932	977,800	215,600	7,822	1,201,222	23,710	0
4	0	0	23,710	0	13,183	0	36,893	0	0	13,183	13,183	23,710	0
5	0	0	23,710	0	13,183	0	36,893	0	0	13,183	13,183	23,710	0
6	0	0	23,710	0	13,183	0	36,893	0	0	13,183	13,183	23,710	0
7	0	0	23,710	0	13,183	0	36,893	0	0	13,183	13,183	23,710	0
8	0	0	23,710	0	13,183	24,100	60,993	0	0	13,183	13,183	47,810	0
9	0	0	23,710	0	13,183	0	36,893	0	0	13,183	13,183	23,710	0
10	0	0	23,710	0	13,183	0	36,893	0	0	13,183	13,183	23,710	0
11	0	0	22,525	118,550	13,183	0	154,258	0	0	13,183	13,183	141,075	0
12	0	0	21,339	118,550	13,183	0	153,072	0	0	13,183	13,183	139,889	0
13	0	0	20,154	118,550	13,183	92,400	244,287	0	0	13,183	13,183	231,104	0
14	0	0	18,968	118,550	13,183	0	150,701	0	0	13,183	13,183	137,518	0
15	0	0	17,783	118,550	13,183	0	149,516	0	0	13,183	13,183	136,333	0
16	0	0	16,597	118,550	13,183	0	148,330	0	0	13,183	13,183	135,147	0
17	0	0	15,412	118,550	13,183	0	147,145	0	0	13,183	13,183	133,962	0
18	0	0	14,226	118,550	13,183	24,100	170,059	0	0	13,183	13,183	156,876	0
19	0	0	13,041	118,550	13,183	0	144,774	0	0	13,183	13,183	131,591	0
20	0	0	11,855	118,550	13,183	0	143,588	0	0	13,183	13,183	130,405	0
21	0	0	10,670	118,550	13,183	0	142,403	0	0	13,183	13,183	129,220	0
22	0	0	9,484	118,550	13,183	0	141,217	0	0	13,183	13,183	128,034	0
23	0	0	8,299	118,550	13,183	92,400	232,432	0	0	13,183	13,183	219,249	0
24	0	0	7,113	118,550	13,183	0	138,846	0	0	13,183	13,183	125,663	0
25	0	0	5,928	118,550	13,183	0	137,661	0	0	13,183	13,183	124,478	0
26	0	0	4,742	118,550	13,183	0	136,475	0	0	13,183	13,183	123,292	0
27	0	0	3,557	118,550	13,183	0	135,290	0	0	13,183	13,183	122,107	0
28	0	0	2,371	118,550	13,183	192,900	327,004	0	0	13,183	13,183	313,821	0
29	0	0	1,186	118,550	13,183	0	132,919	0	0	13,183	13,183	119,736	0
30	0	0	0	118,550	13,183	0	131,733	0	0	13,183	13,183	118,550	0

Remarks: FC = Foreign Currency, LC = Local Currency

Condition of Loan Repayment of Foreign Currency;

Interrest	:	1.0%
Grace Period	:	10 years
Repayment Period	:	30 years (including grace period)

