

**BASIC DESIGN STUDY REPORT  
ON  
NEW AGRICULTURAL VILLAGE DEVELOPMENT PROJECT  
IN  
KANAKANTAPA AREA, LUSAKA PROVINCE  
IN  
THE REPUBLIC OF ZAMBIA**

July 1991

**JAPAN INTERNATIONAL COOPERATION AGENCY  
(JICA)**

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BASIC DESIGN STUDY REPORT ON NEW AGRICULTURAL VILLAGE DEVELOPMENT PROJECT  
IN KANAKANTAPA AREA, LUSAKA PROVINCE IN THE REPUBLIC OF ZAMBIA

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**(JICA)**

国際協力事業団

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## PREFACE

In response to a request of the Government of the Republic of Zambia, the Government of Japan decided to conduct a basic design study on the New Agricultural Village Development Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Zambia a study team headed by Mr. Yasuo Sakaguchi, Deputy Director, Chikugogawa-karyu Irrigation Office, Kyushu Agricultural Administration Bureau, M.A.A.F. from February 13 to March 16, 1991.

The team held discussions with the official concerned of the Government of Zambia, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Zambia in order to discuss a draft report and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

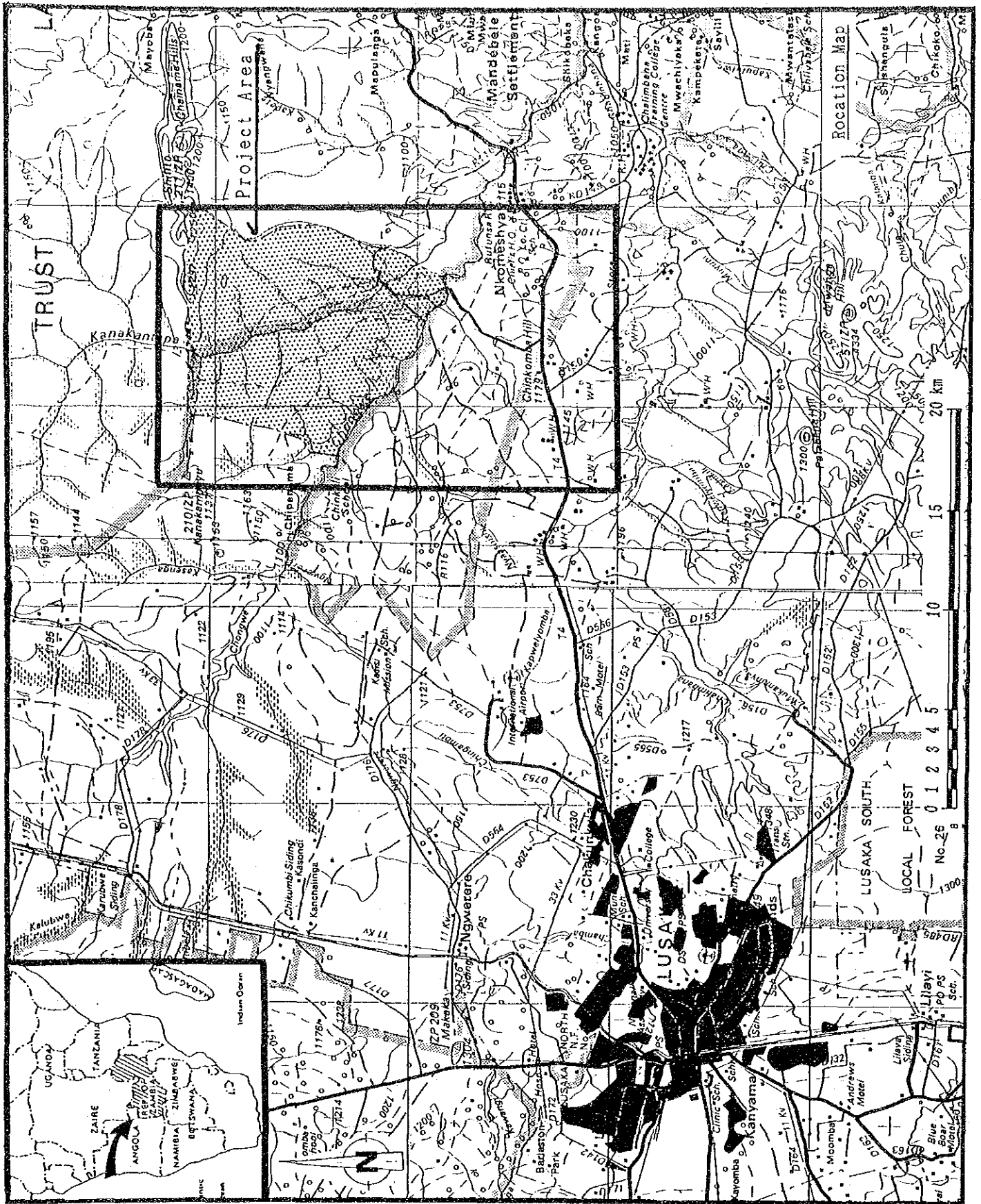
I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Zambia for their close cooperation extended to the team.

July 1991

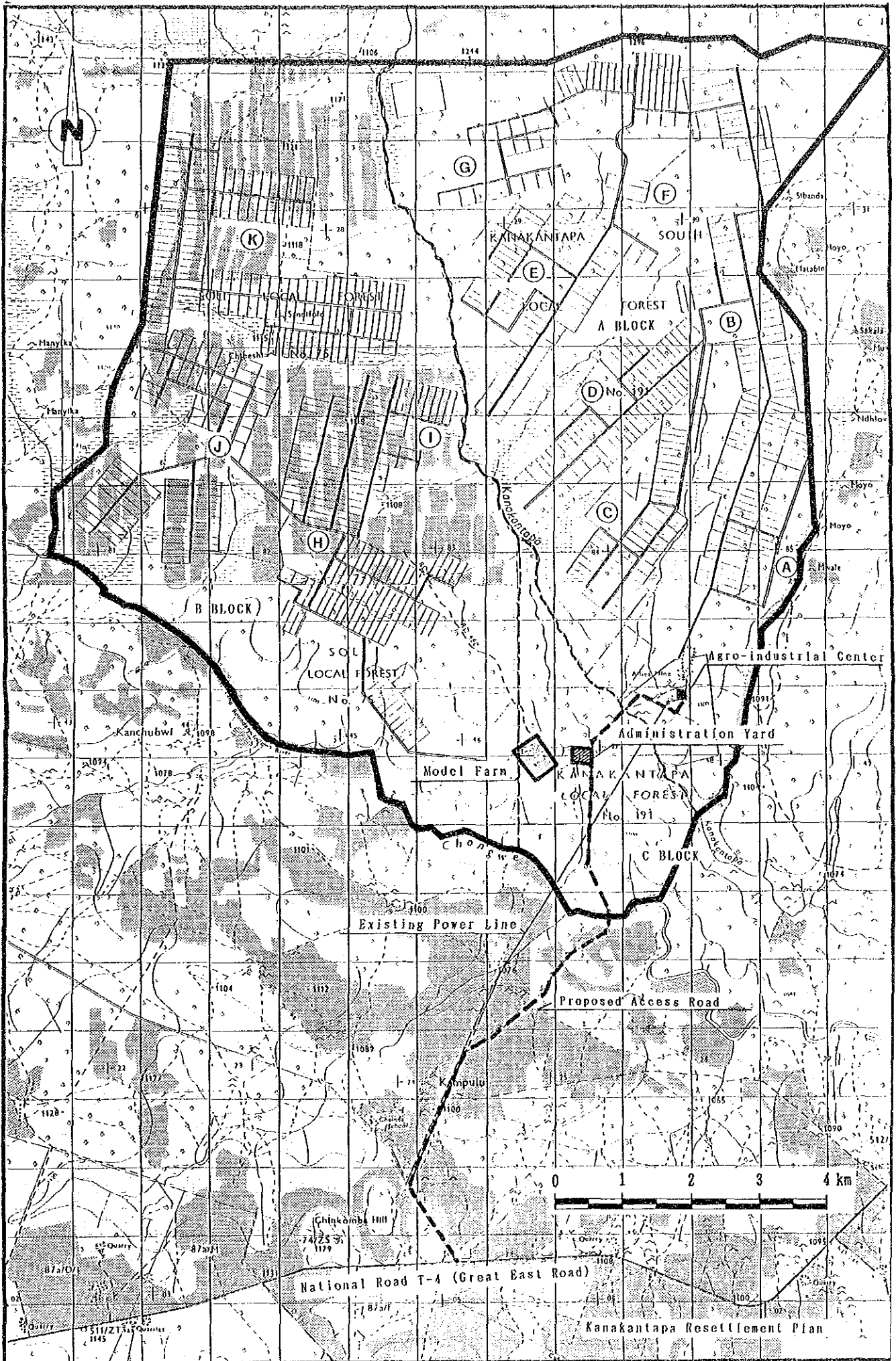


Kensuke Yanagiya  
President

Japan International Cooperation Agency







Kanakantapa Resettlement Plan



## SUMMARY

The economy of the Republic of Zambia (hereinafter refer to as Zambia) had been supported by copper since the country's independence in 1964. Due to the sudden fall of copper price on international markets, the country's economy declined sharply and, as a result, the unemployment rate increased.

In view of above background, the Government of Zambia established the third national development plan(1980 - 84) with considerations of magnification of agricultural product and of employment opportunities. However, as the aggravation of inflation caused by the second oil shock, the devaluation of Kwacha and etc., the target of the third plan was not achieved. After the third plan, the annual plan had been implemented until the establishment of the New Economic Review Plan (1987 - 88). In 1986 The President formed an Ad Hoc Committee, the national resettlement plan was established by the Committee based on the agricultural development. The National Resettlement Plan had been developed to the New Agricultural Village Development Project and Department of Resettlement which is in charge of the Project was started in 1988. The Project has been implementing continually in the Forth National Development Plan (1989 - 93) in which agricultural development and magnification of employment have a high priority.

12 resettlement project areas were selected and the New Agricultural Village Development Project was started in 1988 to resettle the retirees, the unemployed, and the youth. The Kanakantapa Project, in which the project area is 10,300 ha and the land reclamation area is 3,200 ha for cultivation and 800 settlers are expected, is one of the Projects for the youth.

In consideration of the conditions above mentioned and the urgency of the Project, in December 1988, the Government of Zambia requested grant aid cooperation from the Government of Japan for the purpose of accomplishing the Project as soon as possible.

In response to the request, the Japan International Cooperation Agency (hereinafter referred to as JICA) sent the Preliminary Study Team to Zambia from September 30 to October 16, 1990. The Study Team held a series of discussions on the Project with officials concerned of the Government of Zambia, conducted field

surveys, examined the contents of Zambian request, and confirmed the scope of the grant aid cooperation.

Based on the results of the preliminary study, the Government of Japan decided to implement the Basic Design Study for the Project. According to the Japanese Government's decision, JICA sent the Basic Design Study Team to Zambia from February 13 to March 18, 1991. The Study Team held discussions relating to the contents of the Government of Zambian request, conducted field surveys of the Project site, Project related facilities, and construction field conditions, and collected information and data related to the Project.

After returning to Japan, the Study Team analyzed and examined the obtained information and data, prepared the basic design of Project facilities, selected the types of equipment and materials to be provided, and drew up the Project facilities' maintenance and management plan.

After the explanation of the Draft Final report, the Final Report of the Basic Design Study was prepared.

For the purposes of promoting the resettlement programme in the Kanakantapa Area and stabilizing the settlers living situations, the following facility construction and equipment provision will be undertaken by the Project:

1. Improvement of Access Road.

to improve the movement of people, commodities, and information in and around the Resettlement Area and to stabilize the settlers living situations by stimulating economic activities, an access road from National Road T-4 to the resettlement Area will be constructed.

Total length: 10.5 km (section to be improved: 6.2 km;

section to be constructed: 4.3 km)

Major related structures: One bridge and one submersible bridge

2. Training Farm Construction

The objectives of the training farm are to establish an optimum farming system for this area, to provide the settlers with training and guidance in farm management and cropping techniques as well as provide them with

farming work opportunities during the dry season (the farming off-season), and to distribute a portion of the training farm's earned income to the settlers to assist them in improving their living standards.

Training Farm size: 30 ha

Irrigation system: One diversion works and pumping station, approximately 2.5 km of pipeline, one farm pond, distribution piping networks.

### 3. Construction of Buildings

The following buildings necessary for bringing about the smooth operation and management of the training farm will be constructed:

- Management Facility (the management building, and the water supply facility.) : 1 unit 196 m<sup>2</sup>
- Lodging House : 1 unit 132 m<sup>2</sup>
- Garage for Agricultural Machinery and Vehicles : 1 unit 286 m<sup>2</sup>
- Workshop : 1 unit 240 m<sup>2</sup>
- Warehouse : 1 unit 198 m<sup>2</sup>
- Mill Houses : 2 unit 48 m<sup>2</sup>

### 4. Provision of Equipment

The following equipment necessary for the smooth and effective implementation of the Project will be provided.

- Land Reclamation Equipment
- Equipment for training Farm Management and Operations and Cropping Technique Extension Activities
- Equipment for Stabilizing Settlers' Living situations

The implementation period is divided into two phases. The implementation period of phase I is fourteen months with four months of detail design and ten (10) months of construction. And phase II is nine (9) months with three (3) months of detail design and six (6) months of construction and procurement.

After completing Project construction, travelling time from the resettlement Area to Lusaka by ordinary passenger car will be shortened to about 50 minutes. It presently takes one and a half hours to make the trip by a 4-wheel drive vehicle.

Farm products yielded by the 3,200 ha farmland will be quickly shipped to market and the damages to the products during transportation will decrease significantly.

The Government of Zambia still has to develop the remaining 750 ha of land. Once the land reclamation equipment is provided, Government assigned personnel will be able to reclaim the land by themselves.

Furthermore, the equipment to improve existing farm and construct new farm roads, the transportation network within the Area will be greatly improved.

As a result of access road construction, the Area's cultural exchange with Lusaka will progress and economic activities will expand significantly.

As a result of training farm construction, the settlers will not only learn cropping techniques of newly introduced cash crops, but also they will find job opportunities at the farm.

The settlers will gain group work experience, and learn machinery operating techniques and farm management methods, such as selecting markets and purchasing farming materials. They will receive the basic training necessary for the development of the Area's agriculture.

After constructing mill houses, the settlers will be able to obtain high quality maize flour at low cost. The construction of the mill houses and provision of maize hammer mill will greatly contribute to improving and stabilizing the settlers' diet.

As described above, Project construction will contribute immeasurably to the improvement of the settlers' living standards.

Once the resettlement programme in the Kanakantapa Area proves to be successful, it will, as the model area of the programme, have a positive effect on other resettlement areas throughout the country.

In view of the contents and scope of the effects of the Project, implementation of the Project with grant aid cooperation from the Government of Japan is considered to be feasible.

In addition to the construction of Project facilities, technical cooperation for the operation of the training farm and the maintenance and management of the machinery will be needed. Thus, the dispatchment of machinery and farm management experts is required.