Figures

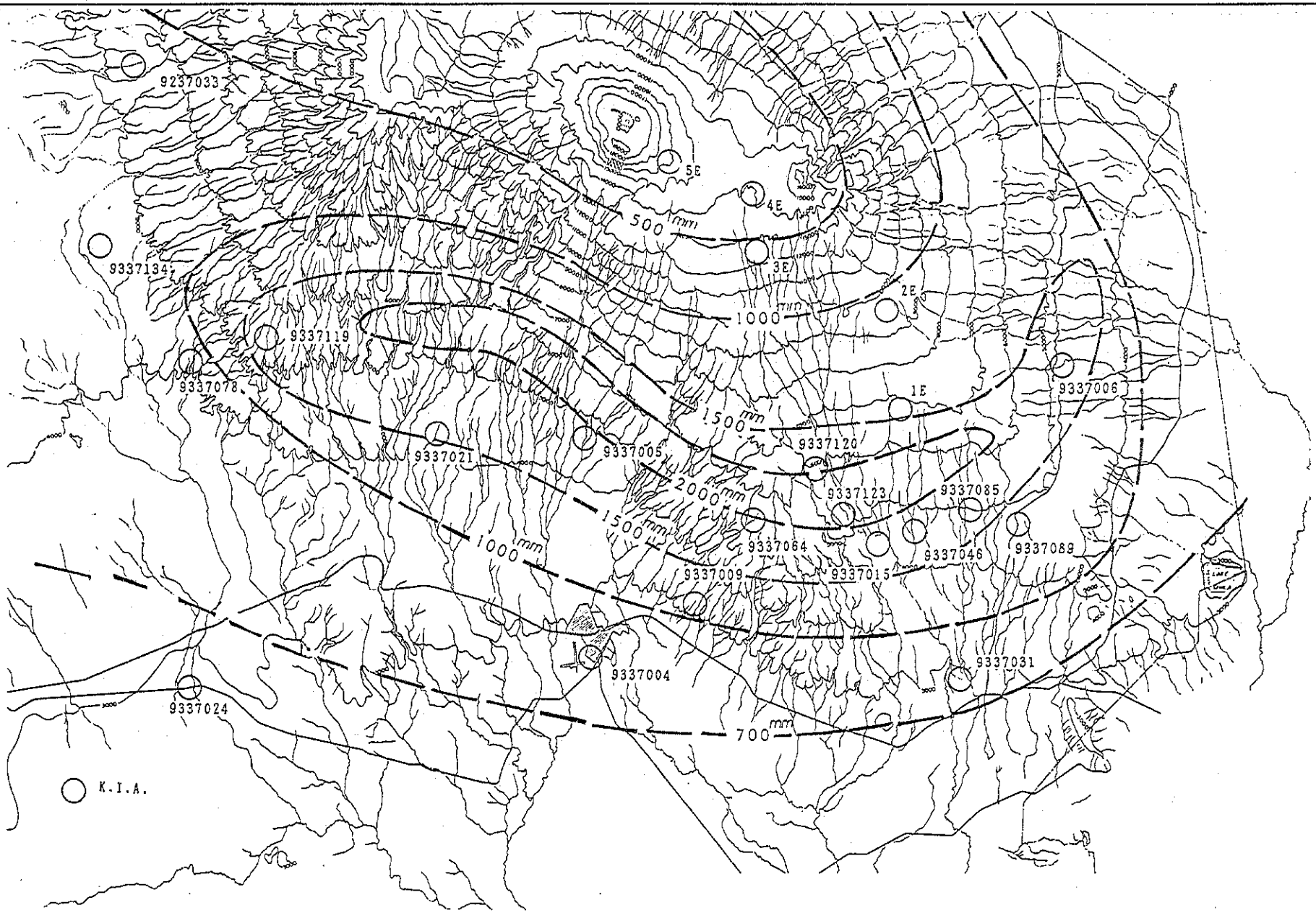


Fig. 1 ANNUAL ISOHYET

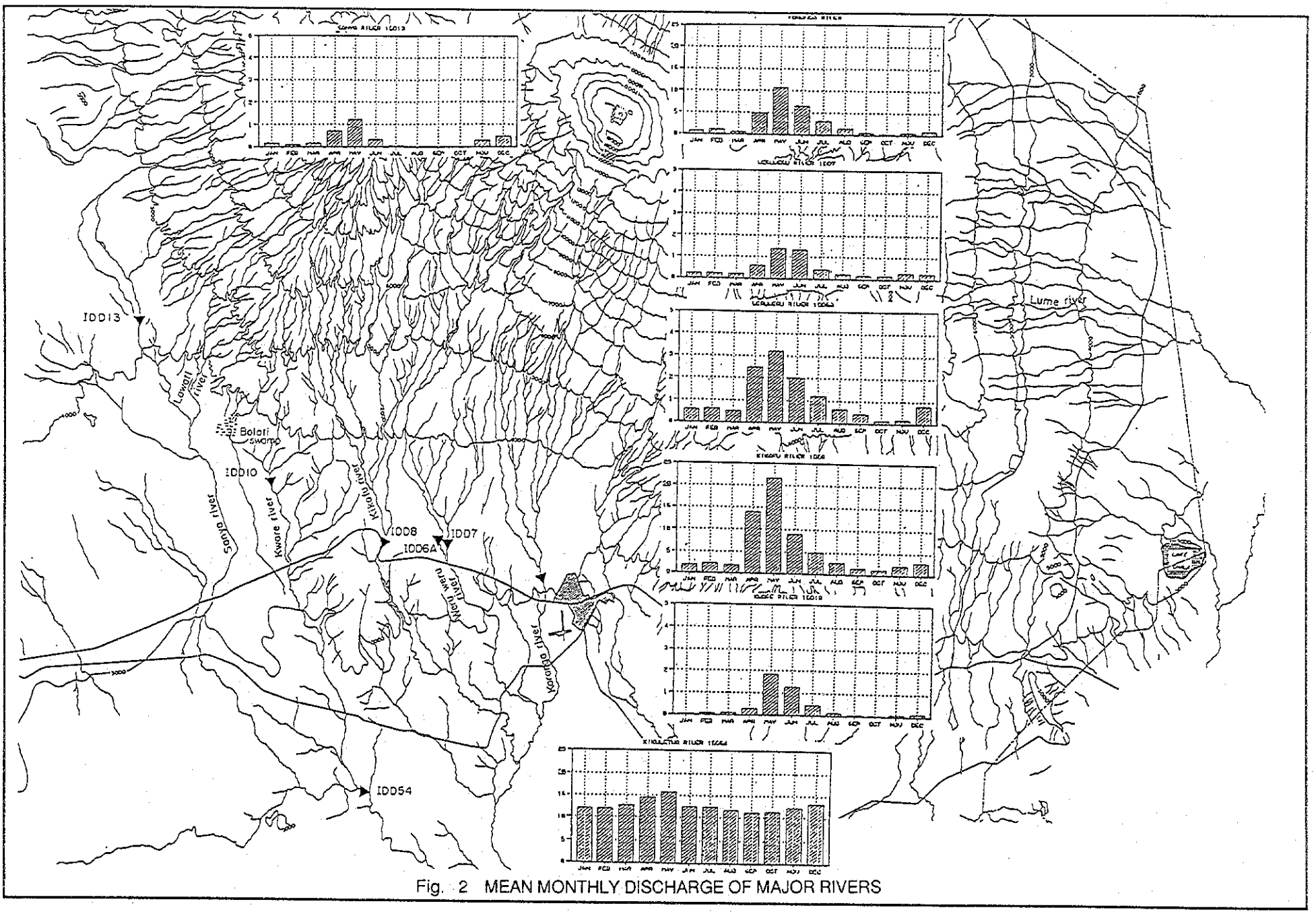


Fig. 2 MEAN MONTHLY DISCHARGE OF MAJOR RIVERS

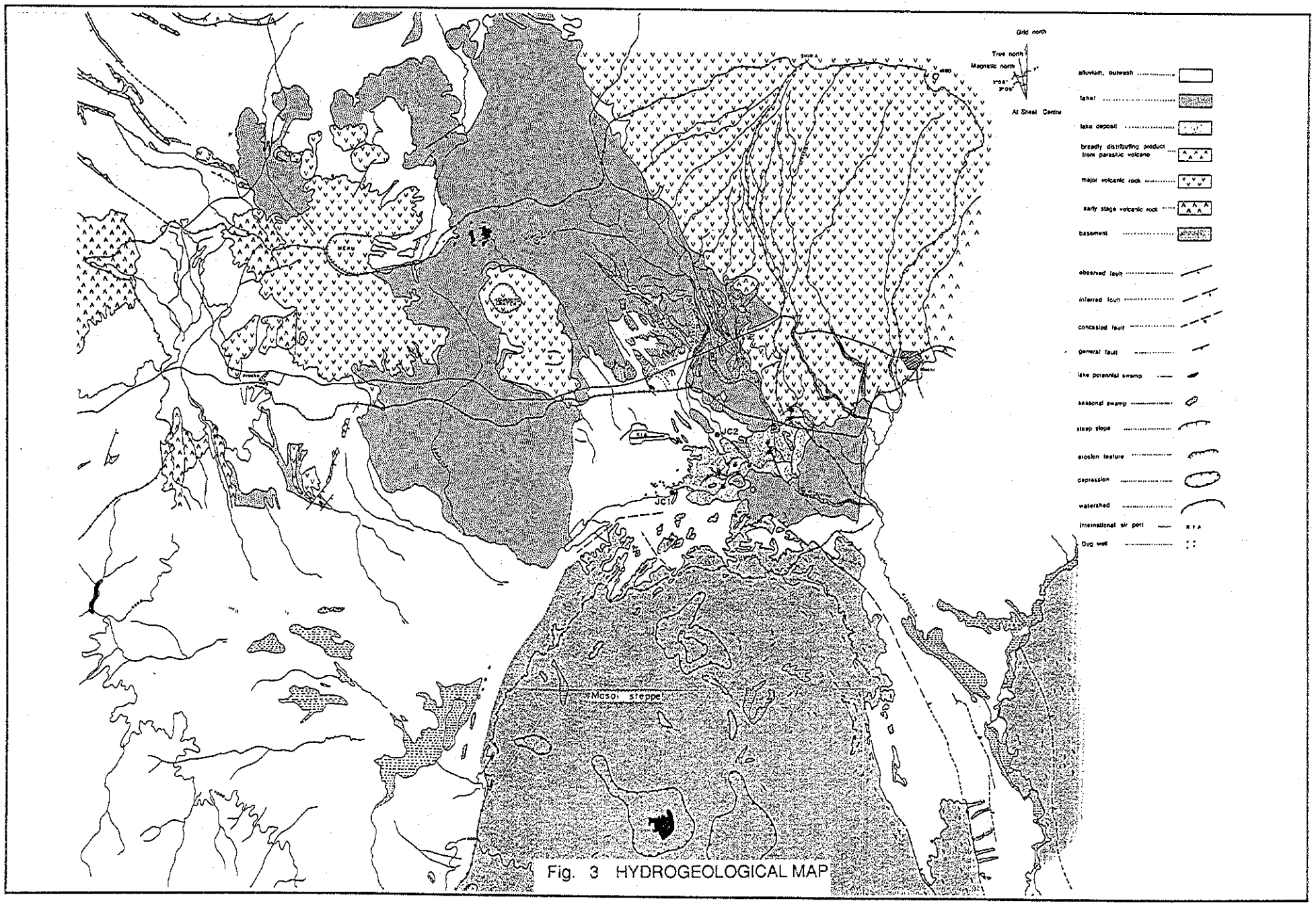


Fig. 3 HYDROGEOLOGICAL MAP

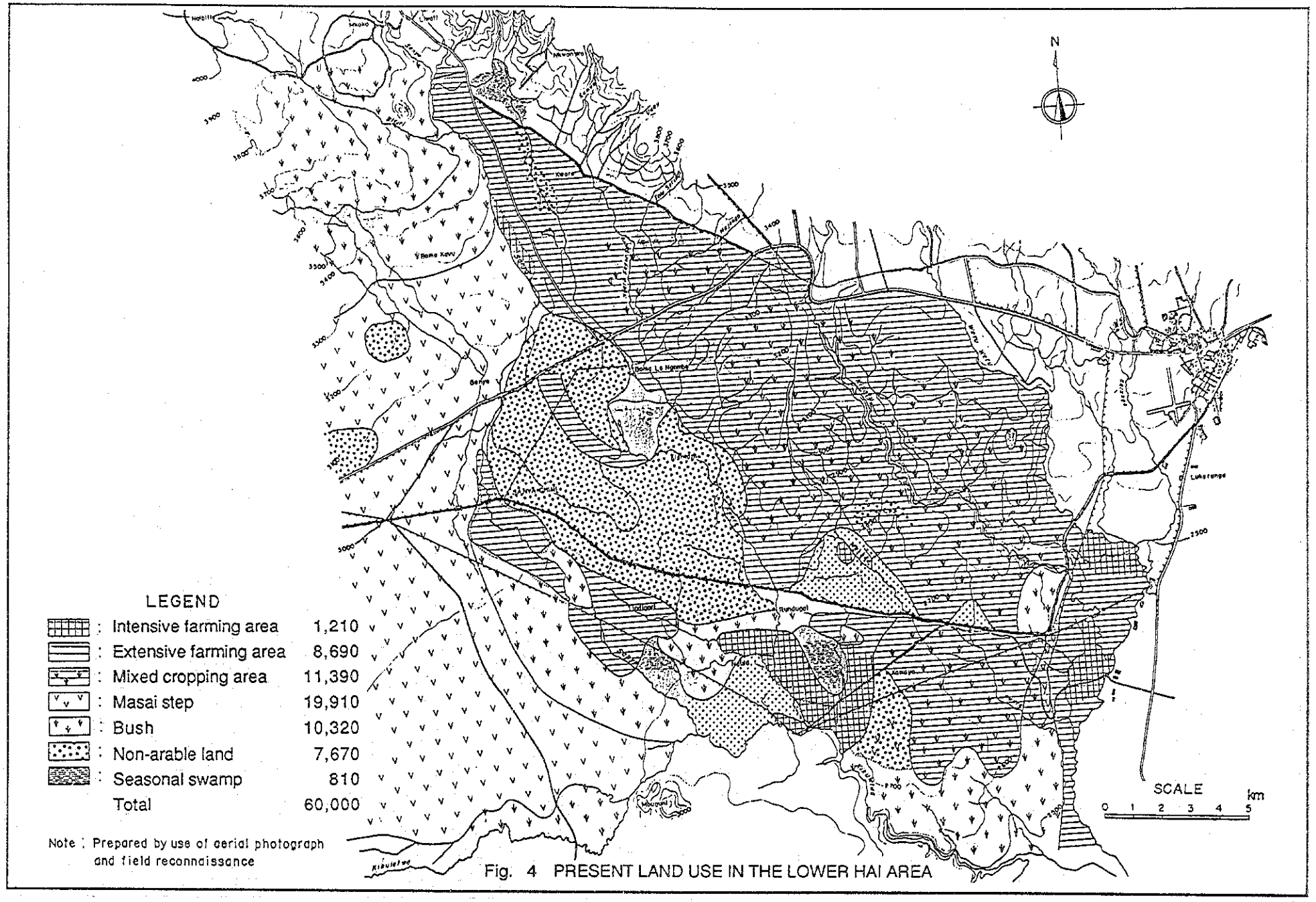


Fig. 4 PRESENT LAND USE IN THE LOWER HAI AREA

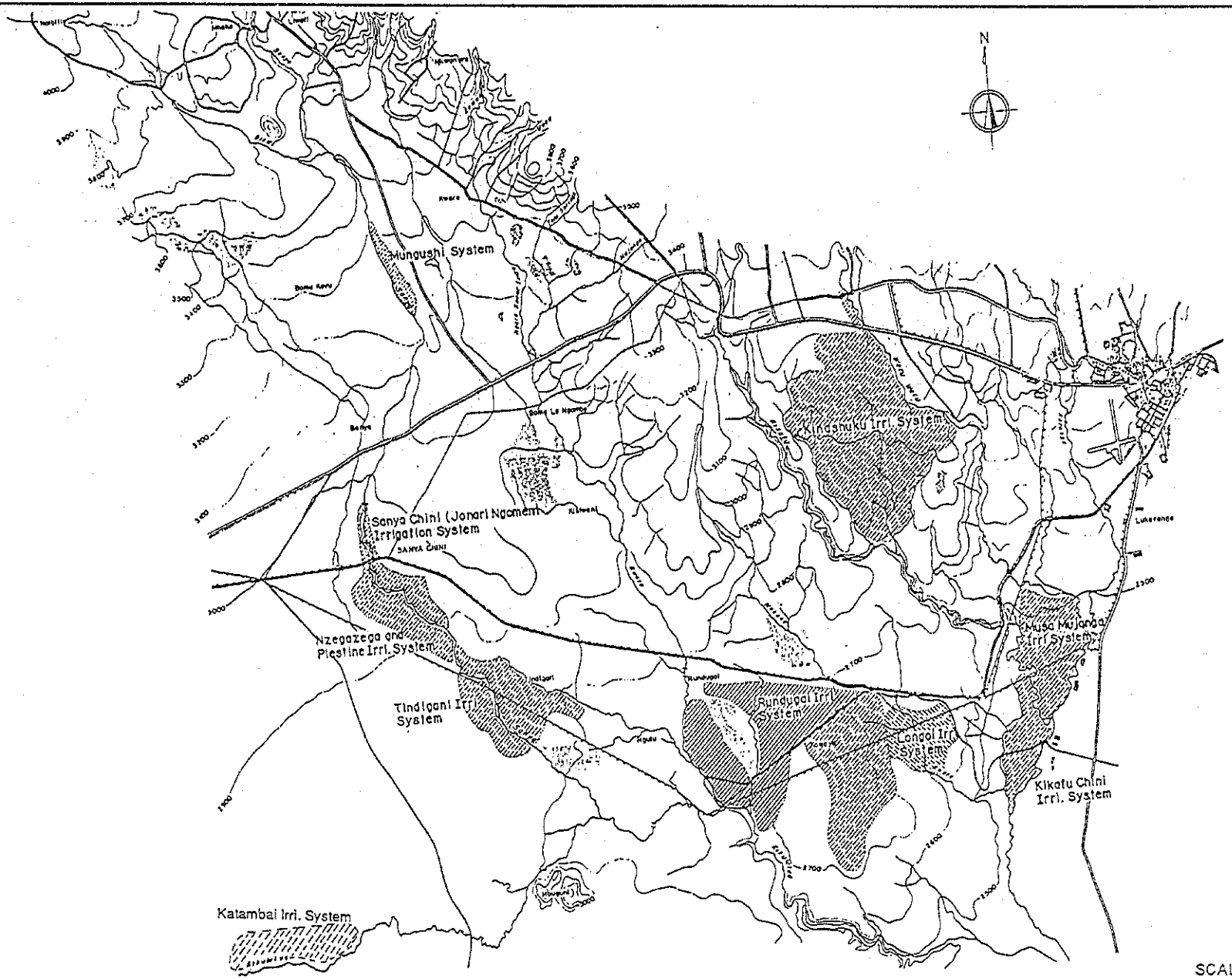