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**CHAPTER 1 Introduction**



## CHAPTER 1 INTRODUCTION

The economy of the Republic of Zambia (hereinafter referred to as Zambia) has been supported by copper since the country's independence. But due to the sudden fall of copper prices on international markets in mid-1970's, the country's economy has worsened and the unemployment rate has increased. As a result of this situation, a social problem has developed in the larger cities where the population concentration has increased dramatically.

In view of the above background information, the Government of Zambia established the Department of Resettlement in 1988 under the Fourth Five year National Development Plan (1989-1993) and launched its policy for developing the country's economy by conducting new resettlement in various provinces, alleviating overpopulation in urban areas by providing employment opportunities through agricultural development, and improving agricultural productivity. According to the Government's policy, the Department of Resettlement established the New Agricultural Village Development Project for the purpose of resettling i) retirees, ii) the unemployed, and iii) youths not having steady jobs. Based on the Project, the Government of Zambia started the resettlement programme for youths in Kanakantapa (a planned area of 10,300 ha) in Lusaka Province.

To develop the resettlement land and stabilize the life of the settlers, the Government of Zambia requested grant aid cooperation from the Government of Japan.

In response to the Government of Zambia's request, the Government of Japan decided to conduct a preliminary study to examine the possibility of implementing the project under the grant aid cooperation programme and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent the preliminary study team, headed by Mr. Yasuo Sakaguchi, to Zambia from 30 September to 16 October 1990.

The preliminary study team held a series of discussions on the Project with officials concerned of the Government of Zambia and confirmed the appropriateness of the objectives and contents of the Project and the necessity of Project facilities and equipment.

Based on the results of the preliminary study, the Government of Japan decided to conduct the Basic Design Study of the Project. According to the decision, JICA sent the Basic Design Study Team headed by Mr. Yasuo Sakaguchi, who was also the leader of the preliminary study team, to Zambia from 13 February to 18 March 1991.

The Study Team confirmed the contents and background of the Government of Zambia's request based on the results of the preliminary study. The Study Team conducted field surveys to examine the feasibility of implementing the Project under the Japanese Government's grant aid cooperation programme including the contents and scope of the cooperation and the effects of the grant aid, and performed information and data collection concerned with the Project.

After returning to Japan, the Study Team, based on the field survey results, conducted the examination of Project feasibility, preparation of the basic design of Project facilities, selection of equipment and materials to be provided, estimation of Project costs, and preparing the Project facilities' maintenance and operation plan. As a result, the Draft Final Report was prepared.

JICA dispatched the study team headed by Mr. Yutaka Hosono for the explanation of the Draft Final Report to Zambia from 5 to 15 July 1991. The study team explained and discussed carefully on the development plan and etc. with the Government of Zambia.

Based on the final meeting with the Government of Zambia, the study team collected and improved the report and this report, the Final Report of the Basic Design Study for the Project, has been prepared.

## **CHAPTER 2**

### **Background of the Project**



## CHAPTER 2 BACKGROUND OF THE PROJECT

### 2-1 Background of the Project

As described in the previous chapter, the economy of Zambia has worsened due to the sudden decline of copper prices on the international market in mid-1970's. This has caused an increase in the unemployment rate, further population concentration in urban areas, and various social problems. In view of this situation, an ad hoc committee to cope with the unemployment problem was established in 1986. The committee proposed a build up of self-employment in the agricultural sector, i.e., a resettlement project as the most practical measure. Furthermore, it was proposed to establish a resettlement programme and form a new administrative organization that would be responsible for its promotion. As a result, the Department of Resettlement was formed in the Prime Minister's Office.

Under the Fourth Five Year National Development Plan (1989 - 1993), the Department of Resettlement (formed in 1988) drew up the economic redevelopment policy in which the New Agricultural Village Development Programme is to be launched, new resettlement lands are to be developed in each province, the population concentration in urban areas is to be alleviated by providing employment opportunities through agricultural development, and the agricultural productivity is to be increased.

The New Agricultural Village Development Programme consists of ten projects for the resettlement of retirees and unemployed persons, and two projects for the resettlement of youths not having steady jobs. This programme has been carried out since 1988. A resettlement programme in Kanakantapa, the Project Area, belongs to the latter project. The programme started in May 1988 and this will be its third year. Plans call for settlement of approximately 800 youths. Thus far, 621 have been settled. The programme is progressing quite well. However, due to the shortage of capital and equipment units, only 750 (approx.) ha out of 1,600 ha of the Government planned reclamation area has been developed. Furthermore, the access road to the area has not been developed and the poor road conditions hinder the transporting of agricultural use materials, living necessities, and outbound agricultural product.

As irrigation facilities have not been installed, the settlers cannot cultivate their land during dry seasons and is the main reason why these people suffer from stress. The settlers must exist on subsidized living necessities and food provided by the Department of Resettlement. If this situation continues, the resettlement of people will be jeopardized.

In December 1988, the Prime Minister's Office's Department of Resettlement requested grant aid cooperation from the Government of Japan for the promotion of the New Agricultural Village Development Project in the Kanakantapa Area. The request includes not only cooperation for land development but for the management and guidance of farming techniques and the resettlement plan in view of the expectations of disseminating the effects of the Project throughout the entire country.

The organizational structure and other related organizations are shown in Fig. 2.1.1.

## 2-2 Outline of the Request

### 2-2-1 Outline of the Request

The contents of the request made in 1988 by the Government of Zambia were mainly for the provision of construction equipment required for land development. The contents of the request given to the preliminary study team in October 1990 covers the following facilities including the construction of irrigation facilities:

A) Land Clearing and Farm Land Development: 650 ha (for the Department of Resettlement)

B) Road Development:

Access Road:	10.7 km
Culverts:	9 crossings

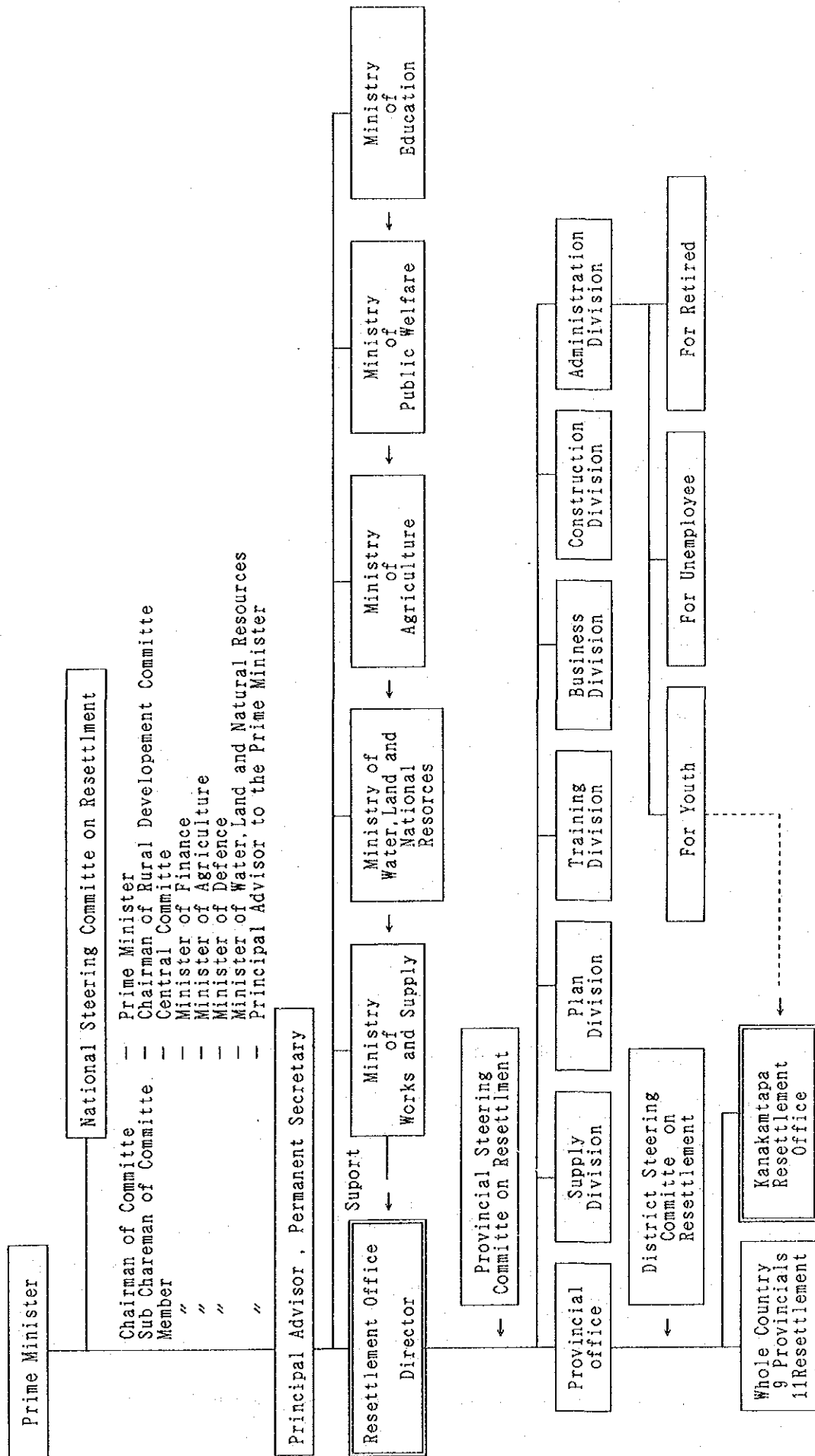
C) Internal Roads:

Main Estate Roads:	61 km (formation 7.5 m and carriageway 5.5 m widths)
Estate Roads:	38 km (class iv)

D) Water Supply:

Administration Center:	For 600 people (2 boreholes)
------------------------	------------------------------

Fig. 2.1.1 Organization Structure



Villages:	10 villages (20 boreholes)
E) Electrical Facilities:	
Supply Line:	7 km
Transformers:	200 kva
F) Social Facilities:	
Hospital:	9 to 16 beds
Grade and Basic Schools:	9 classrooms
Meeting Places:	
Workshop:	
Storage Sheds:	
G) Irrigation Facilities:	Gravity flow irrigation for 150 ha
H) Equipment Units	
Tractors:	2 for farming
Graders:	2 for road improvement
Maize Mills:	6
Maize Shellers:	10
I) Vehicles:	
Trucks (10-ton class)	2
Land Cruisers:	3
Motorcycles:	6

#### 2-2-2 Confirmation on the Scope of the Request

In response the request made by the Government of Zambia, the preliminary study team had a series of discussion with officials of the Government of Zambia so as to confirm the content of the request. At the same time, for the purpose of justifying the Project and identifying the scope of the technical cooperation under the grant aid programme of the Government of Japan, the following items were examined.

- A) Improvement of the main road.
- B) Construction of small irrigation system.
- C) Construction and provision of water supply facilities.



D) Provision of construction and farming equipment.

### 2-2-3 Confirmation on the Scope of the Project for the Basic Design Stage

As the Rural Water Supply Project will be implemented under another grant aid programme of the Government of Japan, the construction and provision of water supply facilities is excluded from this Project. Consequently, it was confirmed between officials of the Government of Zambia and the basic study team that the following works and provision of equipment and machinery shall be included in the scope of the Project.

A) Improvement of the main road.

Improvement of the access road to the Project Area from the National road (T-4)

B) Construction of small irrigation system.

Construction of the training farm with irrigation system including installation of the facilities for the management of the farm and for operation and maintenance of the equipment to be provided.

C) Provision of construction and farming equipment.

Provision of the equipments for development of road and farm land and for operation of the training farm.

### 2-3 Outline of the Project Area

#### 2-3-1 Location

The Project Area is located 42 km northeast of the Capital Lusaka in the Lusaka Province. The Area stretches approximately 15.5 km in a north-south direction and about 10.5 km in an east-west direction. The Area covers approximately 10,300 ha.

National Road T-4 (Great East Road) that runs from Lusaka to Marawi through Chipata in the Eastern Province passes about 10 km south of the Project Area. Two unpaved access roads lead to the Project Area from the National Road.

### 2-3-2 Society and Economy

The Project Area is situated in Chongwe of the Lusaka Rural District in the Lusaka Province. A District Branch Office that conducts the rural administration work is located in Chongwe.

In the Project Area which is under the direct control of the Department of Resettlement a resettlement project is progressing. The Department of Resettlement has its office and staff within the Project Area and is implementing the resettlement project with the cooperation of other departments and is providing guidance to the settlers.

Presently the settlers live on the daily necessities provided by the Department of Resettlement and those products they themselves are able to produce. The town nearest the Project Area is Chongwe which is 10 to 15 km away. Since there is no means of transportation between the Area and Chongwe, settlers rarely go out of the Area. Only when the settlers wish to sell their charcoal or vegetables or when they need to purchase vital goods do they go to Chongwe. Most of the settlers come from outside the District and rarely do they visit their relatives in Lusaka or other areas. Their living zone is limited to a small area.

### 2-3-3 Topography

The Project Area's highest plateau is located in its northern sector. Its highest point is approximately 1,200 m above sea level. The plateau is a gentle plain the slopes southward. The southern border along the Chongwe River Valley is the lowest point with an elevation of 1,070 m above sea level. The average elevation in the Area is about 1,120 m above sea level.

The Kanakantapa River, a tributary of the Chongwe River, cuts through the centre of the Project Area. A number of dambos (marshland) have developed from the two rivers. Within the Project Area, marshland is not being used for growing crops; it is reserved for communal land for grazing or conservation areas.

In the undeveloped area there are many Mionbo trees that are from 50 to 200 years old.

## 2-3-4 Climate and Hydrology

### (1) Climate

The Project Area's climate can be classified into two seasons: the rainy season from November through April, and the dry season from May through October. The dry season can be divided into the cold dry season (May through July) and the hot dry season (August through October).

The average annual rainfall is about 900 mm. More than 95 percent of the rainfall occurs during the rainy season. In particular, more than 70 percent of the rainfall is concentrated during the four-month period from December to March.

Meteorological data observed at the Lusaka International Airport are shown in Table 2.3.1 and Fig. 2.3.1.

### (2) Hydrology

#### 1) Rainfall Analysis

##### 1. Drought year Rainfall

The annual rainfall observed at each station was analyzed for the drought year and the results are shown in Table 2.3.2.

The rainfall data observed at the Kasisi Mission Observation Station was used for the Project plan.

##### 2. 24-hour Maximum Rainfall

The 24-hour maximum rainfalls observed at the Kasisi Mission observation Station were probabilistically analyzed and the results are shown in Table 2.3.3.