Fig. 5 MAJOR IRRIGATION AREAS IN THE LOWER HAI AREA

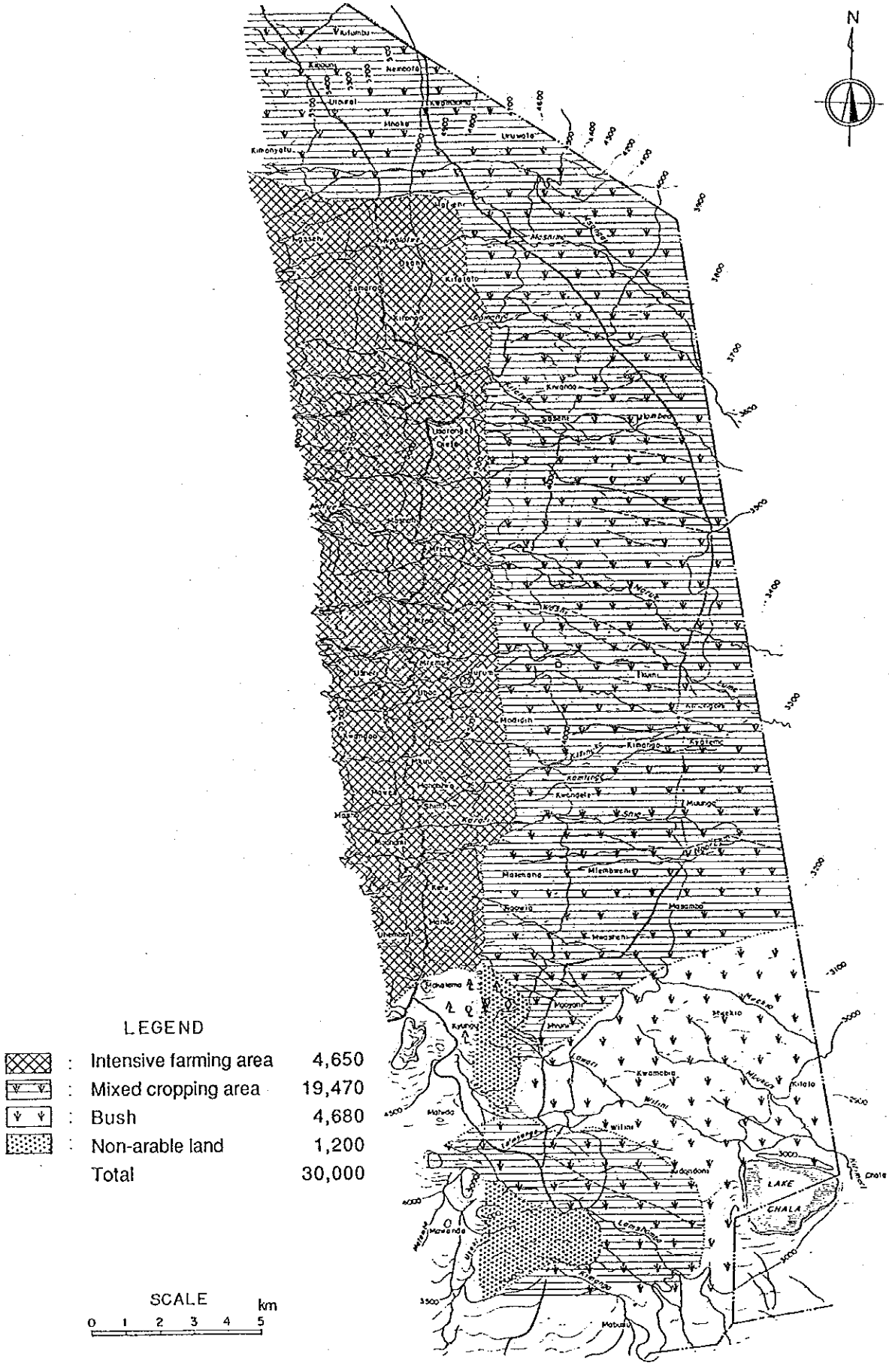


Fig. 6 PRESENT LAND USE IN THE LOWER ROMBO AREA

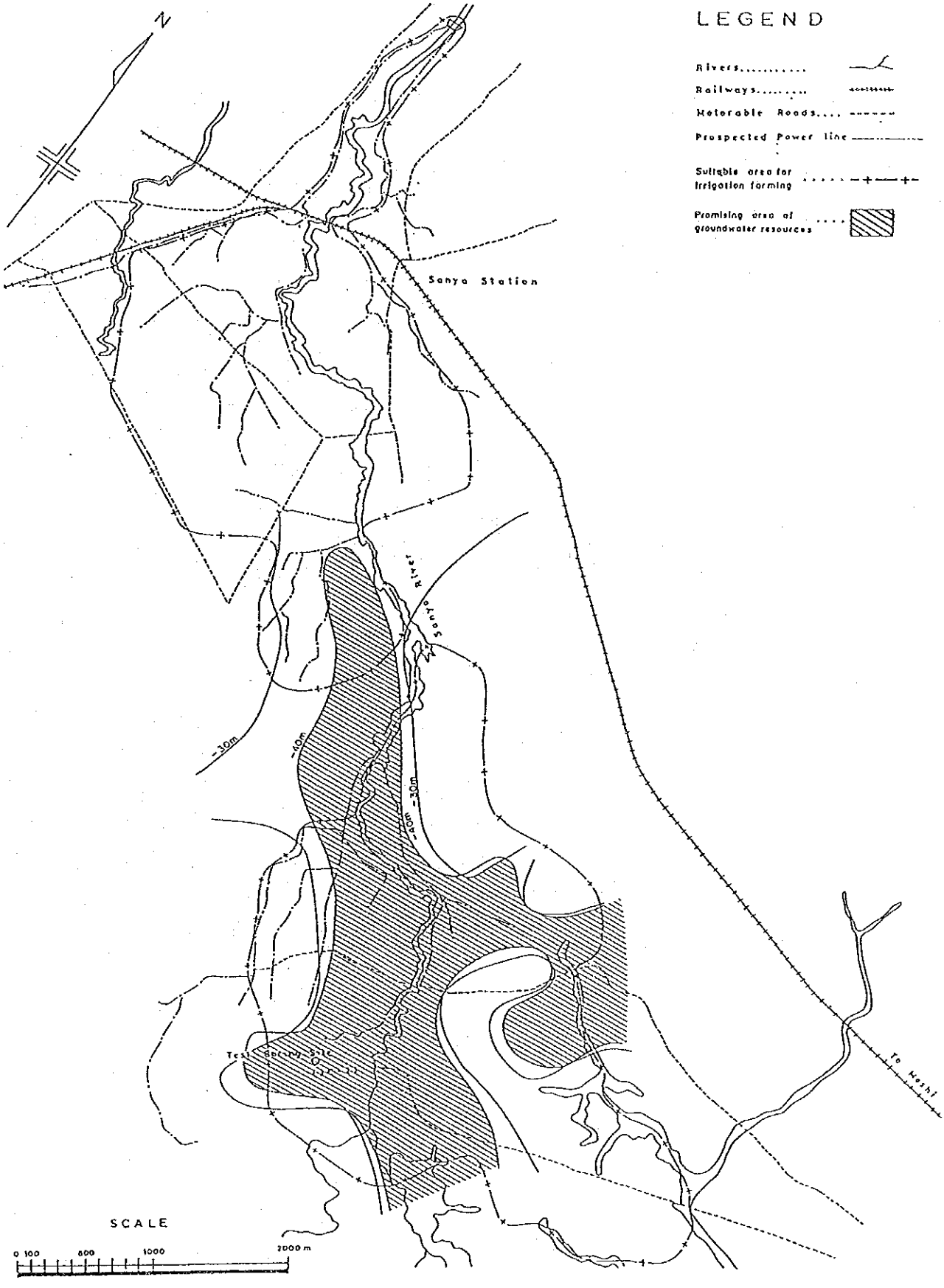
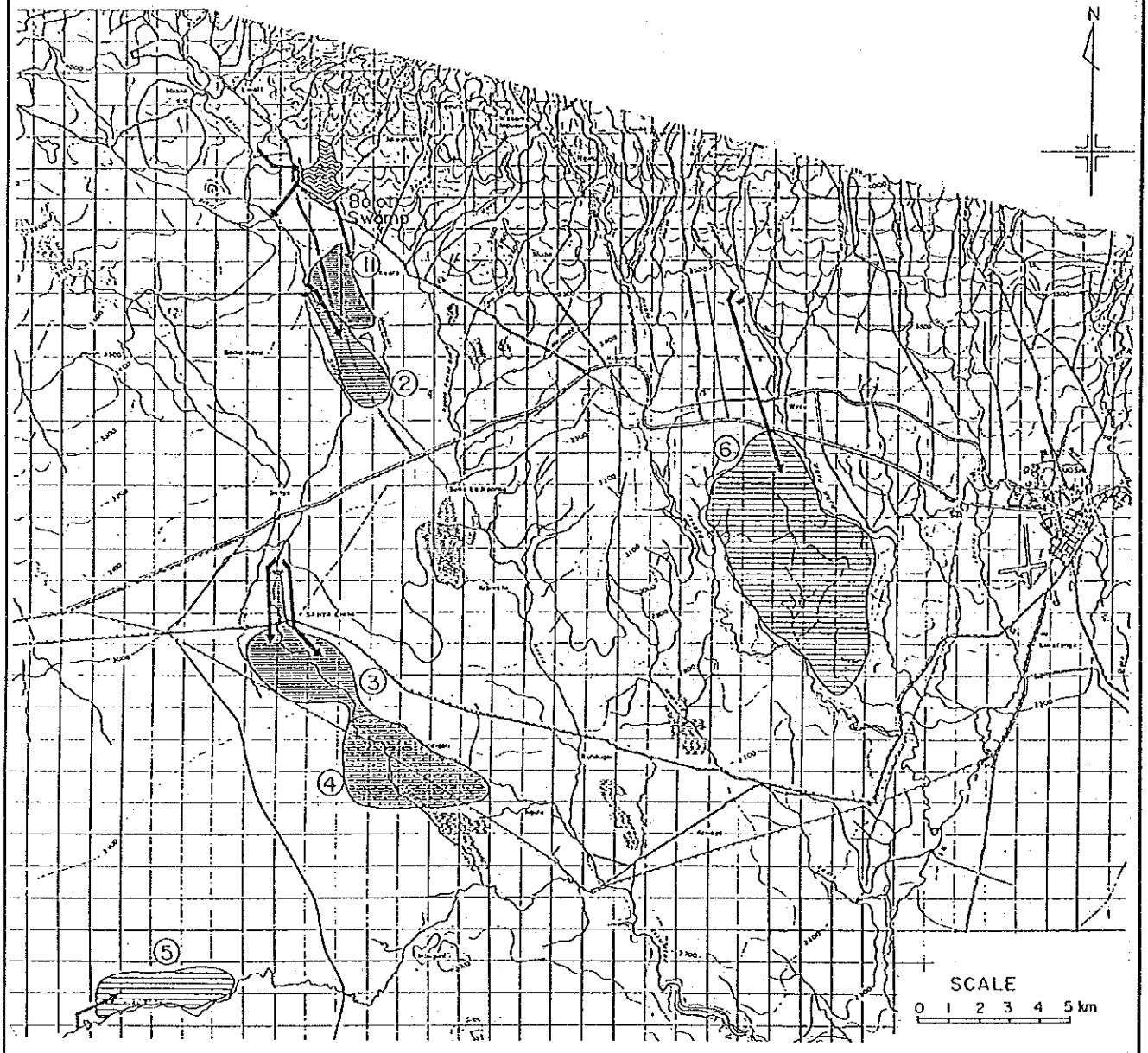


Fig. 7 PROMISING AREA OF GROUNDWATER RESOURCES IN SANYA PLAIN



① Bolori Area
② Mungushi Area
③ Sanyo Plain
④ Sanyo Plain (Groundwater available area)
⑤ Mtakuja Area
⑥ Kimashuku Area