Table 2.3.1 Climatic Condition of Lusaka (Lusaka Int. Airport Station)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
Rainfall(mm) *1	0.1	0.2	1.9	16.4	90.0	199.4	241.6	211.1	114.6	35.5	2.7	0.0	913.6
Max. Temperature (°C) *2	23.9	26.0	29.7	31.5	30.4	27.7	27.3	27.2	27.5	27.0	25.8	23.7	27.3
Min. Temperature (°C) *2	7.2	9.2	13.0	16.1	17.3	17.9	17.0	17.3	16.5	14.0	10.7	7.7	13.7
Mean Temperature (°C) *2	14.9	17.4	21.4	23.4	23.5	21.7	21.5	21.5	21.1	19.8	17.5	15.1	19.8
Relative Humidity (%) *3	60.5	53.2	46.8	51.0	61.0	77.9	80.5	80.1	79.4	68.6	64.8	64.8	65.7
Evaporation (mm/day) *4	6.2	7.4	8.6	8.7	7.9	5.2	5.7	5.0	6.0	6.5	6.9	6.4	6.7
Windspeed (m/s) *5	3.7	4.2	4.3	4.2	3.2	2.6	2.2	2.4	2.9	3.2	3.1	3.5	3.3

\*1 1972~1990

\*2 1969~1990

\*3 1978~1989

\*4 1974~1990

\*5 1969~1980

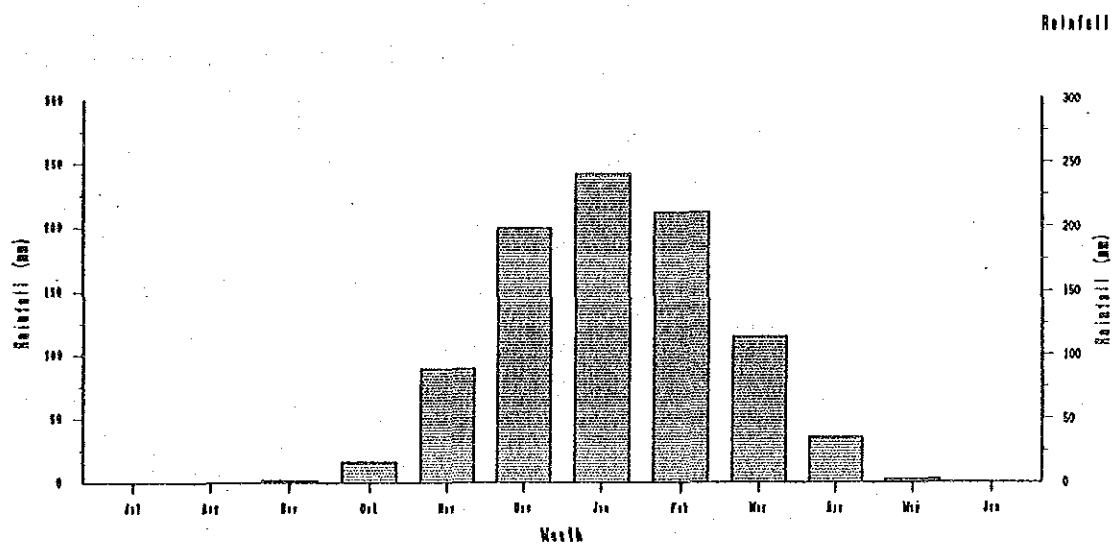
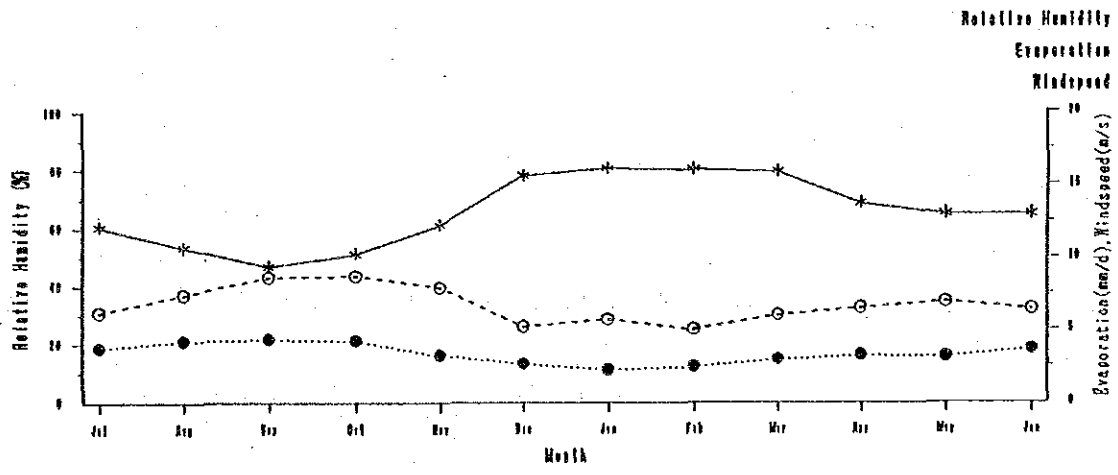
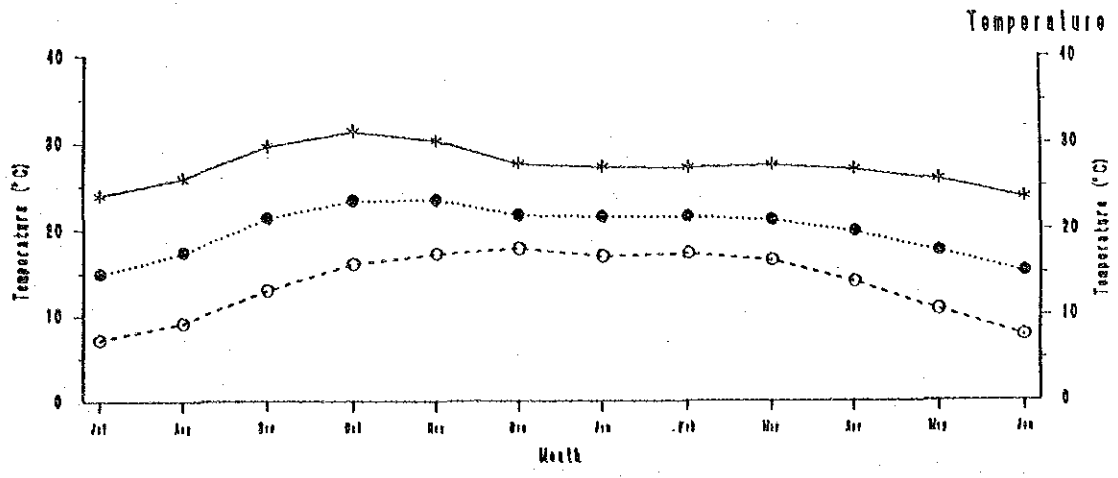


Fig. 2.3.1 Climatic Condition of Study Area  
(Lusaka Int. Airport Station)

Table 2.3.2 Drought Annual Rainfall in Different Return Periods (mm)

Station	Return Period			
	2 Years	5 Years	10 Years	20 Years
Lusaka International Airport	890	728	655	600
Chongwe	822	647	571	514
Chalimbana Agriculture Centre	823	672	603	551
Kasisi Mission	872	680	590	522

Table 2.3.3 24-hour Maximum Rainfall (mm/day)

Station	Return Period			
	2 Years	5 Years	10 Years	20 Years
Kasisi Mission	63.5	78.1	86.4	93.7

### 3. Continuous Drought Days

Continuous drought days (rainfall less than 5 mm/day was considered as no rain) observed at the Kasisi Mission Observation Station were probabilistically analyzed and the results are listed in Table 2.3.4.

Table 2.3.4 Continuous Drought Days in Different Return Periods (days)

Station	Return Period			
	2 Years	5 Years	10 Years	20 Years
Kasisi Mission	183	210	225	238

### 2) Runoff Analysis

For the Chongwe River, the runoff analysis was made based on data observed at the Road Bridge (Code No. 5-025, a catchment area of 1,891 km<sup>2</sup>).

for the Kanakantapa River, the runoff was estimated based on data observed at Code No. 5-025 and at the Kanakantapa Observation Station (having a catchment area of 376 km<sup>2</sup>) by using the correlation equation (correlation coefficient was 85%).

The runoff analyses were made at the planned water intake points in the Chongwe River and the Kanakantapa River (having respective catchment areas of 1,215 km<sup>2</sup> and 441 km<sup>2</sup>).

### 1. Drought Water Discharge

The droughty water discharge at the planned water intake point in the Chongwe River was probabilistically analyzed. The analyzed results are listed in Table 2.3.5.

The droughty water discharge at the planned water intake point in the Kanakantapa River is 0.0 m<sup>3</sup>/s.

Table 2.3.5 Droughty Water Discharge at the Planned Water Intake Point in the Chongwe River (m<sup>3</sup>/s)

Intake Point	Return Period			
	2 Years	5 Years	10 Years	20 Years
Chongwe River	0.517	0.055	0.031	0.018

### 2. Discharge Pattern

The average discharge patterns at the planned water intake points are shown in Fig. 2.3.3. The discharges in different return periods during each month is listed in Table 2.3.6.

### 3. Flood Discharge

The flood discharges in different return periods at the planned water intake points are listed in Table 2.3.7.

Table 2.3.7 Flood Discharges at the Planned Water Intake Points (Average Daily Maximum) (m<sup>3</sup>/s)

Station	Return Period			
	2 Years	5 Years	10 Years	20 Years
Chongwe River	95	172	235	307
Kanakantapa River	48	82	108	134

Table. 2.3.6. Discharge Pattern (m<sup>3</sup>/s)

	Return Period	Month												Annual
		Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	
Chongwe Proposed Intake Site	1/2	1.244	0.942	0.680	0.560	0.703	3.778	9.794	18.209	11.580	5.039	2.033	1.421	4.665
	1/5	0.728	0.551	0.398	0.328	0.411	2.209	5.729	10.650	6.773	2.947	1.189	0.831	2.729
	1/10	0.525	0.398	0.287	0.237	0.297	1.595	4.136	7.689	4.890	2.128	0.859	0.600	1.970
	1/20	0.386	0.292	0.211	0.174	0.218	1.171	3.037	5.646	3.591	1.562	0.631	0.440	1.447
Kanakantapa Proposed Intake Site	1/2	1.002	0.679	0.000	0.000	0.000	2.103	6.316	10.855	7.485	3.736	2.601	1.217	3.086
	1/5	0.561	0.000	0.000	0.000	0.000	1.178	3.537	6.078	4.191	2.092	1.457	0.682	1.728
	1/10	0.000	0.000	0.000	0.000	0.000	0.874	2.626	4.513	3.112	1.553	1.081	0.506	1.283
	1/20	0.000	0.000	0.000	0.000	0.000	0.687	2.063	3.546	2.445	1.220	0.850	0.000	1.008



(3) Water Right

In Zambia, it is necessary to get the water right in all case when water from rivers (including other water sources such as lakes and ponds) is used. For getting the water right, based on the Water Act (Laws of Zambia, Vol.V Cap. 312), it is necessary to describe the purpose, site, volume of intake water, water use plan and etc. and to submit a application of water right to "Water Board" (composed of Ministry of Water, Land, and Natural Resources, Ministry of Agriculture and etc.) and the water right is judged and approved by this organization. The judgment is carried out about twice (irregular) per year with a consideration of water use condition of other facilities (including public announcement on news paper and other media).

For the Project, the application of water right was submitted already and it is hoped that the temporary water right will be given in August, 1991 while a Permanent Water Right will be considered in May, 1992.

The following two facilities, which are working presently, are concerned with the water right of Chongwe river which is proposed water source of this Project.

a) Rural water supply of Chongwe village

240 m<sup>3</sup>/day (5.5 liter/sec for 12 hours/day) of water is pumped up for 12,000 of habitants.

b) Irrigation water for commercial farm

1,000 m<sup>3</sup>/day (25.0 liter/sec for 12 hours/day) of water is pumped up for 35 ha of commercial farm.

The volume of proposed intake water for this Project is 3,400 m<sup>3</sup>/day (50.0 liter/sec for 19 hours/day). The total volume of intake water become to be 4,640 m<sup>3</sup>/day. On the other hand, the drought discharge of the Chongwe river for 5 year return period is 7,340 m<sup>3</sup>/day. Therefore, there is no problem for water volume.

## 2-3-5 Soils and Land Use

The main types of soils in the Project Area are the Luvisoil-Phaeoxum which originated from granite, gneiss, and sandstone. The soils in the Project Area can be classified into the following types:

- a) Arable Land: Land having dark brown or brown fine loamy soil with coarse clayey or sandy top soil. The land is well drained and suitable for cultivation. The land occupies 33% of the Project Area.
- b) Semi-arable Land: Land having dark yellow coarse clayey soil or sandy soil mixed with gravel being well drained. The land occupies 39% of the Project Area and can possibly be used as farmland.
- c) Land Suitable for Forests: Land having coarse loamy, sandy, or rocky soil covers approximately 7 percent of the Project Area. This land will be reserved for building materials and fuel.
- d) Grazing Land: Land having well drained blue-green clayey soil or coarse clayey loamy soil. It is suitable for stock breeding during dry seasons. Approximately 9 percent of the Project Area is comprised of this type of land.
- e) Marshland: The marshland is lowlying poorly drained land called "dambos." 11% of the Project Area is marshland. Marshland soil is comprised of peat, dark silt, blue-green or gray clayey soil, coarse clayey soil, fine sand or solidified sandy soil.
- f) Hills: 3 percent of the Project Area is tree-covered hills.

## 2-3-6 Infrastructure Condition

### (1) Domestic Water

Rainwater or water from near streams is used for domestic purposes during the rainy season. During the dry season, people must draw water from the remote Kanakantapa River. Just prior to the start of the rainy season, the Kanakantapa River does not flow; settlers are obliged to use the water that has ponded in the riverbed.

During the last dry season, each village started to drill boreholes, but only half of the villages were able to establish wet wells.

### (2) Roads

There are two poor access roads leading from National Road T-4 to the Project Area. 30 km of estate roads have been constructed in the Area, but their conditions are poor.

### (3) Educational Facilities

There are no educational facilities in the Project Area. To attend the school in Chongwe that is located alongside National Road T-4, the children have to walk from 10 to 15 km each way.

### (4) Medical Facilities

There is only one clinic located within the Project Area. since last year this clinic has been staffed by one pharmacist and his assistant. During the first three and a half years after the opening of the resettlement land and prior to the establishment of the clinic three people died. Persons suffering serious illness must be sent to Lusaka. The need for improving the medical facility and for establishing an emergency patient transportation system are highly desirable.

(5) Agricultural Extension

Two agricultural extension specialists are dispatched from the Agricultural Office in the Lusaka Rural District.

Due to the lack of extension policies and insufficient budgetary funds, proper agricultural extension is not provided. It is highly desirable that the settlers be provided with agricultural training.

2-3-7 Outline of the Resettlement Project in Kanakantapa

(1) Resettlement Programme and Its Present Condition

As a part of the New Agricultural Village Development Project, the Youth Resettlement Programme initially started May 1, 1988.

The objectives of the programme established by the Department of Resettlement are as follows:

- a) To reduce unemployment by making use of the abundant manpower and undeveloped arable land.
- b) To develop the agricultural industry by increasing food production, industrial materials, and by exporting the products.
- c) To develop rural areas by providing water and electricity supplies and improving public facilities such as medical, etc.

During the 1988 June-August period when the announcement of the establishment of the settlement was advertised, there were more than 1,000 people applied for resettlement. After screening the applicants, 36 people were selected as the first settlers. During the first year of the Programme, 621 people settled in the Area.

Prior to starting the settlement, the Department of Resettlement, with the cooperation of the Ministry of Agriculture, established the land use plan and then began the land clearing and farmland development.

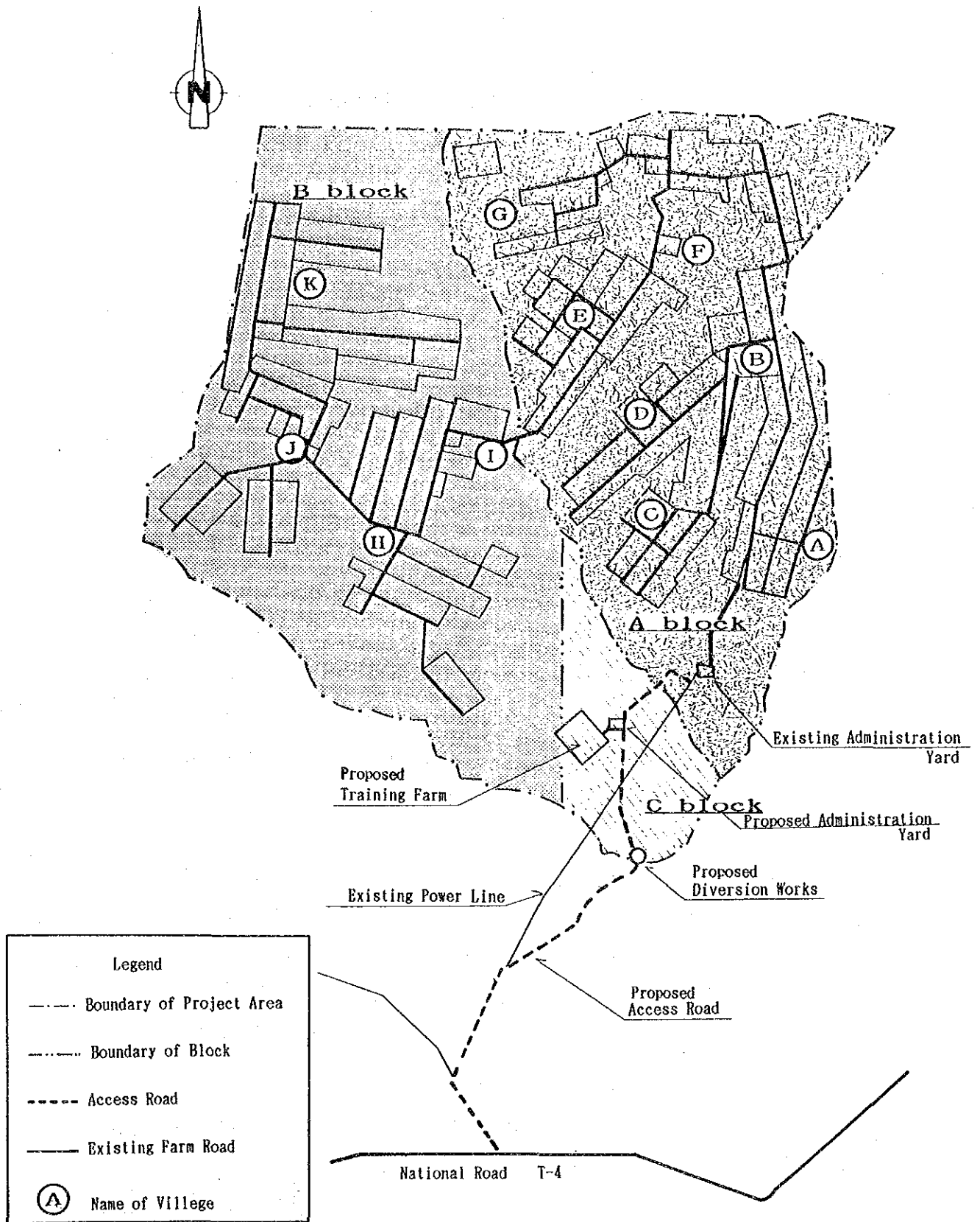


Fig. 2.3.2 Kanakantapa Project Area

One plot of settlement land is 4 ha in size of which 2 ha is cleared by the Department of Resettlement. The remaining 2 ha is to be cleared by the settler.

Until the lives of the settlers are steered in the right direction, the Department of Resettlement provides them with daily necessities, seeds, and food.

(2) Provision for Supporting Settlers

Planned and actually offered provisions for the settlers are listed in Table 2.3.8.

Table 2.3.8 Planned and Actually Offered Provisions for Settlers

<u>Planned</u>	<u>Actual Condition</u>
(1) Each settler is to be allocated 4 ha of land. 2 ha is to be reclaimed by the Department of Resettlement and 2 ha is to be reclaimed by the settler	(1) 4 ha of land was provided to each settler. The Department has reclaimed an average of 1 ha of land per each settler. The remaining land reclamation work is in the planning stage.
(2) Title to the land will be issued to each settler	(2) Not yet issued
(3) Communal land for grazing and livestock breeding is to be provided	(3) Demarcation of the communal land has been completed
(4) Basic agricultural tools, such as a hoe, axe, fork, etc. are to be provided	(4) They were provided
(5) Provision of maize flour (staple food in Zambia) until the first harvest.	(5) Even 3 years after starting the resettlement programme, not only maize flour but also meat, salt, cooking oil, and daily necessities such as soap, etc. are provided.
(6) Provision of blankets and clothes to the settlers	(6) They were provided
(7) Provision of daily necessities such as pots, plates, baskets, etc.	(7) They were provided.
(8) Installation of communal infrastructure such as water supply, roads, clinics, etc.	(8) Being installed

## CHAPTER 3

### Outline of the Project



## CHAPTER 3 OUTLINE OF THE PROJECT

### 3-1 Objectives

In Zambia, due to the worsened economy caused by the mid-1970's sudden decline in copper prices on international markets, there has been a marked increase in the number of unemployed people which has created serious social problems. To alleviate this situation, the Government of Zambia established the land Resettlement Programme with its objective being to decrease the unemployment rate by providing employment opportunities in the agricultural sector and to develop agricultural productivity. They have also initiated the New Agricultural Village Development Project.

The resettlement programme in Kanakantapa (the Project Area for the Study) is one of the New Agricultural Village Development Projects and was started in 1988. However, due to the lack of capital, land reclamation equipment units and agricultural extension leaders, the construction of agricultural infrastructures and farm development have been delayed.

As there are no installed irrigation facilities, the settlers are unable to cultivate their land during dry seasons. The settlers are living under unstable conditions.

It is intended to complete agricultural foundation development in the Project Area at an early stage, to promote the resettlement programme, to provide settlers with training sites where they can receive guidance in farm management and cropping, and to provide farmland that can be cultivated by the settlers themselves during dry seasons by conducting the following undertakings under the Japanese Government's grant aid cooperation programme:

- 1) Construction of an access road to the Project Area
- 2) Construction of a training farm with irrigation facilities
- 3) Provision of land reclamation, construction, and farming equipment units.

## 3-2 Study and Examination of the Request

### 3-2-1 Feasibility and Necessity of the Project

As described in the previous section, the contents of the Project can be categorized as follows:

- 1) Construction of an access road
- 2) Construction of a training farm with a small irrigation system
- 3) Provision of equipment units necessary for land reclamation, farmland development, and training farm management.

The implementation of the Project will greatly contribute to achieving self-sufficiency of food supplies by promoting agricultural development (the country's most important subject) and for increasing employment opportunities in the agricultural sector. Thus, the Project can be evaluated as being one of the Zambia's most urgent projects.

The Resettlement Project in Kanakantapa is presently underway. As the resettlement began when the farmland partially developed, the land area that the settlers can cultivate is insufficient.

The construction of infrastructures for new comers is highly demanded. For the promotion of the Resettlement Programme in Kanakantapa, the construction of an access road, land reclamation and farm development, and the provision of equipment and materials would be necessary.

Without an irrigation system the settlers are unable to farm during dry seasons which causes them to live under unstable conditions. Added to this is the fact that most of the settlers have no farming experience. Thus, the construction of a training farm where settlers can engage in actual farming under the guidance of qualified instructors and where they can learn farming techniques and management takes on a great meaning for assisting the settlers in Kanakantapa as well as for smoothly promoting the resettlement programme.

For the above reasons, the implementation of the Project is essential for the promotion of the resettlement programme in Kanakantapa. Additionally,

the Project implementation is believed to be in accord with the objectives of the Japanese government's grant aid cooperation programme is considered to be feasible.

### 3-2-2 Necessary Conditions for the Project

The following conditions will be required for realization of the Project.

1. Aquisition of water right on the Chongwe river for the irrigation of the training farm
2. Improvement of electric facility to the site
3. Completion of the organization for implementation
4. To ensure necessary budget
5. Technical cooperation by japanese experts

### 3-2-3 Project Components

The Project consists of the construction of an access road, the construction of a training farm, the provision of equipment, and the construction of buildings necessary for the management of the training farm and the provision of training farm equipment.

#### (1) Road Construction

An access road from National Road T-4 to the resettlement area is to be constructed for the purpose of improving the living conditions of the settlers, and for the future development of the area. definite objectives of the access road construction area as follows:

- 1) Together with the construction and improvement of estate roads, the access road will make it easier to bring in necessity items and to transport farm products out of the area.
- 2) The access road will be instrumental in maintaining the quality of farm products being transported to the market. This, in turn, will result in improved and stabilized product prices.

- 3) The access road will secure a commuting route for farm instructors and specialists coming from Lusaka.
- 4) The access road will facilitate the resettlement area to promote cultural and economic exchanges with nearby cities.

## (2) Construction of Training Farm

Most of the settlers have no farming experience. The training farm will provide the settlers with farm management and farming technique instructions. The training farm will also provide settlers with the opportunity to work during dry seasons by allowing them to participate, as trainees, in its management. A portion of the training farm's earned income will be distributed to help support the settlers.

The facilities necessary for the training farm are as follows:

- 1) Water intake and conveyance facilities:  
Facilities for pumping water from the Chongwe River and convey it to the training farm.
- 2) Farm Pond:  
A pond to control the difference between intake water and the actual irrigation water.
- 3) Farm Facilities:  
On-farm roads, irrigation facility and drainage facility.

## (3) Provision of Equipment and Materials

The equipment and materials to be provided can be classified as follows: land reclamation equipment; equipment and material for training farm operations and management and farming extension activities; and the equipment needed to stabilize the lives of the settlers.

1) Land Reclamation Equipment:

Equipment needed by the Government of Zambia to reclaim 750 ha of land within the 10,300 ha Kanakanpata resettlement area is to be provided.

2) Equipment and Materials for Training Farm Operation and Management and Farming Extension Activities:

A training farm having a small irrigation system is to be constructed. This farm will be the center of farming technique extension activities for the settlers and will provide them with a secure place of work during dry season.

3) Equipment Needed to Stabilize the Lives of the Settlers:

Maize hammer-mills (with diesel engines) will be provided to assist the settlers in the stabilization of their diets.

(4) Building Facilities:

Building facilities -- a administration facility, garages for farm machines and vehicles, a workshop, a warehouse, and mill houses -- will be needed.

1) Administration Facility

The administration facility will include a building, lodging house and a water supply system.

2) Workshop

A workshop is to be built where the maintenance and repair of equipment and machinery can be performed. The workshop will have a repair space, parts storage area, and an office.

3) Garages for Farming Machinery and Vehicles

Roofed garages for machinery and vehicles are to be provided.

4) Warehouse

A warehouse for the storage of grain, fertilizer, and agricultural medicine will be installed. The grain storage will be used to

temporarily store the grain harvested at the training farm until it is sent to the market. An open shed for sorting or drying farm products will also be installed.

5) Mill Houses

Maize hammer-mill houses working spaces are to be built. Each mill house will contain one maize hammer-mill.

### 3-2-4 Examination of Request Contents

#### (1) Road Construction

Routes from Lusaka to the Kanakantapa resettlement area via National Road T-4 were examined from the following aspects:

- ① Distance to the final destination and the topography of the routes;
  - ② Road construction costs including related structure construction costs;
  - ③ Difficulty of future road maintenance and management, and distance from Lusaka.
- 1) Comparison of Distances to Final Destination and the Topography of the Routes:

For access from National Road T-4 to the Kanakantapa resettlement area there are two alternative routes. One can start from the eastern point of the Chongwe Bridge -- this is the eastern route that was originally requested (total length: 10.7 km). The other route can start from Chikomba Hill, pass through Kampula Village, cross the Chongwe River at a point approximately 11 km upstream from the Chongwe Bridge, and enter the center of the resettlement area passing through the "C" Block of the area -- this is known as the western route (total length: 10.5 km).

The eastern route must cross Kapete River and two additional rivers that form dambos, and three streams. This route is quite undulated and has very steep slopes. During rainy seasons the water flows down the road like a rapid stream. At such times passenger vehicles cannot travel on the road.

In contrast to the eastern route, the western route runs from the Chikaba Hill and follows its continuing plateau ridge. Undulation of the route is slight and the slopes are mild (see Fig. 3.2.2). The area along the 7 km section to the Chongwe River is farmland and rainwater does not flow towards the road. The field survey of the road was made during the latter part of the rainy season and the road conditions were not considered poor. As this route crosses the upper part of the Chongwe River a new bridge would have to be constructed.

## 2) Construction Costs of Road and Related Structures

The eastern route crosses small rivers at six points. Along the route there is one small bridge and one submersible bridge. For route improvement, four new submersible bridges (total length: 60 m), including one for the Kanakantapa River, must be built.

As this route courses over mountain slopes, rainwater tends to flow on it. To prevent this, wide side ditches would have to be constructed. It would be costly to provide the erosion protection work and maintenance for this route. Also, it would be necessary to pave approximately 2 km of submersible bridge connecting portions and steep slope sections with concrete.

The same as for the eastern route, the western route requires the construction of a 15 m submersible bridge in the Kanakantapa River. It would also require the construction of a bridge over the Chongwe River. Two culverts would have to be installed (one where the access road connects with National Road T-4; the other at the approaching section to T-4).

Since the road slopes are mild, the placement of gravel pavement and the improvement of the side ditches would be sufficient for the access road. No other structures would be required.

It is estimated that the construction costs for the 60 m length of submersible bridges and the 2 km long concrete pavement on the eastern route would almost be the same as for the 15 m long submersible bridge and the 45 m long bridge on the western route.

3) Difficulty of Road Management and Maintenance and the Distance from Lusaka

Even though the eastern route has concrete paved sections, it would be more difficult to manage and maintain than the western route because it runs over mountain slopes. Cost for the western route's side ditch maintenance and management would not be as expensive as for the eastern route.