Fig. 8 AGRICULTURAL DEVELOPMENT POTENTIAL AREAS

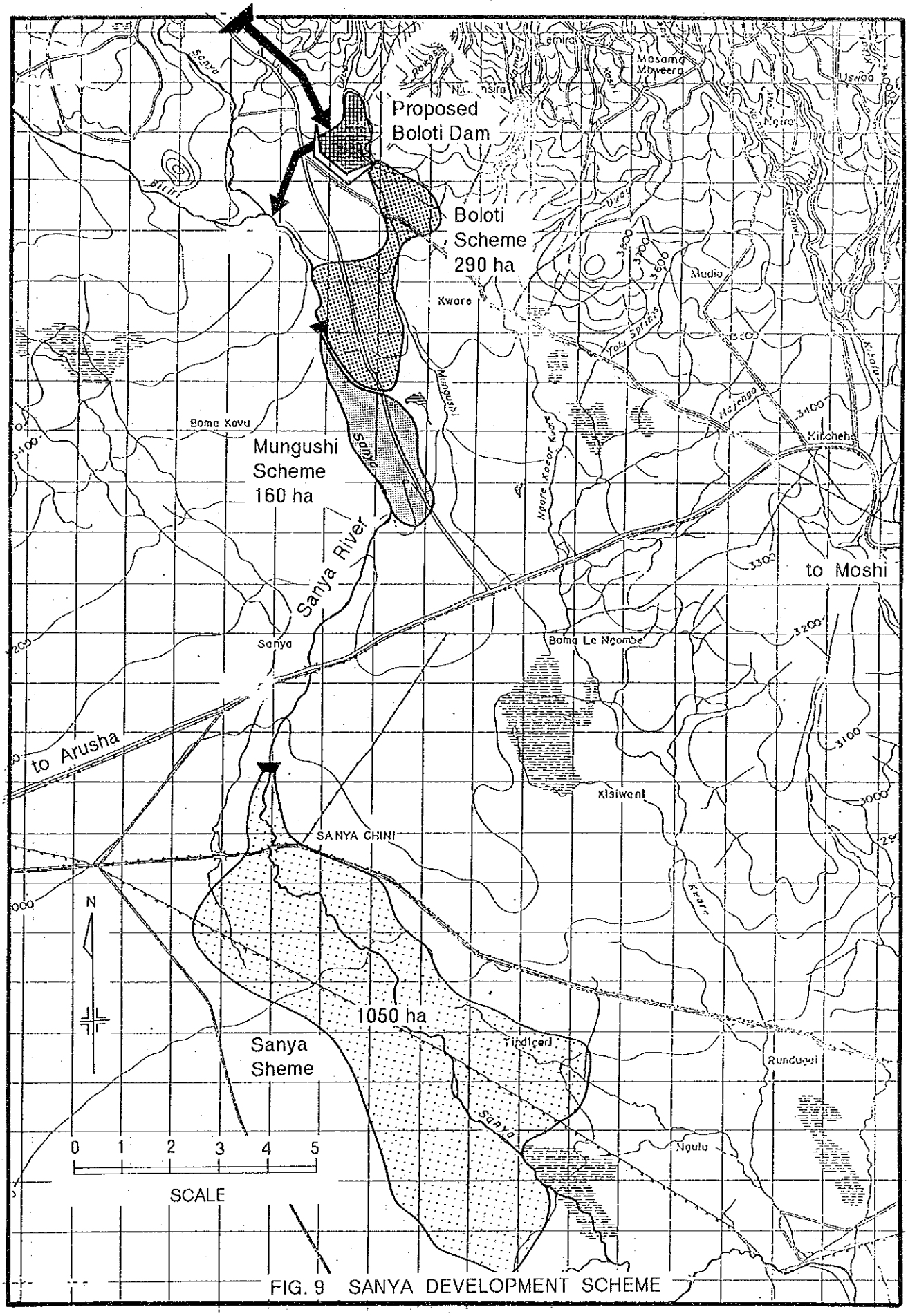


FIG. 9 SANYA DEVELOPMENT SCHEME

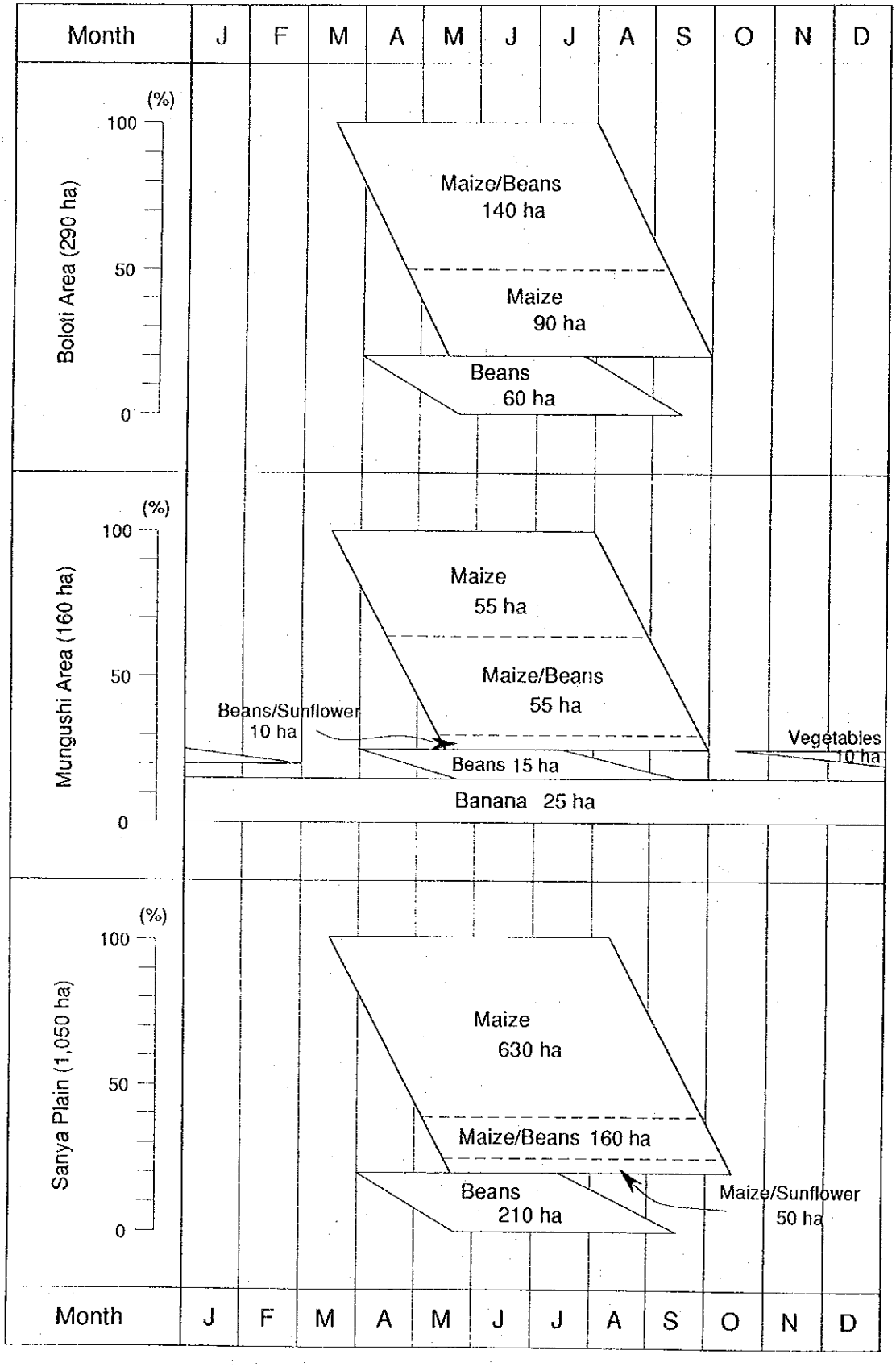
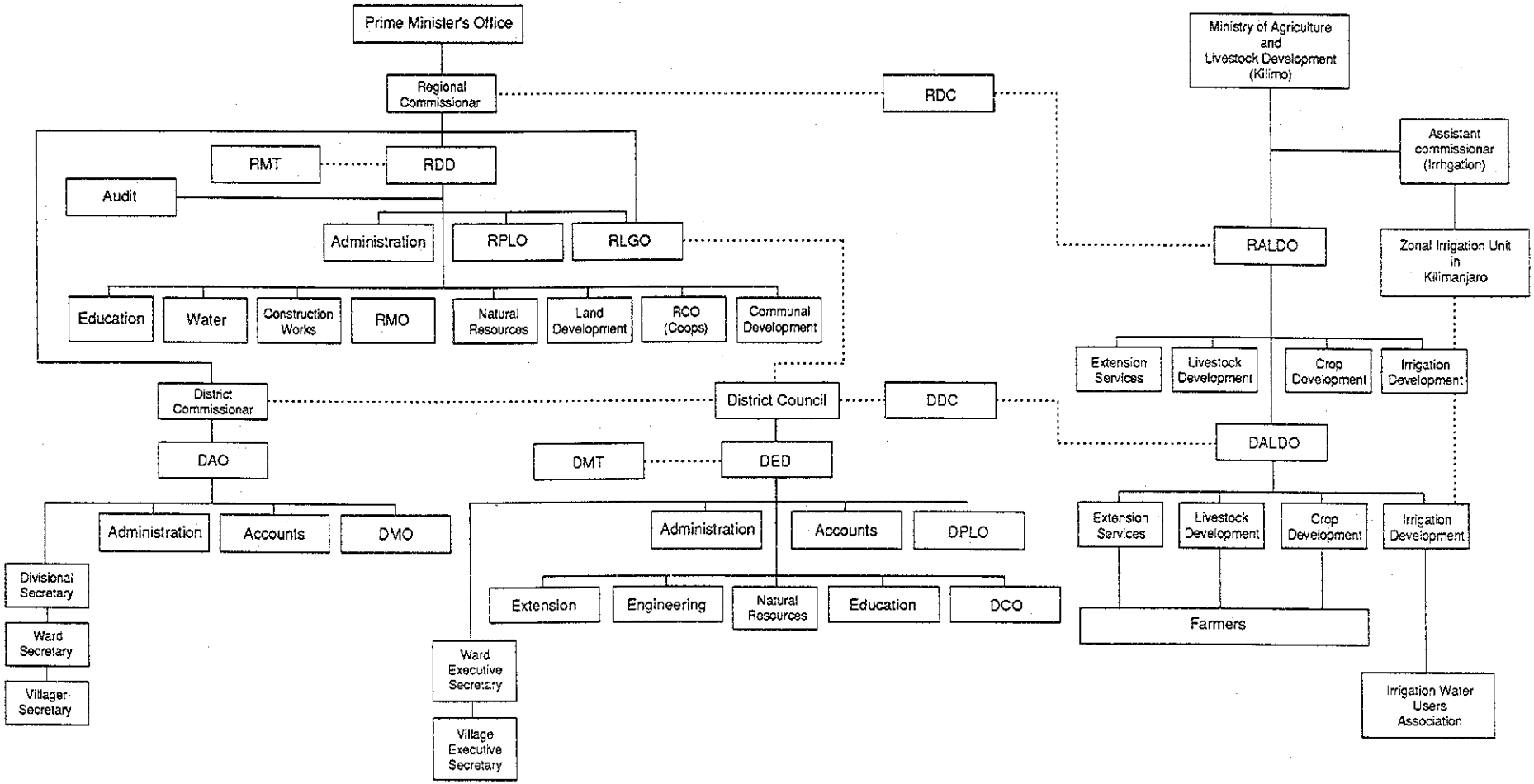


Fig. 10 PRESENT CROPPING PATTERN



LEGEND

RDD	Regional Development Director	DED	District Executive Director	RALDO	Regional Agriculture and Livestock Development Officers
RDC	Regional Development Committee	DDC	District Development Committee	DALDO	District Agriculture and Livestock Development Officers
RMT	Regional Management Team	DMT	District Management Team		
RPLO	Regional Planning Officer	DPLO	District Planning Officer		
RLGO	Regional Local Government Officer	DAO	District Administration Officer		
RCO	Regional Cooperative Officer	DMO	District Medical Officer		
RMO	Regional Medical Officer	DCO	District Cooperative Officer		