This distance from Lusaka along each route is as follows (Fig. 3.2.1 refers):

Eastern Route (Lusaka-Chongwe Bridge-Project Area):	61 km
Western Route (Lusaka-Chinkanba Hill - Project Area):	50 km

4) Conclusion

As a result of the above examination, the western route excels the eastern route in all aspects. Hence, it was decided to use the western route.



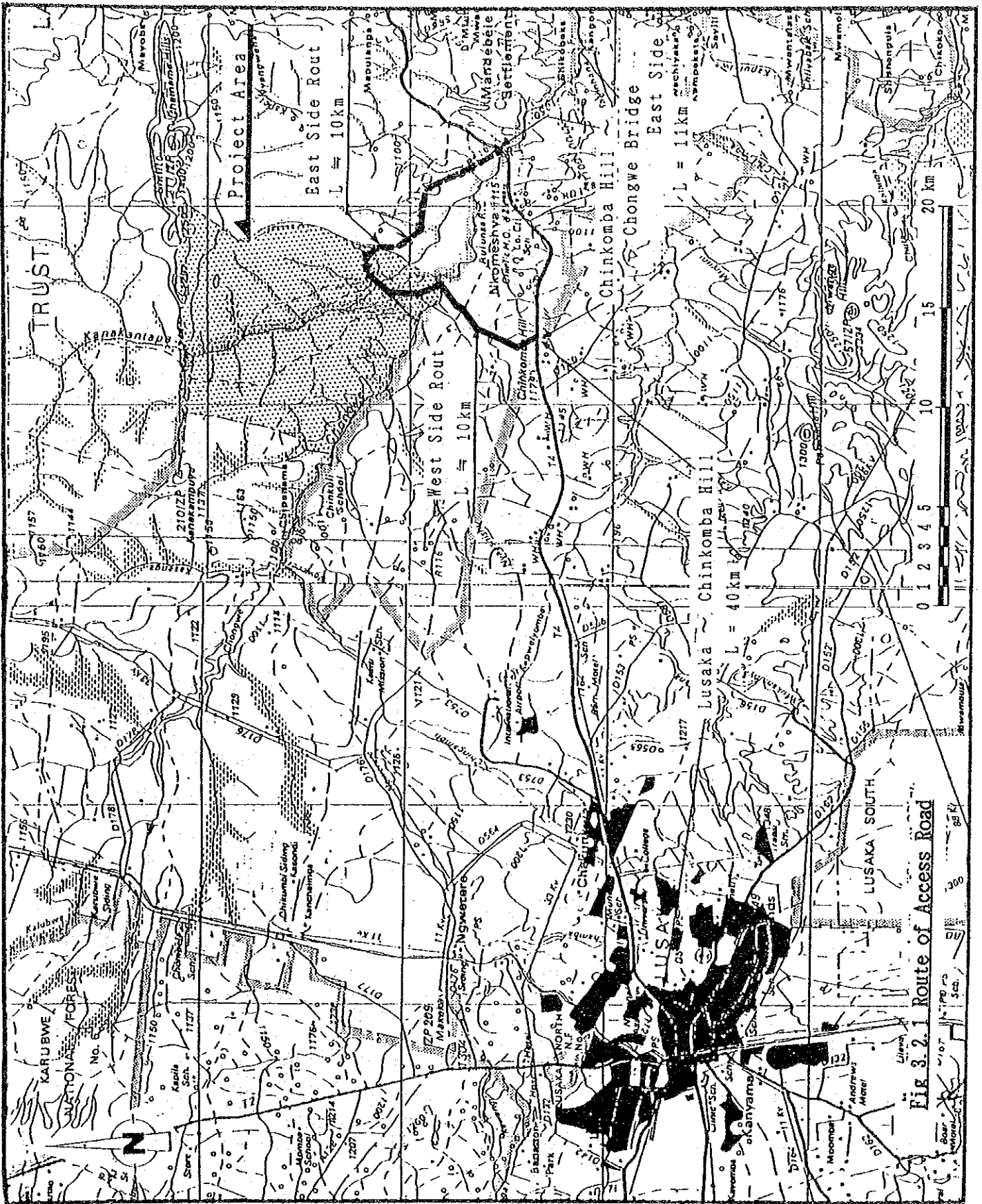


Fig 3.2.1 Route of Access Road

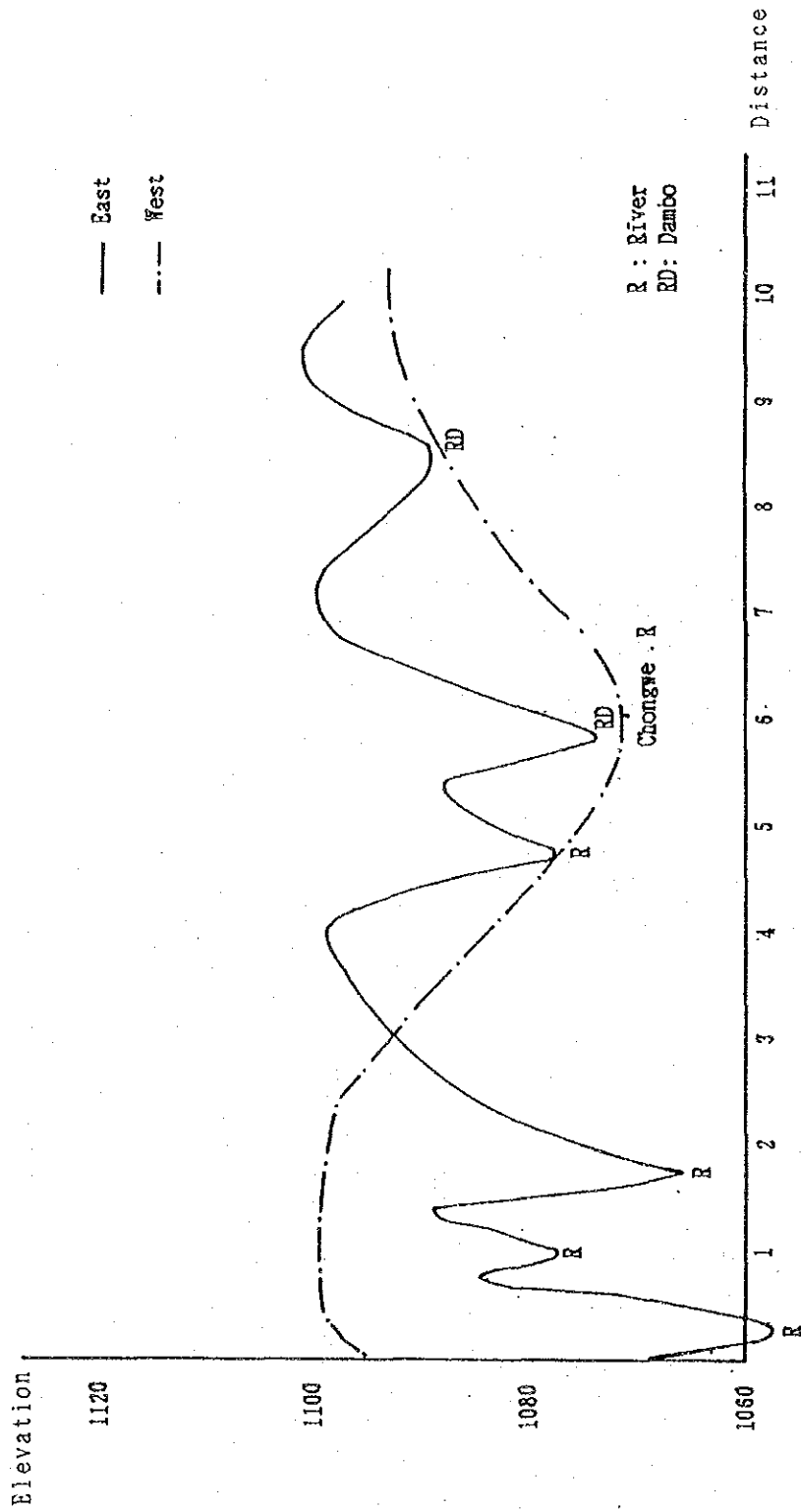


Fig 3.2.2 Longitudinal Section of Existing Road

## (2) Training Farm

### 1) Significant of Training Farm

The purpose of the training farm is to a) guide and train settlers, and b) effectively use the resettlement area's labour force during dry seasons.

During the first year of the resettlement programme, each family had 0.7 ha of farmland. This year, each family owns approximately 1.4 ha of farmland. Maize is growing well and a good harvest is expected and should stabilize the settlers' living situation.

Many of the settlers are unmarried. The average family has two members. At the present time the average family doesn't need to cultivate their entire 4 ha of land. During the early stage of resettlement it would be desirable for each family to cultivate the portion of land to meet their own needs. As families increase in size, their farmland will need to be increased. It is estimated that the average family will be made up of from 6 to 8 persons in the future and it will be necessary for such families to cultivate all of their 4 ha of land.

According to the farm income that was based on the present farming environment (weather, market, farming techniques) the settlers will find it difficult to eke out a living in the future; therefore it will be necessary for them to adopt different farming patterns (refer to Section 4-3-5). There will be a need for the settlers to plant profitable crops, learn farming techniques, and understand market situation.

To allow those settlers not having irrigation systems to take part in training farm operations as trainees will benefit the settlers by providing work opportunities during dry seasons, distribute training farm earned income to assist the settlers.

For the above reasons, the construction of a training farm has a very significant meaning. Basically, the training farm is for the settlers and it would be desirable for them to take part in its operations and maintenance.

## 2) Size of the Training Farm

It is believed that all of the settlers in the Kanakantapa resettlement area will make use of the training farm.

In view of the income distribution to the settlers, a larger training farm would be favorable. However, to allow all of the settlers to take part in the training farm during the dry season, several hundred hectares of land will be needed.

In view of the agricultural technique and training system for the settlers during the early resettlement period, 20 to 30 ha would be the maximum limit for the training farm because of the difficulties that would be encountered in its management, operations, and maintenance.

By taking into consideration the above factors, the size of the training farm was decided upon based upon the overall viewpoint of securing the farmland and irrigation water and the management, operation, and maintenance of the farm facilities.

## (3) Examination of Equipment and Materials to be Provided

### 1) Land Reclamation Equipment

For land reclamation it would be necessary to provide bulldozers, a motor grader, a backhoe, a vibrating roller, and a sprinkle truck.

#### ① Bulldozers and Motor Grader

Presently, root pulling and removing, land clearing, and land levelling work in the Kanakantapa resettlement area are conducted using a combination of two D8 class bulldozers

and one mortar grader. Provision of similar equipment will be necessary for the same type of Project work.

② Backhoe

A backhoe is need for excavating the side ditches along the 40 km length of new roads and the 37 km length of existing farm roads to be improved.

③ Vibrating Roller

A vibrating roller is needed to compact the roadbeds of 40 km length of new roads and the 37 km length of existing farm roads to be improved.

④ Sprinkler Truck

A sprinkler truck will be used to sprinkle water during the compacting of the new and existing roads and for preventing dust during the construction period.

2) Agricultural Machinery for Training Farm

For cultivation at the training farm, tractors and their accessory units, such as disk ploughs, rotary harrows, chisel ploughs, planters, ridger, and trailers are to be provided. A truck for transporting materials, a pickup truck for managing Project facilities, bicycles, and small agricultural tools are also to be provided.

3) Equipment for the Stabilization of Settlers' Lives

Maize hammer-mills (with diesel engines) are to be provided to assist the settlers in the stabilization of their diet, of paramount importance in their daily lives. Maize sheller (threshing machine) are also to be provided to make free from threshing work for promotion of fixation of settlers.

#### (4) Building Facilities

The building facilities will have the following functions and space:

##### 1) Administration Facility

- Administration Building:  
Manager's room, office, expert's room, meeting room (also to be used as a training room), and dining room;
- Lodging house: Lodging facilities for experts and instructors
- Water supply and sewage treatment tanks.

##### 2) Garage for Agricultural Machinery and Vehicles

Sufficient floor space for storing land reclamation equipments and agricultural machinery must be secured. Bulldozers and the motor grader will not be stored in the garage.

##### 3) Workshop

- A repair space, a spare parts storage area, and office will be provided.

##### 4) Warehouse

- Grain storage, fertilizer and agricultural medicine storage, farm product processing and drying space will be provided.

##### 5) Mill Houses

- Each mill house will have one maize hammer-mill.

### 3-3 Project Description

#### 3-3-1 Executing Agency and Operational Structure

The executing organization for the Project is the Department of Resettlement of the Office of the Prime Minister.

The Kanakantapa Resettlement Office of the Department is the organization responsible for Project implementation. The Department of Resettlement has experience in land reclamation and with farmland development projects. If necessary the Department can obtain the cooperation of other ministries and departments. Thus, the Department has sufficient capability for implementing the Project.

As for the operation of a training farm, it will be the first experience for the Department. Therefore, technical assistance from the Government of Japan (dispatchment of experts) would be necessary until the training farm operation is well underway and the Zambian side is able to manage and operate the training farm on their own.

The management and maintenance of Project roads will be transferred to the District Office after completing road construction.

The management system for the training farm is to be planned as shown in the following Figure (the Machinery and Management Division shall also be responsible for the management and maintenance of land reclamation machinery):

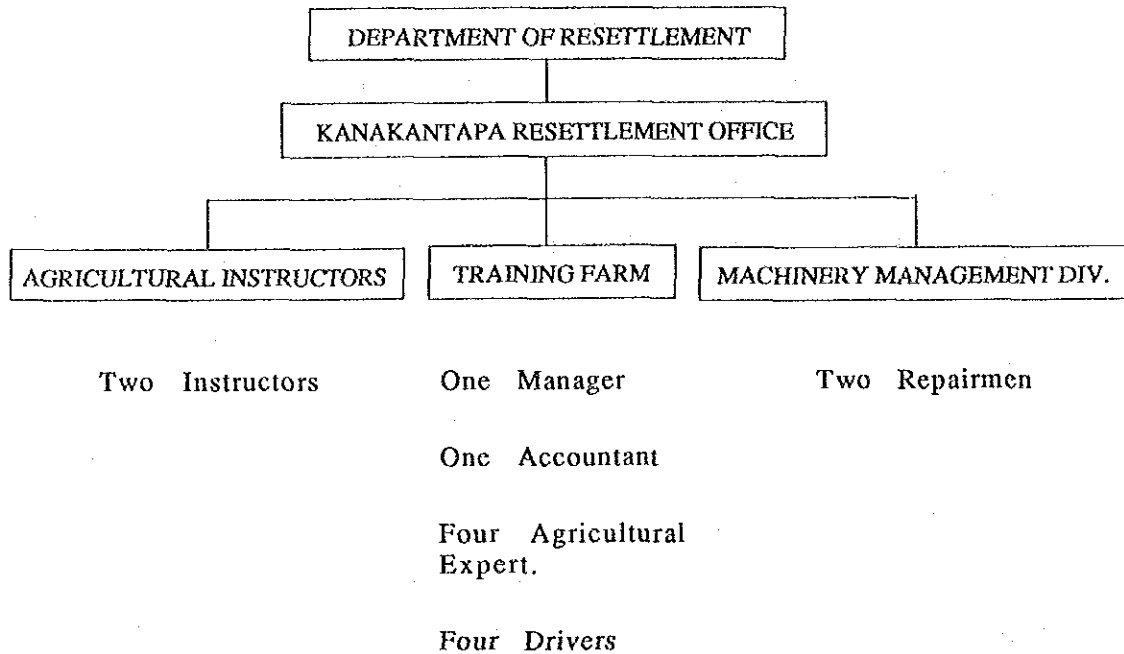


Fig.3.3.1 Management System of Training Farm

Fourteen staff members will normally conduct the management and operation of the training farm. In addition, 20 to 60 labourers, depending upon the season, will be recruited from the settlers to perform work on the training. From time to time the labourers will be rotated to give the settlers equal opportunity to derive an income.

### 3-3-2 Plan of Operation

#### (1) Land Reclamation

750 ha of land still remains to be reclaimed by the Government of Zambia. It is planned for the land to be cleared during the next three years.

#### (2) Training Farm

##### 1) Operation Plan

According to the cropping plan shown in Fig. 3.3.2, the 30 ha training farm will be cultivated and will be operated with farm revenue (refer to the farming plan for operational items).



## 2) Training Plan

The management of training farm shall be established as the first priority. The labour force for the farm shall be comprised of settlers. Through cropping, the settlers will be provided with actual training as well as with employment opportunities. The necessary labour force for the training farm during each month is shown in Table 3.3.1.

Table 3.3.1. Necessary Labour Force for the Training Farm Each Month (persons/day)

APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	Average
56	65	72	48	32	33	38	12	13	19	4	0	33

### 3-3-3 Location and Conditions of the Project Site

#### (1) Location

The Kanakantapa resettlement Area is located approximately 40km east of Lusaka, the capital (15° 11' latitude and 28° 34' to 40' longitude). Its 10,300 ha area stretches approximately 11km in an east-west direction and about 12 km in a north-south direction. The Area is located on a plateau. The Kanakantapa River, a tributary of the Chongwe River, cuts through the middle of the Area. The western border of the Area is the Chongwe River.

The Kanakantapa River's four tributaries have marshes, "dambos," and small streams that divide the plateau area. Rose-family mionba trees grow in the area. This area is a forest conservation area, but a part of it was allotted to the Resettlement Area.

The 10,300 ha Resettlement Area is divided into three blocks (A, B and C) as follows:

A Block: Left bank of the Kanakantapa River (divided into villages "A" through "G")

Dry season

Rainy season

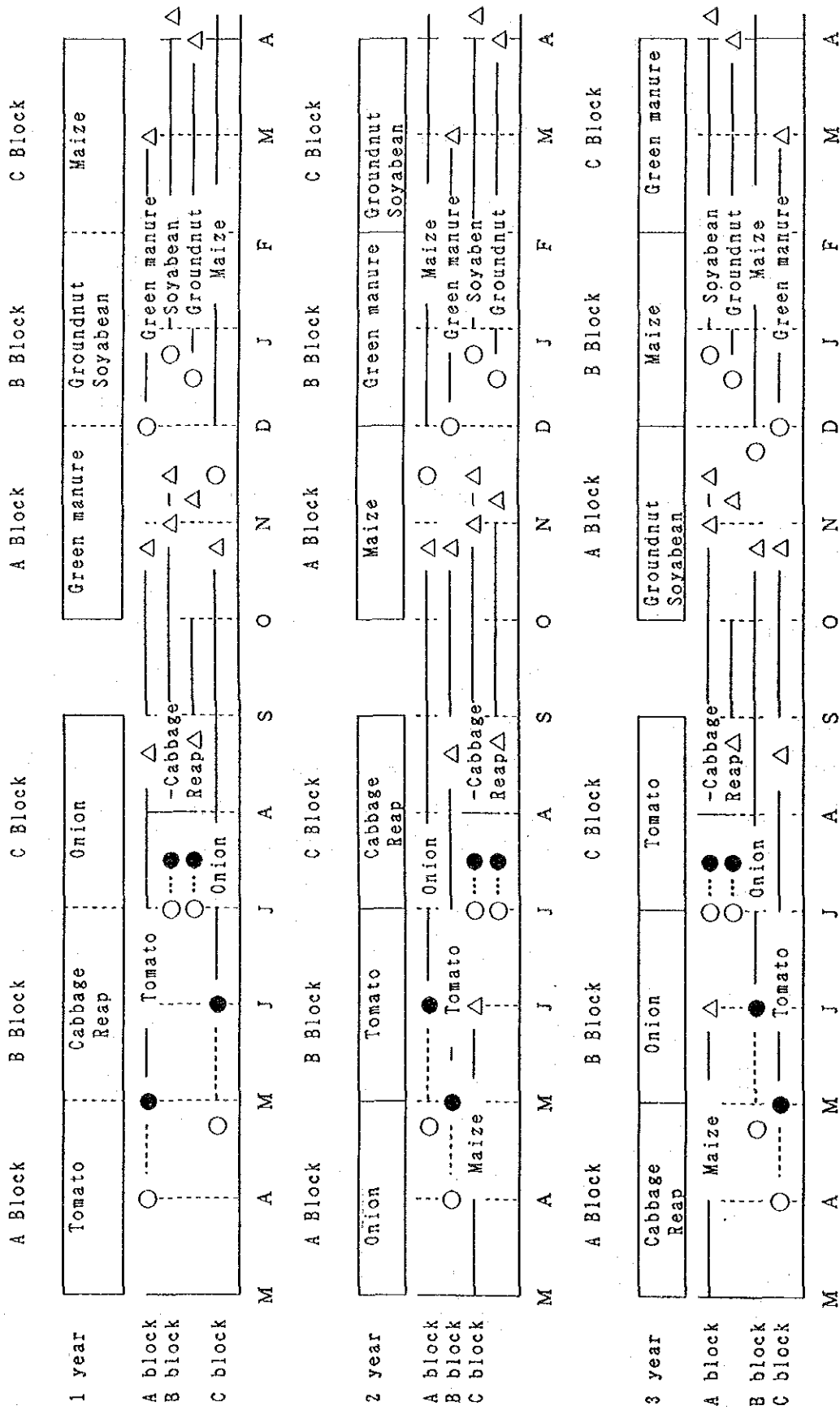


Fig. 3.3.2 Cropping Pattern of Training Farm

B Block: Upper part of the right bank of the Kanakantapa River  
(divided into villages "H" through "K" )

C Block Lower part of the right bank of the Kanakantapa River

Settlement has started in the "A" and "B" blocks but not in the "C" block.

The location selected for the training farm is in an area having more than 250mm thick loam topsoil. It is in "C" Block close to "B" Block. The soil is laterite, reddish loam containing gravel. The area's bearing strength is high except where it is located adjacent to dambos. Using the Yamanaka Hardness Gauge, the penetrating resistance was found to be 10 to 25 kg/cm<sup>3</sup>. No problems will arise in building a foundation on this ground.

The Kanakanpata River which cuts through the Area does not have a surface flow during the dry season. During most of the dry season a 4-wheel drive vehicle can cross the river.

The Chongwe River has surface flow even during the dry season. But, because of its small discharge, a vehicle can cross it. Thus, there will be no problem in transporting construction materials during the dry season.

## (2) Road

The planned road route starts from National Road T-4 at Chinkomba Hill and it runs through Kampuln village, crosses the Chongwe River, and reaches the Industrial Center. The road is approximately 10.5km long. There is presently a 2 to 5 m wide firm road that runs for about 6.2 km from Chincomba Hill to the Chongwe River.

The remaining 4.3 km section of the road from the Chongwe River to the Industrial Center is presently a trail.

Most of the route runs on the side of a mild slope plateau. Farmland or villages are on both sides of the route up to the Chongwe River. About 3 km of the route goes through "C" Block of the Resettlement Area.

Throughout the route, the topography is favourable for road construction. The construction of bridges across the Chongwe and Kanakantapa rivers is needed.

Soil along the route is laterite loam containing a large amount of clayey or silty fine soil. Drainage is poor. Therefore, the construction of side ditches is required. By using a Yamanaka Hardness Gauge the ground bearing strength was found to be more than 5 kg/cm<sup>2</sup> and presents no problem for road construction.

The conditions of the bridge construction sites at the route crossings of the Chongwe and Kanakantapa rivers are as follows:

1. Chongwe River Crossing Site

The width of the Chongwe River at the road crossing point is 30m. The water level greatly varies from the dry season to the rainy season. The river is a double cross section type. During the rainy season, the water depth is about 3.5 m; it drops below 1m during the dry season. According to the past watermark, the maximum flood level was 7.3 m deep.

The riverbed and riverbank soil is a laterite-type loam. Using a Yamanaka Hardness Gauge, the bearing strength of the ground was found to be 5 to 10 kg/cm<sup>2</sup>. rocks having diameters of more than 1.0 m can be seen here and there in the riverbed.

2. Kanakantapa River Crossing Site

The width of the Kanakantapa River where a submersible bridge will be constructed is approximately 20m during the rainy season. The surface flow of the river disappears during the dry season. The water depth during the rainy season is about 0.5 to 0.8 m and varies practically daily. Even during the rainy season a 4-wheel drive vehicle can cross the river just about every day.

In the riverbed sandy loam or silty loam which is thought to have been washed down from the Resettlement Area is deposited. Along the riverbanks gravel is mixed with gravel. Cobblestones can be seen here and there on the grassland. The loam stratum

has a 2 to 5 kg/cm<sup>2</sup> bearing strength and presents no problem for building structures on it.

### (3) Construction Site of Training Farm Related Facilities

The training farm will be constructed in the "C" Block. The site is located in the right bank of the Kanakantapa River and approximately 2.5 km along the main road from the Chongwe river crossing point towards the Industrial Centre. Soil in the site is a laterite-type loam mixed with gravel. The northeastern part of the site has more gravel mix than does the south and southwestern parts. The ground has a 15 to 20 kg/cm<sup>2</sup> bearing strength which is sufficiently strong to support the management building, farm pond, and other related facilities.

Some of the gravel can be removed for the construction of the training farm.

### (4) Diversion Works and Pumping Stations

It is necessary to construct diversion works and pumping stations of the left bank of the Chongwe River for irrigating the training farm.

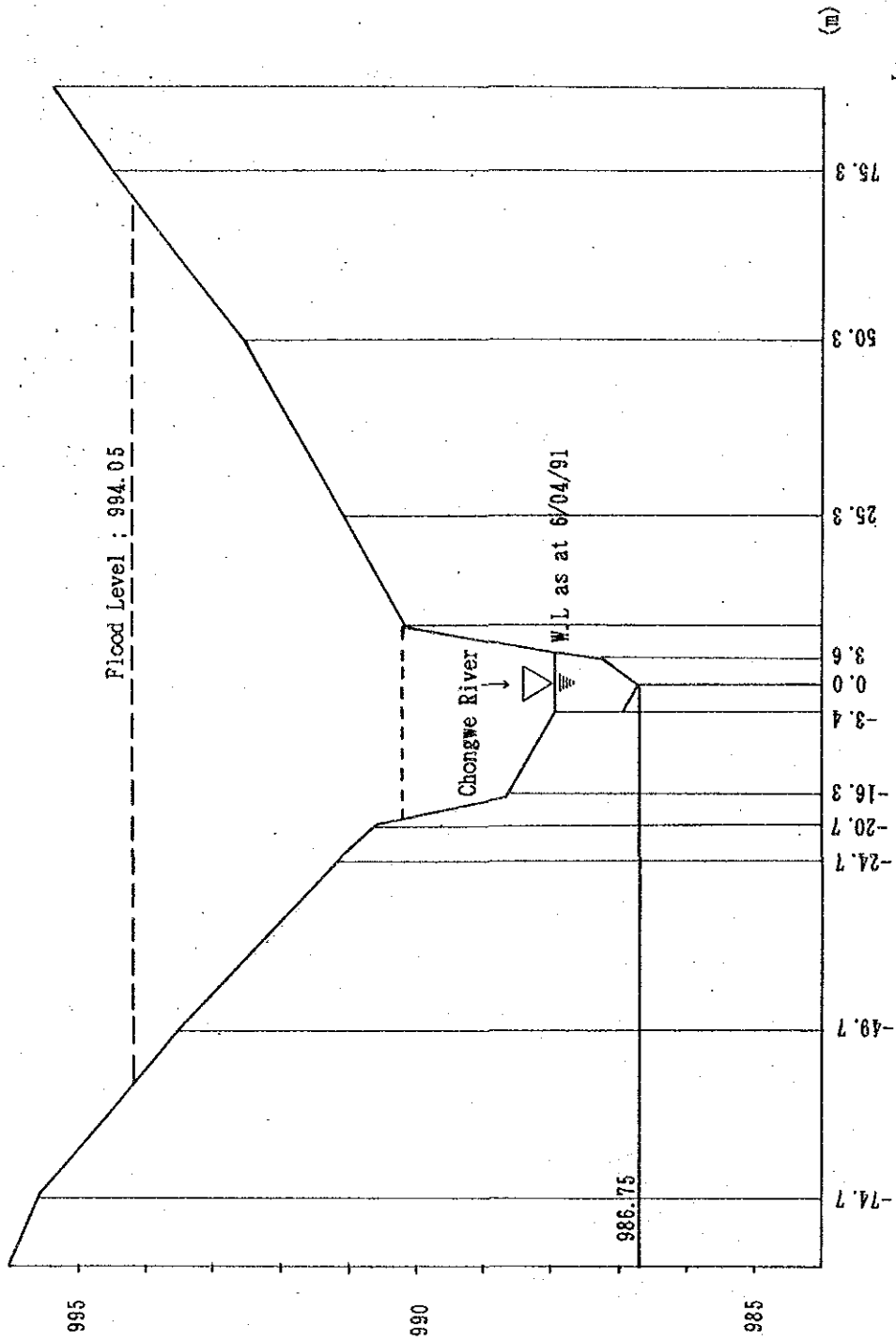
The diversion works is to be constructed in the Chongwe River 20m downstream of the bridge construction site. The Chongwe River's left bank at this point is within the "C" Block. The area is mildly sloped and wooded. Topographically, no problems exist for the construction of the pumping station.

The water level of Chongwe River varies greatly from the dry season to the rainy season. The observed highest flood mark was approximately 8m higher than the riverbed level. The flood mark shall be taken into consideration when designing the pumping station.

The Chongwe River has surface flow even during the dry season. However, the water level is quite low. It is believed that there will be no problem in diverting the flow to permit construction work on the riverbed.

Vert : 1:100

(m)



Long : 1:1000

Fig 3.3.3 Cross Section of Chongwe River

The bearing strength on both banks is from 10 to 20 kg/cm<sup>2</sup> ; they are sufficiently strong to build structures on. It is also estimated that the riverbed will have a strong bearing strength if it is excavated about 1 m.

As there are rocks having diameters of more than 1 m in the river, the construction location must be carefully selected. This area, however, is considered to be very suitable as a construction site.