Fig. 11 AGRICULTURAL DEVELOPMENT ORGANIZATION IN KILIMANJARO REGION

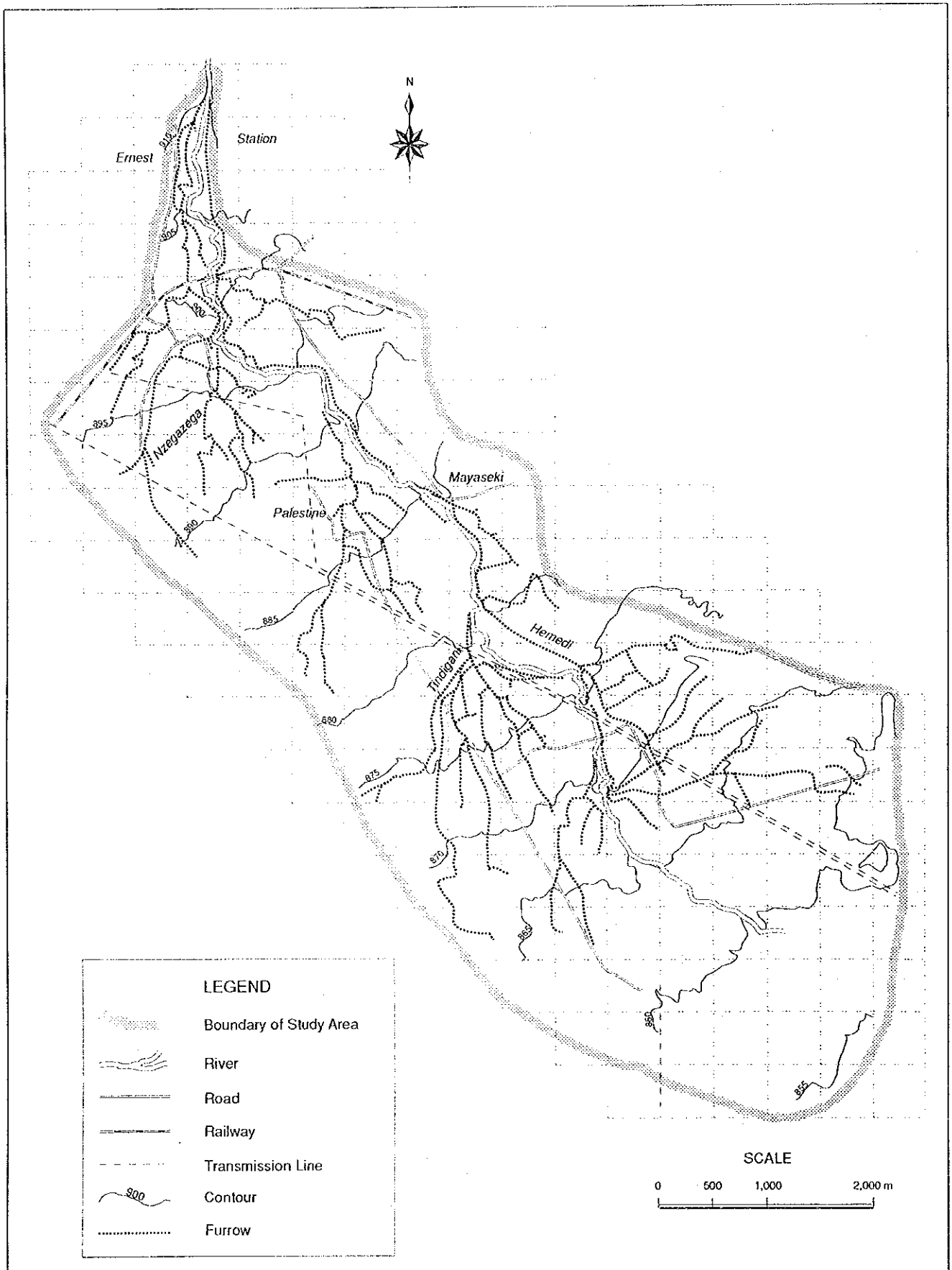


Fig. 12 EXISTING IRRIGATION SYSTEM IN SANYA PLAIN

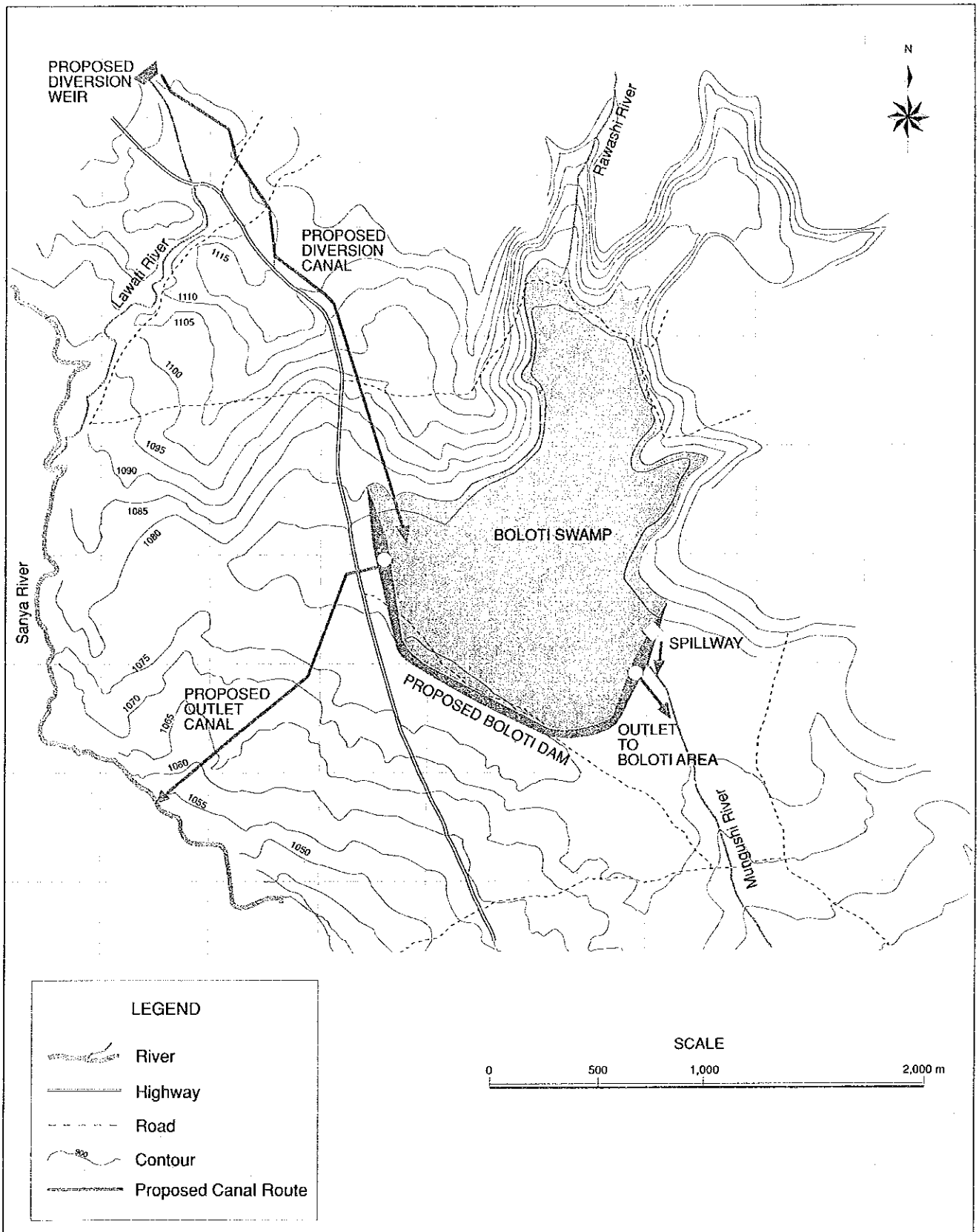


Fig. 13 DEVELOPMENT PLAN OF BOLOTI SWAMP AREA

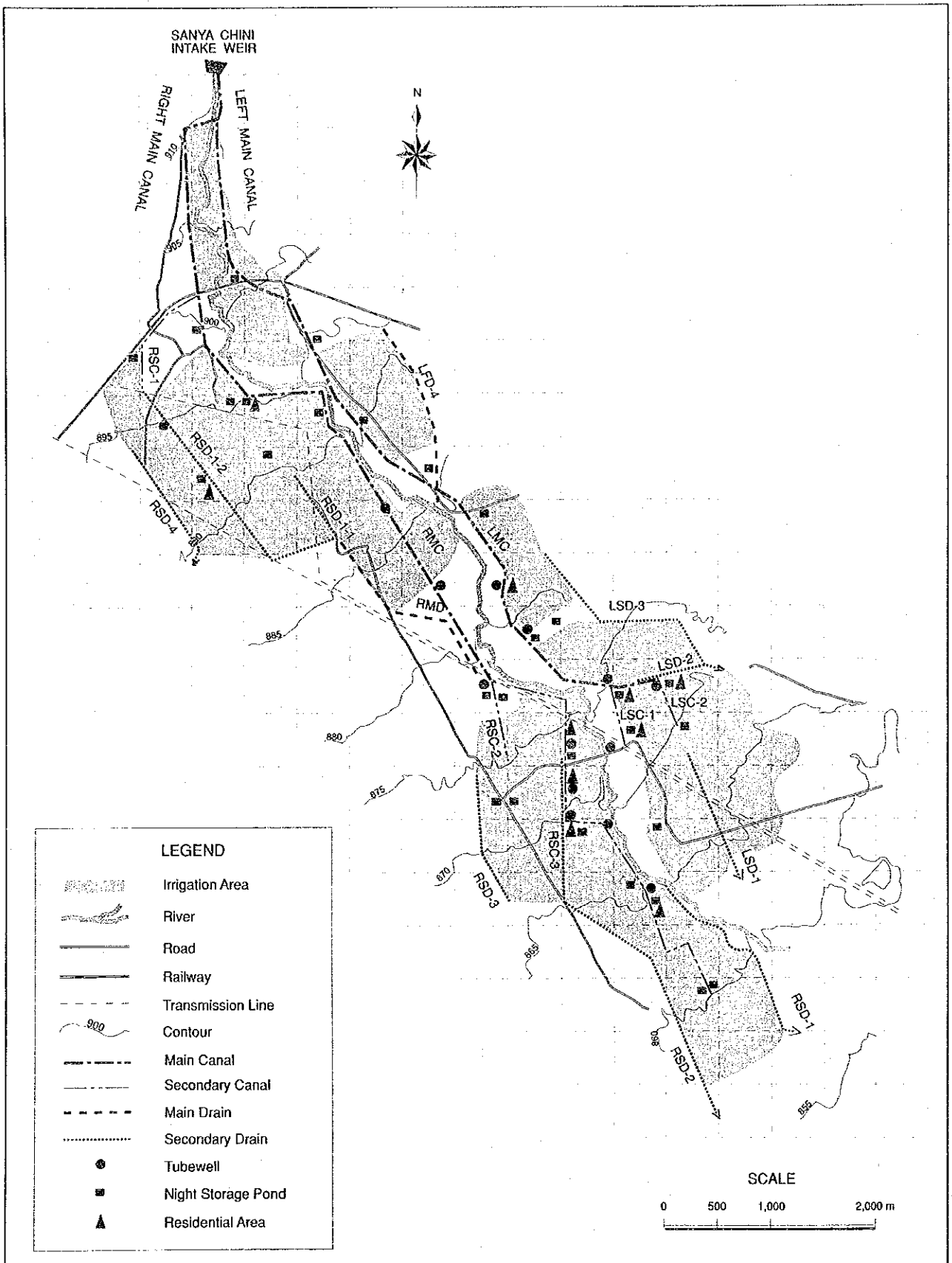


Fig. 14 GENERAL LAYOUT OF PROJECT FACILITIES IN SANYA PLAIN

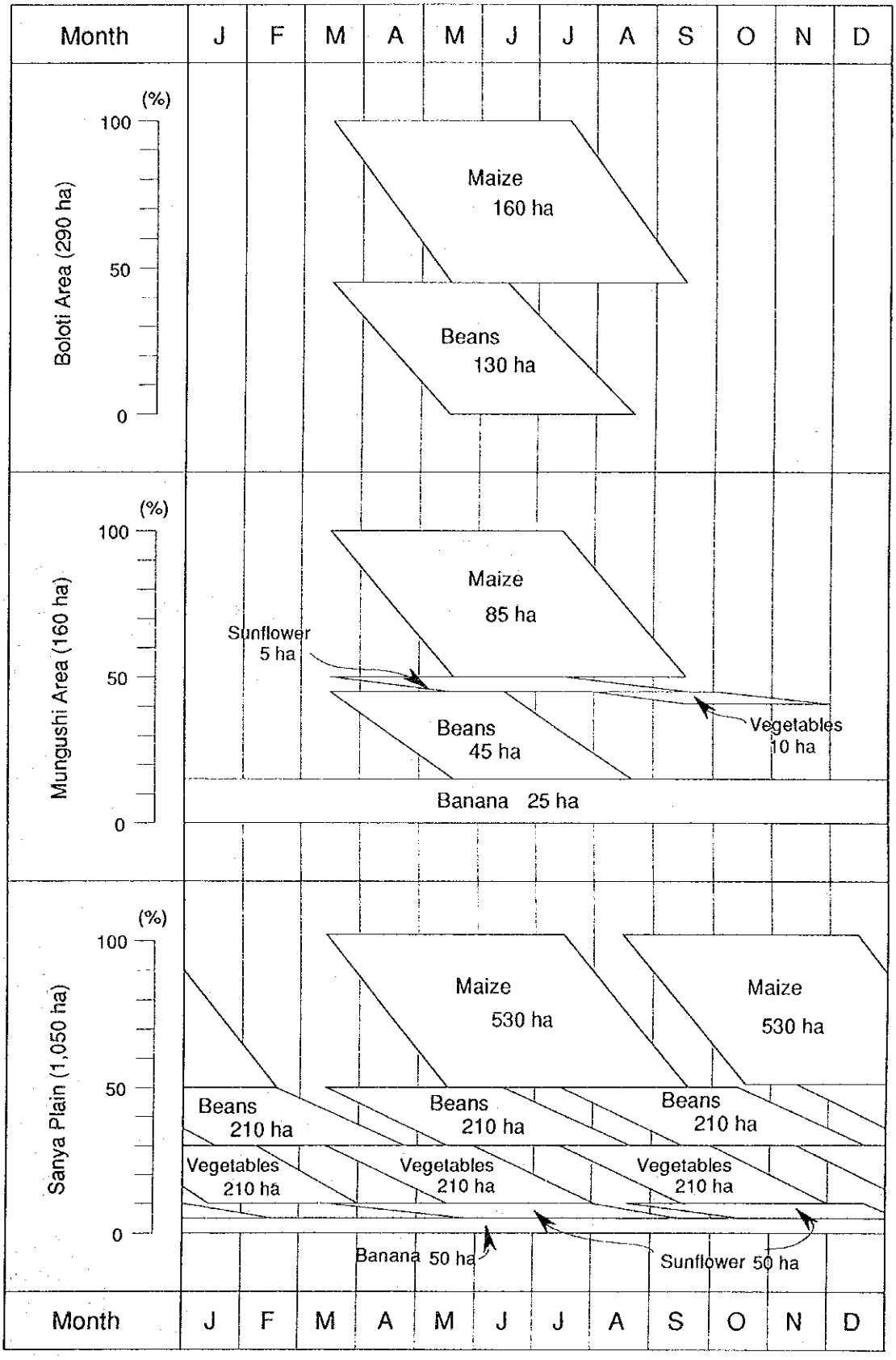
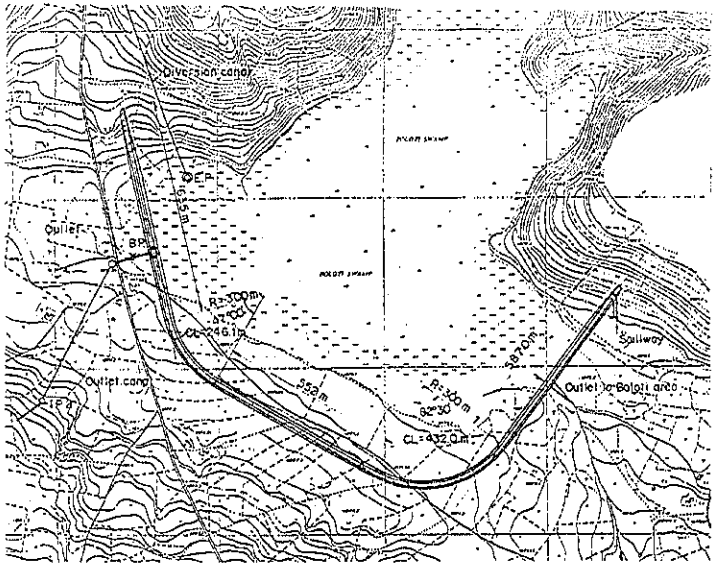
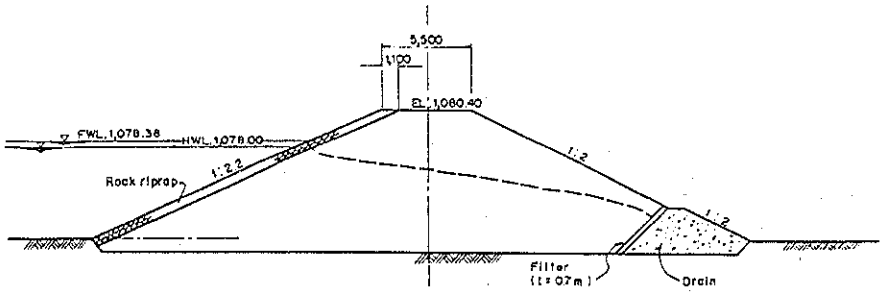


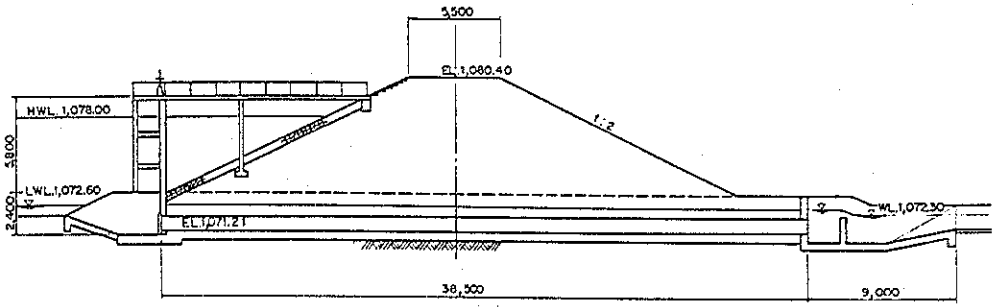
Fig. 15 PROPOSED CROPPING PATTERN



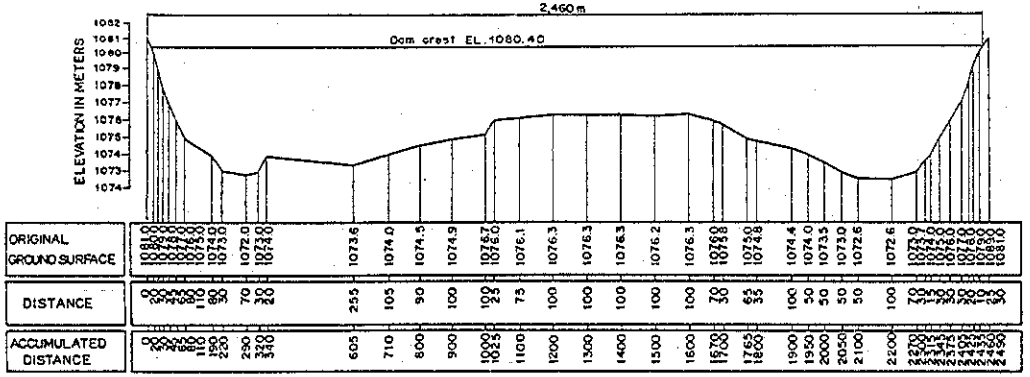
PLAN



TYPICAL CROSS SECTION



PROFILE OF OUTLET



PROFILE OF DAM AXIS

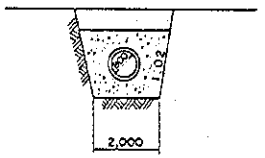


Fig. 16 FEATURES OF BOLOTI DAM

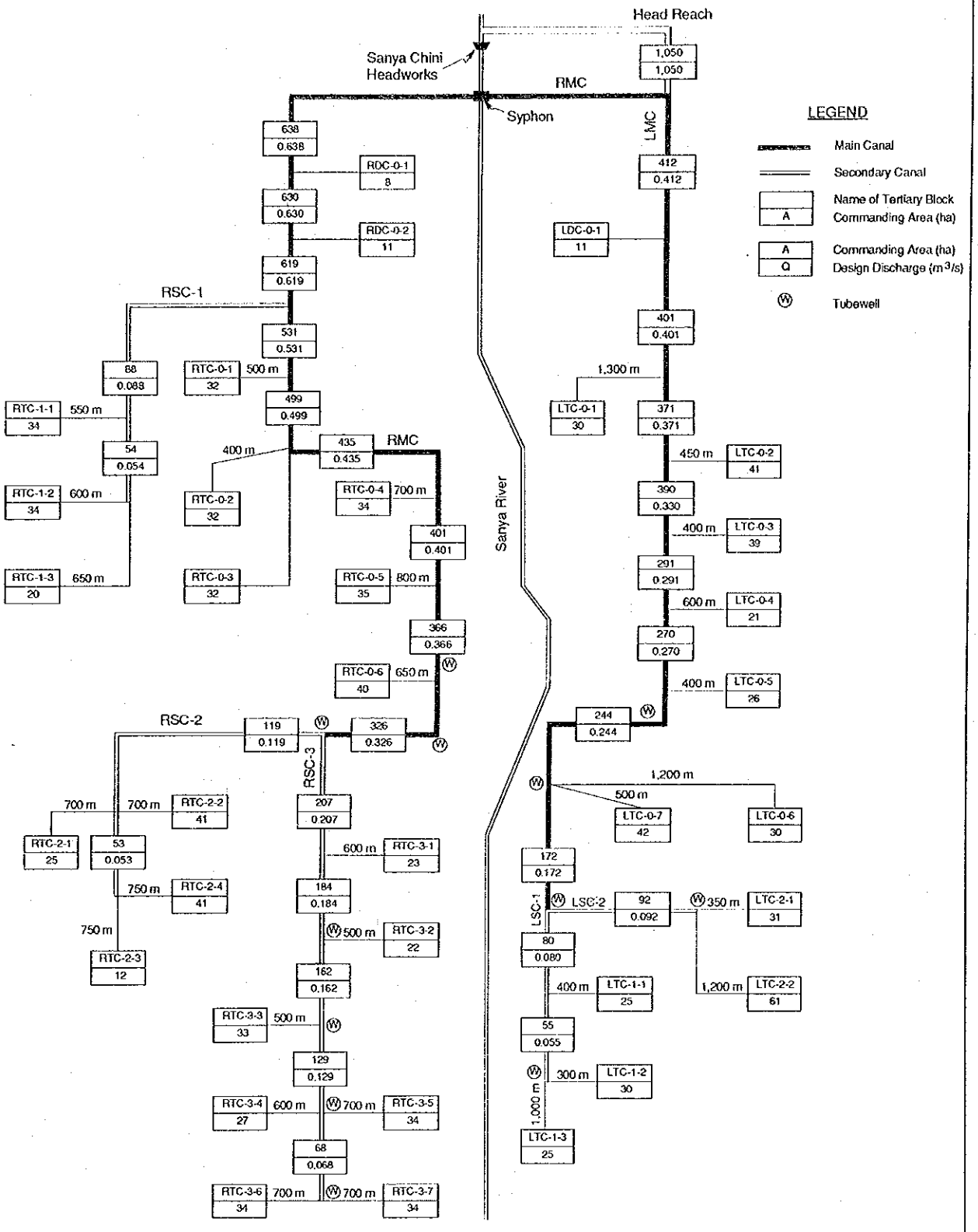


Fig. 17 IRRIGATION FLOW DIAGRAM
(SANYA SCHEME)

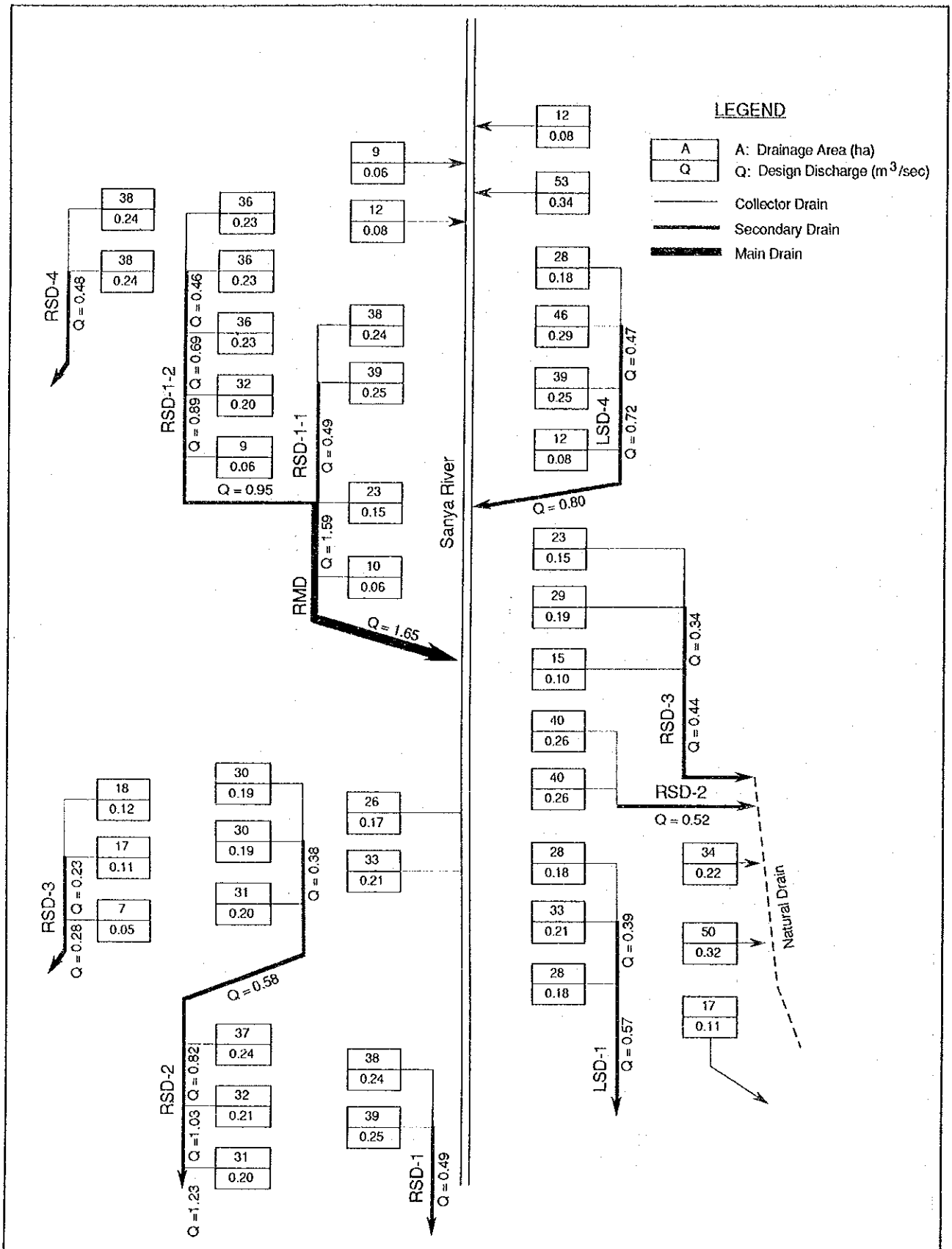


Fig. 18 DRAINAGE FLOW DIAGRAM
(SANYA SCHEME)