### 3-3-4 Outline of Project Facilities and Equipment

#### (1) Summary of Road Facilities

The road route to be improved is approximately 10.5 km from the Chinkomba Hill point of National Road T-4 to the Resettlement Area through Kampula Village.

- Section to be improved: 6.2.km
- Section to be constructed: 4.3 km
- Carriageway width: 5.5 m; shoulder width: 1 m;  
formation: 7.5 m
- Gravel pavement 0.15 m
- Major Related structures:
  - Bridge: One (Chongwe River)
  - Submersible bridge: One (kanakantapa River)

(2) Summary of the Training Farm facilities

- Diversion Works:
  - Diversion weir: One
  - Intake pumps Ø 100 mm, 2 units
  - Supply pumps Ø 100 mm, 2 units
  - Settling Basin: One
- Pipe Line: 2.5 km (approx.)
- Farm Pond One
- Farm: 30 ha
  - Internal roads 7.9 km
  - Main irrigation pipeline: 2.6 km
  - Drainage channel: 3.4 km

(3) Summary of Equipment and Materials to be Provided

1) Land Reclamation Equipment

A summary of land reclamation equipment to be provided is given in Table 3.3.2.

Table 3.3.2 Summary of Land Reclamation Equipment

Equipment Name	Capacity	Number of Units	Remarks
Bulldozer	D8 (Class 320 HP)	2	With rakes
Mortar Grader	155 HP	1	For land reclamation and road construction
Vibrating Roller	4 ton, self moving	1	For road construction
Backhoe	0.4 m <sup>3</sup>	1	For road construction
Sprinkler Truck	9 m <sup>3</sup> tank	1	For road construction



2) Equipment and Materials Necessary for Training Farm Management and Operation

The equipment and materials necessary for training farm management and operation are listed in Table 3.3.3.

3) Equipment for stabilizing Settlers' Living

Maize hammer-mills (with diesel engines) and maize shellers (manual) will be provided as the equipment for stabilizing settlers' living.

Table 3.3.3 Equipment and Materials Necessary for Training Farm Management and Operations

Name of Equipment or Material	Capacity	Number of Units	Remarks
Wheel Tractor	65 Hp	2	For farming of 30 h a
Disk Plough	65 HP Tractor Attachment	2	
Disk Plough	"	2	
Chisel Plough	"	2	
Rotary Harrow	"	2	
Ridger	"	2	
Planter	"	2	
Trailer	"	2	
Truck	6 ton	1	
Pickup Truck	4-wheel Drive 5-passengers	1	For extension activities
Bicycles		30	
Small Farming Tools		One set	40 hoes, 20 rakes, 10 shovels  5 axes, 20 slashers, 10 sprayer, etc.

Table 3.3.4 Equipment for Stabilizing Settlers' Living

Name of Equipment	Capacity	Number of Units	Remarks
Maize Hammer-mill	500 kg/hr or more	3	diesel engine 2 electric mortar 1
Maize Sheller	700 kg/hr	9	manual

(4) Summary of Building facilities

A summary of the building facilities are given in Table 3.3.5.

Table 3.3.5 Summary of Building facilities

Building Name	Room Name	Planned Space (m <sup>2</sup> )	Remarks
Management Building	Office	25.0	Including 36.0 m <sup>2</sup> hall
	Expert's Office	20.0	
	Manager's Room	16.0	
	Meeting Room	25.0	
	Janitor's Room	17.0	
	Common Use Space	93.0	
	<u>Subtotal:</u>	<u>196.0</u>	
Lodging House	Bedroom, Dining Room	<u>132.0</u>	
Agricultural Machinery Garage		<u>288.0</u>	
Workshop	Repair Space	180.0	
	Parts and Tool Storage	30.0	
	Office	20.0	
	Multipurpose Use Area	10.0	
	<u>Subtotal:</u>	<u>240.0</u>	
Warehouse	Grain Storage	99.0	
	Fertilizer & Agricultural	25.0	
	Medicine Storage		
	Multipurpose Use Area	74.0	
	<u>Subtotal</u>	<u>198.0</u>	
Mill House		<u>48.0</u>	24.0 x 2
Building Facilities	Total	1,102.0	

### 3-3-5 Farm Management Plan

The training farm has the duties which are training the farming technique and manner to settlers through farming practice and lectures, establishment of farming system of the Kanakantapa Resettlement Area, introducing new conversion crops and development of agricultural market. The training farm will be operated using benefit obtained from farm management, and further more, will make a contribution to improvement and stabilization of living standard of settlers by distributing some part of the benefit to settlers.

#### (1) Training farm

##### 1) Objectives

##### 1. Guidance and Training

To teach the techniques of rainy season and dry season farming and provide farm management guidance based on the demand for agricultural products, and the management and preservation of agricultural products.

- Irrigation Farming : Selection of crops, seeding method, crops' growth management, irrigation method
- Farming without Irrigation : Examination of crops to be newly introduced, cropping pattern, use of organic fertilizer, crop preservation method
- Environment Protection : Forest conservation, planting windbreaks, farmland soil improvement
- Agricultural Machinery : Tractor farming method, machinery operation, machinery management and maintenance

- Farm Management : Study of farm product prices and demand, improvement of marketing and preservation method, farmers' organization

2. Effective Use of Available Labourers Within the Resettlement Area During the Dry Season

By taking part in the operation of the training farm as trainees, the settlers will be able to obtain employment opportunities during the dry season.

Income earned from the training farm will be allotted for the management and operations costs of the farm as well as being distributed to the settlers to assist in improving their living situations.

2) Management Items

- a. Training
- b. Cropping -- Cropping Plan -- Work Plan -- Machinery Use Plan
  - Irrigation Plan
  - Labourer Mobilization Plan
- c. Farm Maintenance -- Farmland Maintenance -- Windbreaks, Irrigation Pipes, Fences, etc.
  - Agricultural Machinery Maintenance
- d. Farm Product Marketing --- Market Development, Making a Contract With a Purchasing Firm
- e. Material Management ----- Material Purchase
  - Inventory
- f. Accounting

### 3) Operating Cost

The operating cost of the training farm will mainly be appropriated from training farm revenue. However, the farm's operating cost for the first fiscal year (costs for seeds, fertilizer, agricultural medicine, fuel etc. ) and the personnel expenditures for staff members who will be dispatched from the Government of Zambia (manager, irrigation farming technicians, and equipment operators) will be borne by the Department of Resettlement.

### 4) Training Plan

The training farm's training programme for settlers can be classified into practical training given through actual farm work and lectures delivered in the classroom. Practical training will be the programme's main subjects. The settlers will undergo training according to the farming work plan and the labour plan.

Good training for the settlers will be to inform them of the farming work plan and the labour plan. Prior to the settlers (trainees) starting their daily farm work, the instructor will explain the work they are to perform and advise them of how to do it.

For classroom lectures, the instructor will prepare a curriculum for the subjects he feels should be taught to the settlers during the training programme.

**Farm Training :** To be conducted in accordance with the farming plan. Settlers from each village will participate in the training on a rotation basis.

**Farming Lectures :** Settlers will attend lectures as a village unit during the farming off - season.

Lectures will be given in the management building, but, if necessary, the instructor will go to the village and give the lecture in an open space.

Course Plan	JUN	JUL	AUG	SEP	OCT
Irrigation Farming (vegetable seedling growing method)	—				
Farming Without Irrigation (bad effects of repeated cropping)		—			
Environment Conservation (necessity of windbreaks)			—		
Agricultural Machinery (necessity of cultivation)				—	
Farm Management (crop revenue and operating costs)					—

## 5) Cropping

### 1. Selection of Crops

If the farmland in the Project Area is irrigated, it will be possible to have two croppings annually and an intensive cropping system will be achieved.

Maize, cotton, sunflower, ground nuts, and soy bean that are presently grown in the Resettlement Area will be planted as the major crops during the rainy season. Vegetables will be grown during the dry season.

The vegetables will be highly demanded in the urban area. Since the Resettlement Area is close to an urban area, it would be possible to market vegetables there. By taking into account preservability and marketability, it is planned to introduce tomato, cabbage, onion, rape, and potato.

### 2. Cropping Plan

To maintain the fertility of the land and prevent the bad effects of repetitive cropping, it is necessary to select a suitable cropping system for the land. In particular, special attention should be paid to the effects of repetitive vegetable cropping.

As shown in Fig. 3.3.2, it is planned to conduct rotation cropping of vegetables and grain crops.

### 3. Cropping Method

By referring to the literature "Resource Guide in Agriculture" and "Planting Guide of Zamseed", and as the result of discussions held with personnel of the Department of resettlement, the cropping method for the training farm was established (see Table 3.3.6).

### 6) Work Plan

According to the cropping plan, the work plan will be divided into a machinery work plan and a manual work plan (see Tables 3.3.7 through 3.3.10) . To prepare a labourer mobilization plan, the number of workers per hectare required for each crop (Table 3.3.11) was to be set up first and then, according to the cropping plan and the work plan, the number of monthly necessary workers for 3 ha of the training farm (two croppings a year) was calculated (Table 3.3.12). By dividing this figure by the number of settlers in each village, the number of workers to be mobilized for 30 ha of the training farm (labourer mobilization plan) was obtained (Table 3.3.13). According, each settler will work on the 30 ha training farm 15 days a year.

Table 3.3.6 Cropping Method

The method of cultivation in project area are cited from the [Resource Guide in Agriculture] and [Planting Guide of Zamseed]] as well as being discussed with Department of Resettlement staff members.

Crop	Cultivar	Sowing or Planting	Seed Rate kg/ha	Fertilizer kg/ha		Method of Sowing	Depth of Sowing in cms	Spacing in cms		Days to Maturity	Expected yield in kg/ha
				Basal	Top			Rows	Plants		
Maize	MM 601, 603, 604 MM 612, 600	NOV with rains	15-25	200-D	200-N/A	Direct Sowing	5	75-90	25-30	135-145	2,000-3,000
Soya Beans	Jupiter Santa Rosa Kaleya Tunia	DEC	80	200-D	-	Direct Sowing	3	45-75	3-5	140 110 115 120	800-1,000
Groundnuts	Natal Common Comet Makulu Red Chalimbana	NOV-DEC	80	100-X	-	Direct Sowing	5	75-90	10-15	100-120 100-120 140-150 150-170	800-1,000
Sunflower	CCA 81 CH 258 CH 284 CH 301	DEC	8	150-D	-	Direct Sowing	2-3	75-90	25-40	110-115 105-110 110-115 110-115	700-1,000
Cotton	-	NOV-DEC	20	100-X	-	Direct Sowing	2	90	20-25	150-180	500- 700
Cabbage	Golden Acre Glory Enkhuzen Gloria F1	APR-SEPT	2	300-D	150-N/A	Transplanting	0.5	60	45	147	10,000-20,000
Onion	Pusa Red Henry's SYG F1	MAR-JULY	6	400-D	100-N/A	Transplanting	1-1.5	30	15	154	15,000-20,000
Potato	Up-to Date Pimpernel Pentland Dell Baraka, Arka	JAN-APR JULY-NOV	2,000			Direct Sowing	5-10	90	30	112-133	10,000-15,000
Rape	Giant Essex Fera	MAY-AUG	2.5	300-D	150-N/A	Transplanting Direct Sowing	1-1.5	45	30	112	3,000-4,000
Tomato	Heinz-1370 Red Khaki	FEB-SEPT	0.23	400-D	150-N/A	Transplanting	0.5	120	50	188	20,000



Table 3.3.7 Operation Plan of Tractor

Operation Crop	Plough	Rotary harrow	Disc- harrow	Ridger	Planter	Transport
Tomato	Mar.	Apr.		Apr.		Aug. - Oct.
Cabbage	Jun.	Jul.		Jul.		Nov.
Rape	Jun.	Jul.		Jul.		Sep. - Nov.
Onion	Apr.	May		May		Oct.
Maize	Nov.		Nov.	Nov.	Nov.	Jun.
Chinese milk vetch	Nov.		Nov.	Nov.	Dec.	Apr. - May
Groundnuts	Nov.		Nov.	Dec.	Dec.	Apr. - May
Soybean	Dec.		Dec.	Dec.	Dec.	Apr. - May

Table 3.3.8 Time Requirement of tractor

Machine and Type	Size in Horsepowers	Estimated Time requirement in hours per hectare		
		Square field	Irregular field % to be added	Small field Less than 2 ha % to be added
Plough	40	5	+40	+10
	60	4	+45	+15
Rotary harrow	40	2.2	+20	+10
Disc harrow	60	1.5	+20	+15
Ridger	40	3	+45	+15
	60	1.5	+55	+25
Planter	40	3	+50	+20
	60	2.5	+55	+25

Table 3.3.9 Time Requirement of tractor for Training Farm (for 3ha)

Crop	Cultivated Area	(hour)												
		Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Total
Tomato	1 ha	4	3											7
Cabbage	1/3			2	1.5									3.5
Rape	1/2			2	1.5									3.5
Onion	1		4	3										7
Maize	1									9.5				9.5
Chinese milk vetch	1									7	2.5			9.5
Groundnuts	1/2									2.7	2.1			4.8
Soybean	1/2									4.8				4.8
		4	7	3	4	3.0				19.2	9.4			49.6

Table 3.3.10 Operation Plan of Settlers

Operation	Nursery	Ridge	Prant and apply basal dressing	Weed (Twice)	Top dress	Spray	Harvest	Shell or other practice	Transport and pack
Tomato	Apr.	Apr.	May	May, Jun.	Jun.	May- Aug.	Aug. - Oct.		Aug. - Oct.
Cabbage	Jul.	Jul.	Jul.	Aug., Sep.	Aug.	Aug. - Oct.	Nov.		Nov.
Rape	Jul.	Jul.	Jul.	Aug., Sep.	Aug.	Jul. - Sep.	Sep. - Nov.		Sep. - Nov.
Onion	Apr. - May	May	Jun.	Jun., Jul.	Aug.	Jun. - Sep.	Oct.		Oct.
Maize			Nov.	Dec., Jan.	Jan.		Jun.	Jun.	Jun.
Chinese milk vetch			Dec.	Dec., Jan.			Apr.	Apr. - May	Apr. - May
Groundnuts			Dec.	Dec., Jan.			Apr.	Apr. - May	Apr. - May
Soybean			Dec.	Jan., Feb.			Apr.	Apr. - May	Apr. - May

Table 3.3.11 Time and Labour Requirement of Crops

Operation	Nursery	Ridge	Prant and apply basal dressing	Weed (Twice)	Top dress	Spray	Harvest	Shell or other practice	Transport and pack	Total Rounded
Tomato	30	1	50	75	5	40	60		4	265
Cabbage	10	1	50	60	5	20	20		3	169
Rape	10	1	50	80	5	20	60		5	231
Onion	50	1	50	80	5	20	50		4	260
Maize			2	20	4		15	15	2	58
Chinese milk vetch			1	16			10	24	1	52
Groundnuts			4	36			55	70	1	166
Soybean			3	30			20	20	1	74

(man/ha)

Table 3.3.12 Monthly Labour Requirement of Training Farm

Crop	Cultivated Area	(man)													
		Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Total	
Tomato	10 ha		310	980	520	100	210	310	220						2650
Cabbage	5					310	210	180	40						1690
Rape	5					330	280	280	140						2310
Onion	10		250	260	950	450	100	50	540						2600
Maize	10				320										580
Chinese milk vetch	10		220	130						20	100	90	80		520
Groundnuts	5		450	180							110	90	80		1660
Soybean	5		150	60							20	80	80		740
	30ha		1380	1610	1790	1190	800	820	940	280	320	390	80		9600

Table 3.3.13 Labour Plan of training Farm

Person / 30ha

Village	Number of householders	Proportion	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
A	76	12.2%	0	168	196	218	145	98	100	115	34	39	48	10
B	58	9.3	0	128	150	166	111	74	76	87	26	30	35	7
C	47	7.6	0	105	122	136	90	61	62	71	21	24	30	6
D	50	8.1	0	112	130	145	96	65	66	76	23	26	32	7
E	64	10.3	0	142	166	184	123	82	84	97	29	33	40	8
F	55	8.9	0	123	143	159	106	71	73	84	25	28	35	7
G	41	6.6	0	91	106	118	79	53	54	62	18	21	26	5
H	83	13.3	0	184	214	238	158	106	109	125	37	43	52	11
I	11	1.8	0	25	29	32	21	14	15	17	5	6	7	1
J	75	12.1	0	167	195	217	144	97	99	114	34	39	47	10
K	61	9.8	0	135	158	175	117	78	80	92	27	31	38	8
	621	100.0												

#### 7) Management Plan of the Training Farm

Gross revenue from the training farm is estimated to be Kw3,127,000 to Kw4,683,000 a year (Table 3.3.14).