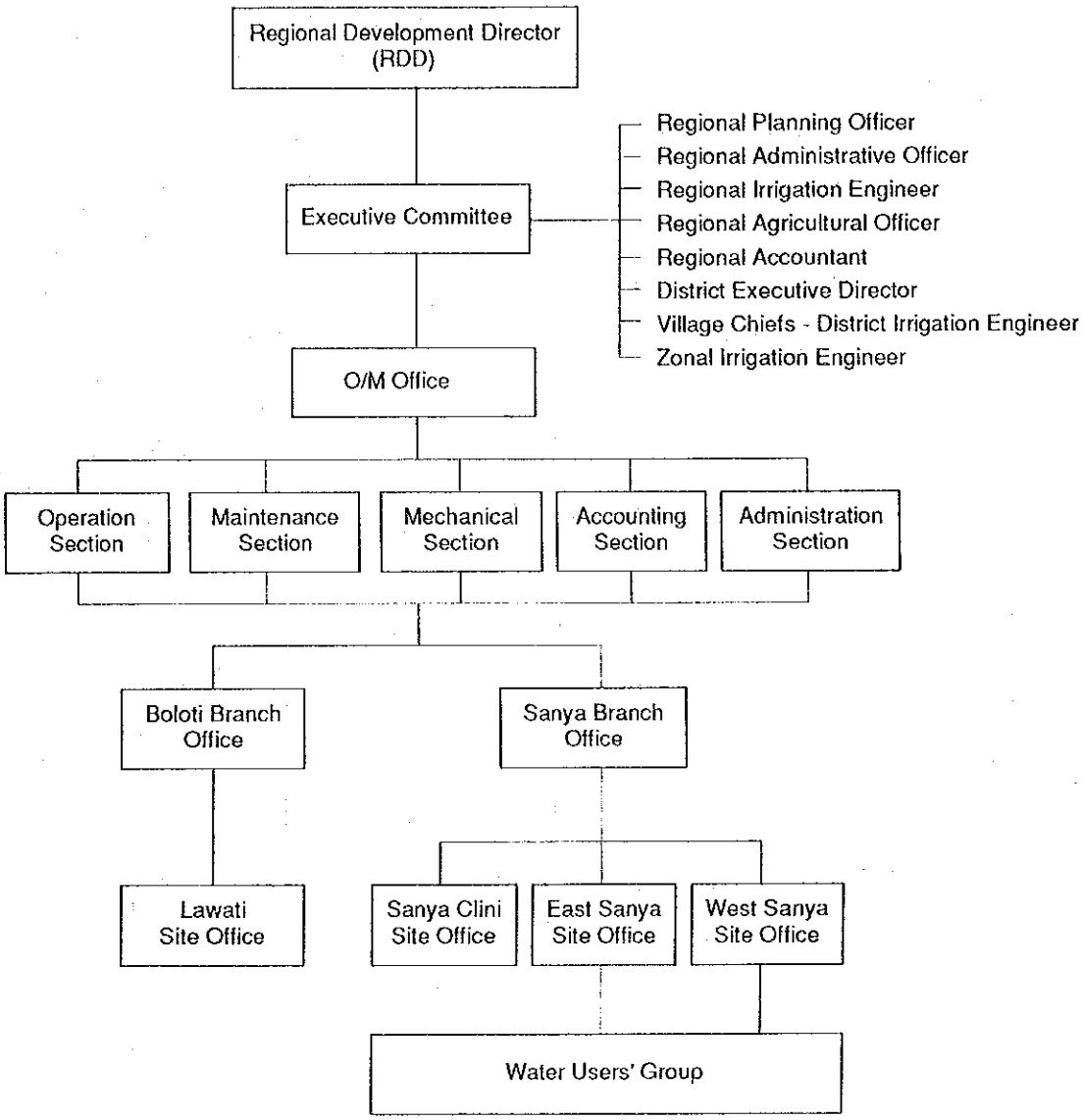


Fig. 19 ORGANIZATION CHART FOR OPERATION AND MAINTENANCE

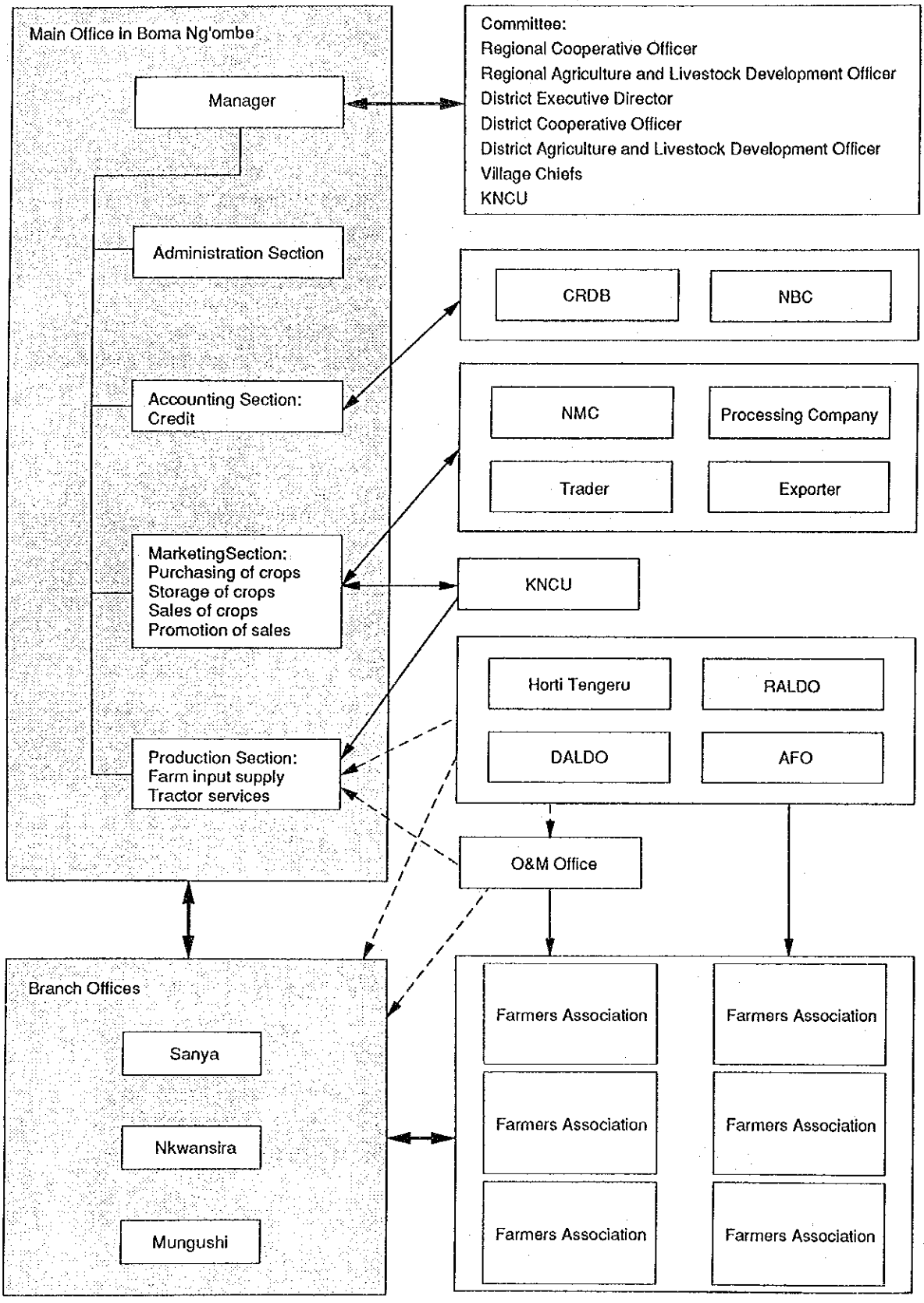


Fig. 20 ORGANIZATION STRUCTURE OF SRBC

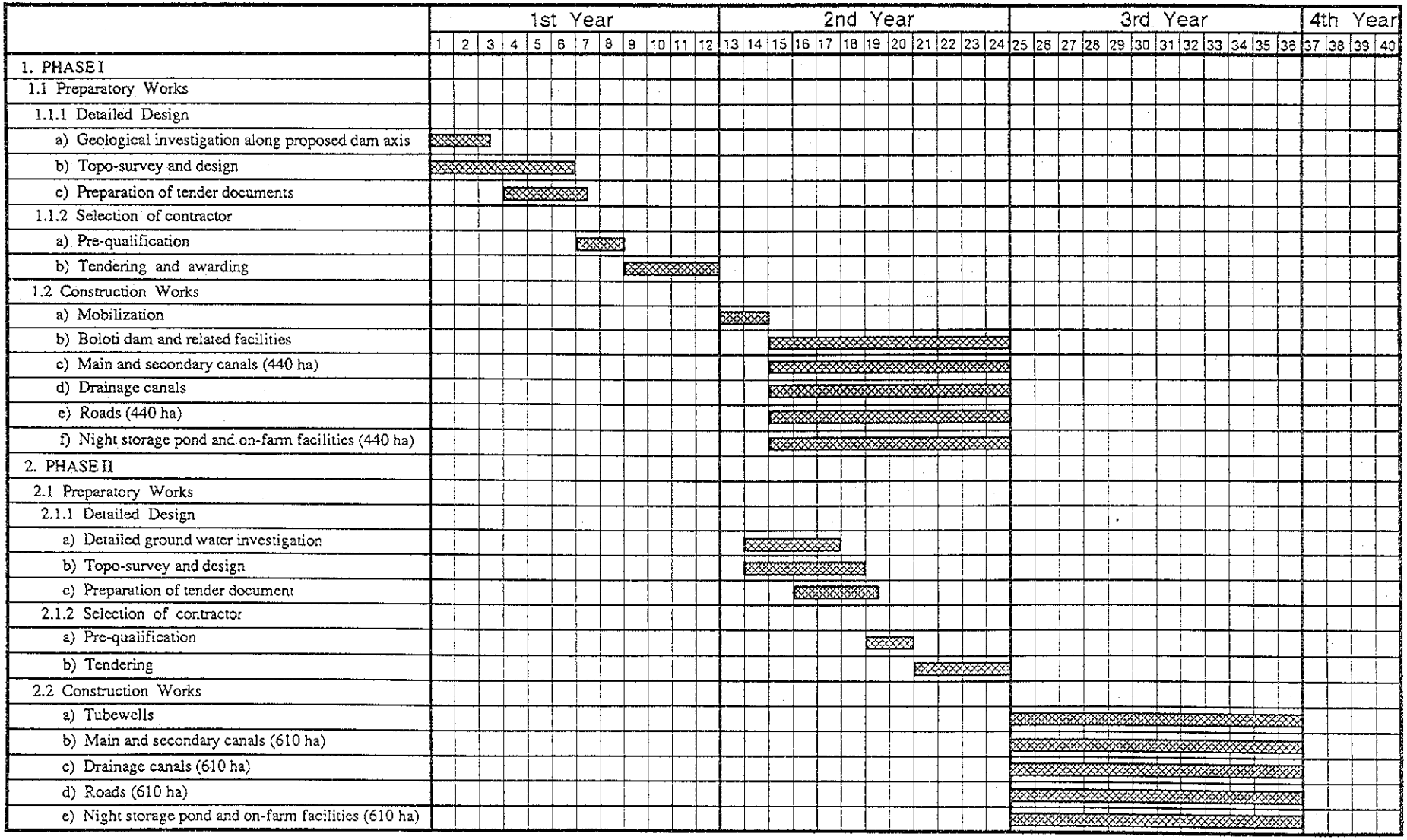


Fig. 21 PROJECT IMPLEMENTATION SCHEDULE

Attachments

SCOPE OF WORK

FOR

THE FEASIBILITY STUDY

ON

LOWER HAI AND LOWER ROMBO AGRICULTURAL DEVELOPMENT PROJECT

IN

THE UNITED REPUBLIC OF TANZANIA

AGREED UPON

BETWEEN

JAPAN INTERNATIONAL COOPERATION AGENCY

AND

REGIONAL DEVELOPMENT DIRECTORATE, KILIMANJARO REGION

27th February, 1988, Moshi

Mr. Godwin N. Mgendi
Regional Development Director
Kilimanjaro Region

Mr. Kanezo Takeuchi
Leader of the Preliminary
Survey Team,
Japan International
Cooperation Agency

Mr. M. T. Kibwana

Miniatry of Finance, Economic
Affairs and Planning

I. INTRODUCTION

In response to the request of the Government of the United Republic of Tanzania, the Government of Japan decided to conduct a Feasibility Study on Lower Hai and Lower Rombo Agricultural Development Project (hereinafter referred to as"the Study"), in accordance with the relevant laws and regulations in force in Japan.

Accordingly, Japan International Cooperation Agency, (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan, will undertake the Study in close cooperation with the authorities of Tanzania.

The present document sets forth the scope of work for the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are:

1. To assess the availability of groundwater and surface water resources for agriculture development,
2. To identify subareas with high agriculture development potential, and
3. To formulate agriculture development plan(s) for selected priority subarea(s).

III. OUTLINE OF THE STUDY

1. Study Area

The Study covers Lower Hai and Lower Rombo areas of about 600 km2.

2. Scope of the Study

The Study consists of three(3) phases as follows:

2-1 Phase I

Preliminary study for the availability of groundwater and surface water resources is conducted, and provisional selection of subareas

for feasibility study in the Phase II is made through the following activities.

(1) Aerial photography (1:20,000)

(2) Collection and review of data and information, and field survey on the following items.

a. Topography

b. Meteorology and Hydrology

c. Geology and Hydrogeology

d. Soil

e. Land use

f. Irrigation and drainage

g. Agriculture

h. Agriculture supporting services

i. Agro-economy and rural economy

j. Rural infrastructure

k. Construction materials and cost

l. Others

(3) Identification of subareas with the potentials of water resource development and agriculture development

2-2 Phase II

Based on the result of Phase I study, availability of groundwater is assessed in the high potential subareas.

(1) Selection of test well drilling sites

(2) Test well drilling and groundwater monitoring

2-3 Phase III

Feasibility study on agriculture development plans in subarea(s) with priority is conducted as follows:

(1) Selection of subsrea(s) for the feasibility study;

(2) Topographic mapping (1:5,000) of the selected subarea(s);

(3) Supplemental data collection and additional field survey on the items listed in 2-1, (2) ;

(4) Formulation of agriculture development plan(s) in the selected subarea(s) including,

a. Delineation of project area

b. Cropping pattern and farming system

c. Irrigation and drainage system

d. Rural infrastructure

e. Preliminary design of major structures

(5) Recommendation of project implementation schedule

(6) Estimate of benefits and cost

(7) Project evaluation

Ⅳ. WORK SCHEDULE

The whole study shall be conducted in accordance with the attached tentative schedule.

Ⅴ. REPORTS

JICA shall submit the following reports in English to the Government of the United Republic of Tanzania.

1. Inception report(I)

   Thirty (30) copies at the commencement of the Phase I aerial photography.

2. Inception report(II)

   Thirty (30) copies at the commencement of the Phase I study.

3. Progress report (I)

   Thirty (30) copies at the end of the Phase I study.

4. Interim Report

   Thirty (30) copies at the end of the Phase II study.

5. Progress report (II)

Thirty (30) copies at the end of the Phase III field survey.

6. Draft final report

Thirty (30) copies at the end of the Phase III study.

The Government of the United Republic of Tanzania shall provide its comments on the report within one (1) month after the receipt of the Draft Final Report

7. Final Report

Fifty (50) copies within two (2) months after the receipt of the Government of the United Republic of Tanzania's comments on the Draft Final Report.

VI. UNDERTAKING OF THE GOVERNMENT OF THE UNITED REPUBLIC OF TANZANIA

1. To facilitate a smooth conduct of the Study, the Government of the United Republic of Tanzania shall take necessary measures:

(1) To secure the safety of the Japanese study team,

(2) To permit the members of the Japanese study team to enter, leave and sojourn in the United Republic of Tanzania for the duration of their assignment therein, and exempt them from alien registration requirements and consular fees,

(3) To exempt the members of the Japanese study team from taxes, duties, fees and any other charges on equipment, machinery and other materials brought into the United Republic of Tanzania for the conduct of the Study,

(4) To exempt the members of the Japanese study team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the study,

(5) To provide necessary facilities to the Japanese study team for the remittance as well as the utilization of funds introduced into the

United Republic of Tanzania from Japan in connection of the implementation of the Study,

(6) To secure permission for entry into private properties or restricted areas for the conduct of the Study,

(7) To secure permission to take all data and documents related to the Study including photographs out of the United Republic of Tanzania to Japan by the Japanese study team,

(8) To provide medical services as needed;
Its expenses shall be chargeable on the member of the Japanese study team.

2. The Government of the United Republic of Tanzania shall bear claims, if any arises, against the members of the Japanese study team resulting from, ocurring in the course of or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or wilful misconduct on the part of the members of the Japanese study team.

3. Regional Development Directorate in Kilimanjaro Region (hereinafter referred to as "RDD") shall act as counterpart agency to the Japanese study team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for smooth implementation of the Study.

4. RDD shall, at its own expense, provide the Japanese study team with the following, in cooperation with other agencies concerned:

(1) Available data and information related to the Study,

(2) Additional survey related to the Study, if necessary,

(3) Counterpart personnel,

(4) Suitable office space with necessary equipments in Moshi,

(5) Credentials or identification cards.

VII. UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures:

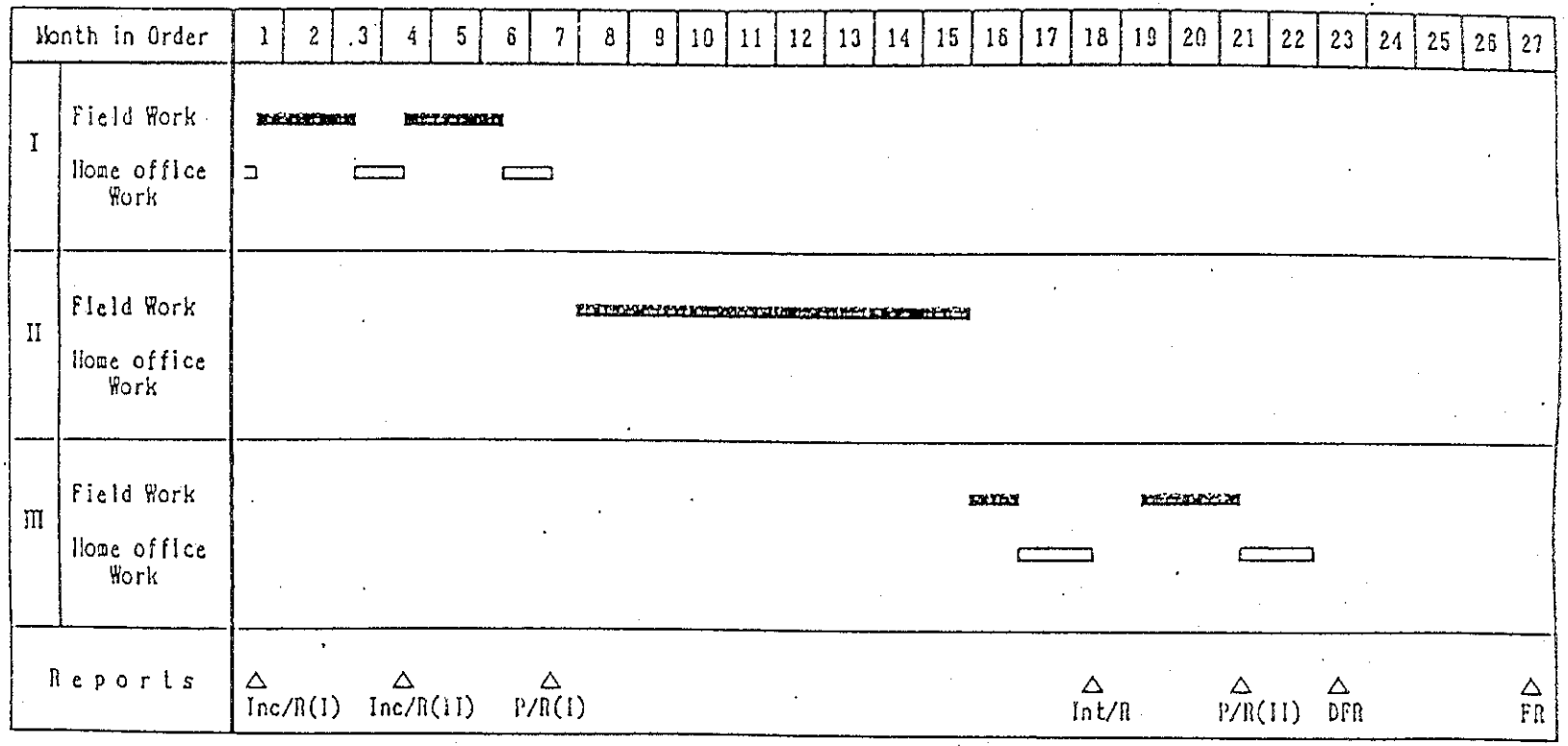
1. to dispatch, at its own expense, the Study team to Tanzania,
2. to pursue technology transfer to Tanzanian counterparts in the course of the Study.

VIII. CONSULTATION

JICA and RDD shall consult with each other in respect of any matter that may arise from or in connection with the Study.

APPENDIX

TENTATIVE WORK SCHEDULE



Remarks:

Inc/R(I) : Inception Report(Aerial photography)
Inc/R(II): Inception Report(Feasibility study)
P/R(I) : Progress Report I
Int/R : Interim Report
P/R(II): Progress ReportII
DFR : Draft Final Report
FR : Final Report

MINUTES OF MEETING ON THE SCOPE OF WORKS FOR THE FEASIBILITY STUDY ON LOWER HAI AND LOWER ROMBO AGRICULTURAL DEVELOPMENT PROJECT IN THE UNITED REPUBLIC OF TANZANIA

In response to the request of the Government of the United Republic of Tanzania, for the Feasiblity study on Lower Hai and Lower Rombo Agricultural Development Project in Kilimanjaro Region, the Government of Japan dispatched, through Japan International Cooperation Agency (hereinafter referred to as "JICA") responsible for the implementation of the technical co-operation programmes of the Government of Japan, the preliminary Survey Team headed by Mr. Kanezo TAKEUCHI, to Tanzania, from 20th February to 1st March, 1988.

Team held a series of discussion for the Scope of Works with the Regional Development Directorate and other authorities concerned.

Followings are the results at the meeting,

1. Regarding to the paragraph III, 2-1, (2), b, JICA will install 4 sets of water level recorder.
   RDD, will carry out data collection and the daily maintenance works.

2. Regarding to the paragraph III, 2-2,
   (a) RDD,will at its own expense, carry out the test well drilling works.
   (b) RDD requested that the spare parts for the drilling machine and the consumable materials etc for the test well drilling, as shown in attached papers, would be provided by JICA.

3. Regarding to the paragraph VI, RDD recommended JICA to read the sentences as follows:

   VI, 1, (2) To permit the members of the Japanese study team to enter, leave and sojourn in the United Republic of Tanzania for the duration of their assignment therein in accordance with existing regulations.

   VI, 1, (5) To provide necessary facilities to the Japanese study team for the remittance as well as the utilisation of funds introduced into the United Republic of Tanzania from Japan in connection with the implementation of the study as will be applicable.

4. RDD strongly requested that JICA would provide appropriate numbers of vehicles for the study.

5. RDD suggested that the training of the Tanzanian Counterparts would be continuously carried out through the field work in Tanzania and home office work in Japan.

27th February, 1988, Moshi.

Mr. Godwin N. Mgendi
Regional Development Director
Kilimanjaro Region

Mr. Kanezo Takeuchi
Leader of the Preliminary
Survey Team
Japan International
Cooperation Agency

ATTACHED TABLE I

DRILLING ITEMS FOR TONE RIG MODEL "THS 70"

1. Water swivel assembly capacity 6 tone type "FH 6" with 73T drillrod pin and 50mm hose connection EA 4 pcs
2. Hoisting plug assembly type B - 4A - EA I
3. Stabilizer three wings size $3^{1}/2$ I.F. x 120mm diameter x 130mm EA 1.
4. Drill rod inside tape size 73T - RH (Fishing tool) EA 2
5. Drill rod outside tape size 73T - RH x RH (Fishingtool) EA 2
6. Bolt chuck E.0325 - 001 EA 6
7. Hoisting cable $^{3}/_{8}$" x 100 metress with pin
8. Drillrodes 73mm OD x 3m External flush 60 pcs
9. Drill coller 127mm OD x 3m long weight approx. 200kg. with $3^{1}/_{2}$" I.F. 60° to pin connector EA 4 pcs.
10. Subsitute to connect drillrod to drill coller or drill coller 73mm OD box to $3^{1}/2$" I.F. pin 3 pcs.
11. Substute to connect drill coller to stabilizer to three cutter bit $3^{1}/_{2}$" I.F. (Box) to $4^{1}/_{2}$" Regular EA 3 pcs.
12. Sunction hose 3" 12ft. EA. 2
13. Horse Air Size 50mm 8 metres long
14. Drill bits tricon rollerbit (for hard rock) size $12^{1}/4$" EA 4
15. " " " " " size 10" EA 4
16. " " " " " size 8" EA 4
17. " " " " " size 6" EA 2
18. Hydraulic Jacks 10 Ton EA 2

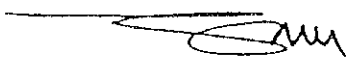
SPARE PARTS FOR DIESEL ENGINE F. 21912

FOR MUD PUMP MODEL MITSUI - DEYTS 26.5HP DIN A 6270

1. Oil filter PN 01501980 each 10 pcs
2. Fuel filter PN 02001760 10 pcs
3. Desc. Plate assey PN 04507311 each 8 pcs.
4. Air cleaner PN. 22201360 each 10 pcs
5. Self starter motor 12 Tone type No. 2
6. Starter switch assy PN 04801501 2 Nos
7. Chuck spanner each 2 Nos
8. Chuck Jews EA 10 sets (30 Nos)
9. Breaklining EA 5 sets (10 Nos)
10. Spedal meter cable (EA 2 Nos)

SPARE PART FOR MUD PUMP

1. Ruber parking PB 2702 - 080 - 50 pcs
2. Ruber piston PN E 2703 - 006 (85mm diameter) 20 pcs
3. Ruber piston PN E JISB 2403 - 425 each 200 pcs.
4. Parking PN E 2521 - 541 each 10 pcs
5. "V" belt each 4 sets (size B.32) and size B4 (10 sets)
6. "O" ring PN JSB 2410 - P 70 - 12 pcs
7. - do - P110 - 12 pcs
8. "O" Ring 045 each 12 pcs
9. Piston rod PN d. 2841 - 059 - 20 pcs
10. "V" Belt for cooling system 20 pcs.
11. Bearings - 2 set (16 Nos).



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PARTS FOR NISSAN TRUCK TK 20 UD

1. Wind screen (glass front window) Key 28
   PN. 72613 - Z3000 EA 1.
2. Weather strip (rubber) 27, PN.72610 - 92000 EA one
3. Wood Assy top 60. PN.72610 - 92001 EA one
4. Cushion Assy seal PN. 86004 Z9001 EA one
5. Cushion Assistant Seat PN 86300 Z 3000 EA one
6. Batteries 21 plates 12 volts EA 2
7. Voltage regulator 24 Volts EA one
8. Battery relay switch Assy PN.25613 - 90008 EA one
9. Hanes Sppd Indicator Lamp Key 41 PN.24009 Z3000 EA 1
10. Hanes Assy Magnetic valve Key 5 PN.24015 Z 4001 EA L
11. King Pln PN. 40563 - 90009.

ADDITIONAL REQIREMENTS

1. Consumable Material:
   a. Bentonite
   b. Fuel (diesel)
   c. Hydraulic oil
   d. Lubricants

2. a. Submessible pump for pump test
   b. Generator set

MINUTES OF INCEPTION MEETING ON THE FEASIBILITY STUDY ON LOWER HAI AND LOWER ROMBO AGRICULTURAL DEVELOPMENT PROJECT

In accordance with the Scope of Works for the Feasibility Study on Lower Hai and Lower Rombo Agricultural Development Project in the United Republic of Tanzania agreed upon between Japan International Cooperation Agency (JICA) and the Regional Development Directorate (RDD), Kilimanjaro Region on 27th February, 1988, JICA dispatched the feasibility Study team in November 1988. Based on Inception Report submitted to the Government of Tanzania by the Study Team, a series of discussion for the basic approach to the study, plan of operation and work schedule was held between the Study Team and RDD and other authorities concerned.

The following major items were discussed and confirmed.

1. The Inception Report submitted by the Team was satisfactorily accepted by the RDD.
2. RDD will dispatch engineers in charge of the rig to Dar es Salaam for delivery checking of equipment, materials and spare parts supplied by JICA when those goods arrive from Japan.
3. RDD accepted to make all necessary preparations for overhaul of drilling equipment by the time when JICA dispatch a mechanic for drilling machine after the deliver of spare parts.
4. JICA will provide the spare parts of drilling machine and materials, which will be delivered by the end of November, 1988.
5. RDD strongly requested that JICA would further provide necessary materials and spare parts if needed, required for effective execution of the project.

6. RDD and Study Team confirmed that one test well drilling work shall be at least completed by the beginning of March 1989 by RDD so that its ground water tests will be carried out in presence of JICA hydro-geologist.

9th November 1988

Mr. Godwin N. Mgendi
Regional Development Director
Kilimanjaro Region.

Mr. Shin-ichi Yano
Team Leader
Feasibility Study Team
Japan International
Cooperation Agency.

C.P.A. Nyangala
Director,
KADP - Construction &
Development.

Dr. Toshiro Sugahara
Leader of Advisory Mission
Japan International
Cooperation Agency.

MINUTES OF MEETING
ON
THE FEASIBILITY STUDY
ON
LOWER HAI AND LOWER ROMBO AGRICULTURAL DEVELOPMENT PROJECT

Date	:	October 14, 1989
Place	:	Office of Regional Planning Officer
Attendances	:	See List of Attendances

The Feasibility Study Team for the Lower Hai and Lower Rombo Agricultural Development Project and the Advisory Team dispatched by Japan International Cooperation Agency (JICA) and the Regional Development Director (RDD), Kilimanjaro Region held a series of discussion and exchanged views on the Interim Report to be prepared by the end of December 1989 for the Lower Hai and Lower Rombo Agricultural Development Project.

The following were observed and confirmed:

1) As the results of hydrogeological investigation so far carried out, the ample groundwater is obtainable in the Lower Hai area while negligible groundwater from the shallow wells is available in the Lower Rombo area.

2) There exist four (4) perennial surface river flows in the Lower Hai area, most of which are utilized for irrigation in respective river basin. Water balance between the existing water rights and the river flows will be carefully studied. In the Lower Rombo area, one perennial flow of the Lume river is available. The substantial amount of this river flow is utilized for irrigation in Ikuini scheme under rehabilitation of FAO along the lower Lume basin.

3) From the viewpoints of both surface and groundwater availability, land capability, agronomy and agro- and socio-economy, several agricultural development schemes will be identified in the Lower Hai area. On the other hand, economical irrigated agricultural development in the Lower Rombo area is hardly possible in view of negligible groundwater availability from the shallow wells and surface water availability in the rivers.

4) Apart from the present study, RDD expressed the needs of study on rural water supply system as a future development project in the Rombo District.

5) Topographic mapping using aerial photographs mentioned in the Scope of Works for the feasibility study will be carried out for selected agricultural development areas in the Lower Hai area.

6) RDD accepted to carry out supplementary geo-electrical prospecting in the Lower Hai area where ample groundwater potentials were identified through the groundwater test carried out from March to September 1989. The results of electrical prospecting shall be forwarded to JICA Study Team by the end of November 1989 for the study on the available groundwater resources and the preliminary design of production wells. RDD requested JICA to provide further necessary materials and spare parts if needed for the effective execution of above study.

Mr. JULIUS SEMWAIKO
Regional Development Director,
Kilimanjaro Region

Mr. SHINICHI YANO
Team Leader,
JICA Feasibility Study Team

for Mr. C. P. A. NYANGALA
Director,
Construction and Development
Project (KADP)

Dr. TOSHIO SUGAHARA
Team Leader,
JICA Advisory Team

LIST OF ATTENDANCES

Name	Position
Mr. A. J. LWELAMILA	Acting Regional Development Director/ Regional Planning Officer
Mr. E. A. MATOWO	Regional Irrigation Officer
Mr. R. L. DALUTI	Acting Zonal Irrigation Engineer
Mr. B. M. H. LUSEWA	Acting Regional Agriculture and Livestock Development Officer
Mr. E. J. DAMBALL	Regional Water Engineer
Mrs. R. J. BENNE	Planning and Control Officer
Mr. M. E. KESSI	Acting Director, Construction and Development Project (KADP)
Mr. M. WAKABAYASHI	Team Leader, Kilimanjaro Agricultural Development Project (KADP)
Mr. T. YANAGIDA	Irrigation Engineer, Kilimanjaro Agricultural Development Project (KADP)
Dr. T. SUGAHARA	Team Leader, JICA Advisory Team
Mr. Y. NISHIKAWA	Coordinator, JICA Advisory Team
Mr. S. YANO	Team Leader, JICA Feasibility Study Team
Mr. H. MATSUURA	Irrigation and Drainage Engineer, JICA Feasibility Study Team
Mr. Y. SEKIGUCHI	Agronomist, JICA Feasibility Study Team

MINUTES OF MEETING

ON

THE FEASIBILITY STUDY

ON

LOWER HAI AND LOWER ROMBO AGRICULTURAL DEVELOPMENT PROJECT

Date	:	September 3, 1990
Place	:	Office of Regional Development Director
Attendance	:	See List of Attendance

The Feasibility Study Team for the Lower Hai and Lower Rombo Agricultural Development Project and the Advisory Team dispatched by Japan International Cooperation Agency (JICA) held a series of discussion and exchanged views on the Draft Final Feasibility Report with the Regional Development Director (RDD) in Kilimanjaro Region and authorities concerned.

Both sides agreed in principle with the Draft Final Feasibility Report prepared by the JICA Study Team. RDD promised to forward its comments on the Draft Final Report within one (1) month through JICA Tanzania Office in Dar es Salaam.

JICA Study Team will proceed to prepare the (Final) Feasibility Report based on the comments and will submit the Report within two (2) months after the reciept of the comments.

RDD appreciated the provision of following equipment and spare parts by JICA for the study and requested to be handed over to RDD.

(1) One (1) unit of five (5) ton cargo truck with three (3) ton cab back crane (model: CMA81FHR) and standard accessories, and spare parts for above,

(2) One (1) lot of spare parts and equipment for the existing (supplied in 1976) one model: "THS" truck mounted drilling rig, and

(3) One (1) set of vertical water level recorders.

RDD expressed the desire for early implementation of the Project through technical and financial assisstance from the Government of Japan.

Following the negative results to develop agriculture in Lower Rombo through irrigation, RDD expressed the desire to conduct early study on domestic water supply through technical and financial assistance from the Government of Japan.

Mr. JULIUS SEMWAIKO
Regional Development Director,
Kilimanjaro Region

Mr. SHINICHI YANO
Team Leader,
JICA Feasibility Study Team

Mr. C. P. A. NYANGALA
Director,
Construction and Development
Project (KADP)

Mr. TAKASHI TACHIBANA
Team Leader,
JICA Advisory Team

LIST OF ATTENDANCE

Name	Position
Mr. J. SEMWAIKO	Regional Development Director
Mr. A. J. LWELAMILA	Regional Planning Officer
Mr. C. P. A. NYANGALA	Director, Construction and Development Project (KADP)
Mr. C. K. CHIZA	Zonal Irrigation Engineer, Zonal Irrigation Unit (ZIU)
Mr. P. J. SHAYO	Assistant Exective Engineer, ZIU
Mr. M. KANYAWANA	Regional Hydro-geologist, Maji Office
Mr. C. LYIMO	Senior Technician, Maji Office
Mr. G. S. NGALISONI	Assistant Exective Engineer, KADP
Mr. T. TACHIBANA	Team Leader, JICA Advisory Team
Mr. S. YAZAWA	Coordinator, JICA Advisory Team
Mr. S. YANO	Team Leader, JICA Feasibility Study Team
Mr. H. MATSUURA	Irrigation and Drainage Engineer, JICA Feasibility Study Team
Mr. Y. SEKIGUCHI	Agronomist, JICA Feasibility Study Team