As shown in Tables 3.3.15, the net income will be Kw1,196,000 to Kw2,751,000 a year.

#### 8) Farm Product Sale

As the prices of vegetables are determined by the demand at the market, they are unstable. For the training farm, it would be necessary to conduct market development, unification of product qualities, and marketing control. For an early stage of training farm operations, it may be necessary to make a sales contract with farm product processing companies to secure purchasers.

### (2) Resettlement Area's Farm Management

As for the settlers' farming situations, each settler family cultivates 1.4 ha of land. Maize grows quite well and a good harvest can be expected. Therefore, it is believed that the settlers' farming conditions will be stabilized.

Many of the settlers are still single. The average number of members in a settler's family in Kanakantapa is 2.0. Thus, at the present time, the average settler does not need to cultivate all of his 4 ha of land. It would be desirable for settlers to cultivate their land corresponding to the size of their present labour force.

According to the "Resource Guide Data in Agriculture", one hectare of maize requires 105 man-days of work (7 hours of work per day). Thus, the average family should be able to cultivate 1.4 of its farmland solely by human power.

Table 3.3.14 Agricultural Receipt

Rainy Season

Crop	Maize	Groundnut	Soybean
Cultivated area	10 ha	5 ha	5 ha
Estimated yield	20,000 ~ 30,000 kg	4,000 ~ 5,000 kg	4,000 ~ 5,000 kg
Price of unit	500 kw / 90 kg	1,106.84 kw / 80 kg	801.49 kw / 90 kg
Amount of sale	111,110 ~ 116,670 kw	50,340 ~ 69,230 kw	35,620 ~ 44,530 kw

Dry season

Crop	Tomato	Cabbage	Reap	Onion
Cultivated area	10 ha	5 ha	5 ha	10 ha
Estimated yield	150,000 ~ 200,000 kg	60,000 ~ 100,000 kg	15,000 ~ 20,000 kg	120,000 ~ 200,000 kg
Price of unit	10 kw / kg	3.75 kw / kg	3.125 kw / kg	10 kw / kg
Amount of sale	1500,000 ~ 2,000,000 kw	180,000 ~ 300,000 kw	46,880 ~ 62,500 kw	1,203,450 ~ 2,000,000 kw

\*The yield is estimated low.

The tomato price is taken from the purchasing price of the processing industry.

Other vegetable price are taken of half the price of the Soweto market.

Total.....3,127,400 ~ 4,682,930 kw

Table 3.3.15(1) Farming Expenses (Rainy season)

Crop	Maize	Groundnut	Soybean	Green manure
Cultivated area	10 ha	5 ha	5 ha	10 ha
Seed expenses	4,170 kw	24,140 kw	5,050 kw	1,500 kw
Seed rate per ha	20 kg/ ha	80 kg/ ha	80 kg/ ha	3 kg/ ha
Price per unit	1,043 kw/ 50 kg	2,414 kw/ 40 kg	758 kw/ 60 kg	500 kw/ 10 kg
Fertilizer expenses	38,560 kw	5,300 kw	11,340 kw	
Basel	2,000 kg(Comp.X)	500 kg(Comp.X)	1,000 kg(Comp.D)	
Top dress	2,000 kg( N/A )			
Price (Basel)	530 kw/ 50 kg	530 kw/ 50 kg	567 kw/ 50 kg	
(Top dress)	434 kw/ 50 kg			
Fuel expenses	75,580 kw	38,190 kw	38,190 kw	75,580 kw
Time x Fuel	9.5 x 17 l/ha	9.6 x 17 l/ha	9.6 x 17 l /ha	9.5 x 17 l/ha
Price of unit	36 kw/ l	36 kw/ l	36 kw/ l	36 kw/ l
Oil expenses	17,440 kw	8,810 kw	8,810 kw	17,440 kw
Sub-total	118,310 kw	67,630 kw	54,580 kw	77,080 kw

Table 3.3.15(2) Farming Expenses (Dry season)

Crop	Tomato	Cabbage	Rape	Onion
Cultivated	10 ha	5 ha	5 ha	10 ha
Seed expenses	2,840 kw	4,360 kw	4,910 kw	78,960 kw
Seed rate per ha	230 kg/ha	2 kg/ha	2.5 kg/ha	6 kg/ha
Price of unit	1,233 kw/kg	436 kw/kg	393 kw/kg	1,316 kw/kg
Fertilizer expenses	62,720 kw	23,520 kw	23,520 kw	54,040 kw
Basel	4,000 kg(Comp.D)	1,500 kg(Comp.D)	1,500 kg(Comp.D)	4,000 kg(Comp.D)
Top dress	2,000 kg(N/A)	750 kg(N/A)	750 kg(N/A)	1,000 kg(N/A)
Price (Basel)	567 kw/50 kg	567 kw/50 kg	567 kw/50 kg	567 kw/50 kg
(Top dress)	434 kw/50 kg	434 kw/50 kg	434 kw/50 kg	434 kw/50 kg
Chemical expenses	35,000 kw	15,000 kw		20,000 kw
Fuel expenses(Tractor)	55,690 kw	27,850 kw	27,850 kw	55,690 kw
Time x Fuel	7.0 x 17 l/ha	7.0 x 17 l/ha	7.0 x 17 l/ha	7.0 x 17 l/ha
Price of unit	36 kw/l	36 kw/l	36 kw/l	36 kw/l
Oil expenses	12,850 kw	6,430 kw	6,430 kw	12,850 kw
Fuel expenses(truck)	27,220 kw	6,800 kw	3,400 kw	27,220 kw
Time x Fuel	12 x 6.3 l/ha	6 x 6.3 l/ha	3 x 6.3 l/ha	12 x 6.3 l
Price of unit	36 kw/l/ha	36 kw/l/ha	36 kw/l/ha	36 kw/l/ha
Sub-total	183,470 kw	77,530 kw	59,680 kw	235,910 kw

Total .....874,190 kw

Gross Revenue 3,127,400~4,682,930 kw  
 Production Cost 874,190 kw  
 Pumping up Cost 97,500 kw  
 Labour Cost 960,000 kw

Net Income 1,195,710~2,751,240 kw



Although some settlers employ cattle or tractor cultivation, they should first try to cultivate their land themselves. When they have excess working hours, they should think first how to become self-sufficient and plant fruit trees, root vegetables, leafy vegetables, and fruit vegetables. Then, the excess products could be sold. When they earn extra money, they should increase their assets by buying livestock.

When the number of family members increases, they should increase the size of their farming land. Only when their own labour forces are insufficient in number to cultivate their land, they may then employ the use of cattle or tractors.

It would be desirable for the settlers to have willingness to raise their own cattle. Even if they must borrow money to do so, and cultivate their land using the cattle. To earn extra income, the owners of cattle can also cultivate the land of other settlers.

At first the settlers should plant crops for their own use. After securing self-sufficiency in the supply of food, they should select cash crops that can easily be sold.

There is practically no rain in the Resettlement Area during the dry season. Once the land is cleared for farmland, soil erosion and, in particular, wind erosion of the top soil may progress significantly. One way to prevent soil erosion is to retain the existing trees and plant crops between them. However, it is necessary to take into consideration the future situations of the settlers who must cultivate their entire 4 ha of land when their families increase in size. Due to the lack of manual labour, they may have to use cattle or machinery to cultivate their land. For this purpose, the land should be cleared when land clearing equipment becomes available in the Resettlement Area.

The resettlement programme in the Kanakantapa area is to reclaim 3,200 ha of farmland within the 10,300 ha Resettlement Area. Approximately 7,000 ha of land will remain as is. The percentage of farmland to be cleared is not high, but it is a fact that land erosion will

be caused by the land clearing. For this reason, the settlers should take preventive measures, such as planting trees for windbreaks around their land and around each farm block. Another means for preventing soil erosion is to plant cover crops. However, no crops can grow in the Area during the dry season.

Thus, it would be realistic to retain the crops and grass grown during the rainy season for as long as possible in order to keep the farmland covered. For this case, only the seeds or fruit of the crops should be harvested.

#### 1) Farm Management Plan of Settlers

Each settler family is presently given 4 ha of land. It is believed that the number of family members will increase from 6 to 8 persons ( based on the result of a questionnaire concerned with an idealistic family structure) and it will cultivate the entire 4 ha of land. Based on the present farming environment (climate, market situation, farming techniques, etc.) a model farm management plan for 4 ha of land was drawn up as follows :

##### 1. Cropping

###### a. Selection of Crops

The selection of crops was made in view of suitability to climatic conditions and the marketability of products. Maize, cotton, ground nuts, sunflower, and sweet potato were selected.

These crops are already being grown in the Resettlement Area and no particular cropping problem exists.

###### b. Cropping Pattern

A suitable cropping system for the Area is of utmost importance for maintaining the soil's fertility and for preventing the bad effects of continuous cropping.

As shown in the following figures, maize, soy bean, ground nuts, sunflower, and cotton crops shall be rotated every three years.

	1/3	1/3	1/3
1 st Year Cropping	(1.3 ha) Maize	(1.3 ha) Ground nuts or Soy Beans	(1.3 ha) Cotton or Sunflower
2 st Year Cropping	Cotton or Sunflower	Maize	Ground nuts or Soy Beans
3 st Year Cropping	Ground nuts or Soy Beans	Cotton or Sunflower	Maize

Fig. 3.3.4 Proposed Cropping Pattern for Settler

## 2. Fruit Trees

There are presently no plans to plant fruit trees in the Area. Fruit trees that can grow under rain-fed conditions shall be planted by the settlers on their own land with the fruit being for their own consumption.

Fruit trees that can be grown under rain-fed conditions are as follows :

Within the Resettlement Area: Mango, guava, papaya

Along rivers: Banana, sugar cane, avocado

## 3. Livestock

Cattle, goats, and poultry are the main livestock raised in the resettlement Area. No pastures nor improved grassland exists in the Area. Natural grassland is used for grazing cattle and goats. The natural grassland is mostly on hill slopes or marshes. Approximately 4,000 ha of land may be used for cattle grazing.

However, the capacity of the land to graze cattle is not high. It is estimated that approximately 7 to 9 ha of land would be required to raise one cow. Accordingly, about 500 head of cattle may be raised on the grassland in the Resettlement Area.

Even if cattle are fed crop remains, the maximum number of cattle would be limited from 600 to 700 head in the Area.

#### 4. Use of Agricultural By-products

The trashing remains of maize and beans can be used for feed. The remains, instead of being burned, should be used for making fertilizer.

#### 5. Tree Planting

Cutting down trees in the communal use land for fuel use or support material is prohibited in the Resettlement Area for forest and soil conservation purposes. However, this rule is not strictly adhered to.

It is highly recommended not only to conserve the present forest but to plant trees along the borders of new farmland and farm roads.

#### 6. Sale of Farm Products

Grain produced in the Resettlement Area will be purchased by an agency authorized by the Government of Zambia at prices specified by the Government. Such prices are not very high, but, at least, a certain income for the settlers is assured.

Regarding horticultural crop market, it will be necessary to organize settlers under the instruction of training farm, to cultivate beneficial crop like a tomato, to establish the effective shipping system such as keeping the destination by joint shipping. The administration center will be able to use as the collection and shipping center in the future and it is possible to implement the quality control using the center. Therefore, realization of the collection and shipping center should be promote.

## 7. Settler's Economy

By assuming the number of family members as being 7 persons (a couple with five children), each family's gross revenue is estimated as being Kw38,410 (Table 3.3.16), farm operating costs as being Kw10,537 (Table 3.3.17), and profit as being Kw27,820. Living expenditures will be Kw40,890 (Table 3.3.18). As a consequence, each family's balance will be Kw-13,106.

Faming Gross Revenue:	Kw38,410
Farm Production Costs:	<u>-10,540</u>
Subtotal (profit)	Kw27,870
Living expenditures:	<u>- 40,890</u>
Total (Balance)	Kw-13,020

The Government of Zambia regards such families as low income families that make less than Kw25,000 annual income per family and provides one food coupon per each family member a month (equivalent to Kw42).

According to the Government's evaluation standard, a family income of Kw27,870 per year is not extremely low because such families can produce their own food.

If a settler grows tomatoes on his land, the settler's surplus income will be Kw143,302/1.3 ha. However, with the present farming techniques it would be quite difficult for the settler to grow tomatoes. Also, it would be physically difficult to plant tomatoes on 1.3 ha of land.

As the above estimate indicates, it is clear that farming in the Area will be profitable if suitable crops are selected. Accordingly, settlers need to select suitable crops, learn farming techniques, and study market conditions. For these reasons, construction of the training farm has great meaning.

Farming Gross Revenue:	Kw221,320
Farm Production Costs:	- 37,130
Subtotal (profit)	Kw184,180
Living expenditures:	- 40,890
Total (Balance)	Kw143,300

Table 3.3.16 Farming Gross Revenue

Name of Crop Item	Maize	Groundnuts	Cotton
Cropping Area	1.3 ha	1.3 ha	1.3 ha
Yield	3,250 kg	1,107 kg	780 kg
Home Use	630 kg	50 kg	
Surplus (to be sold)	2,620 kg	840 kg	780 kg
Unit Price	Kw500/90 kg	Kw1,107/80 kg	Kw15.5/ kg
Selling Price	Kw14,556	Kw11,762	Kw12,090
<b>TOTAL</b>	<b>Kw38408</b>		

Table 3.3.17 Farm Production Cost

Name of Crop Item	Maize	Groundnuts	Cotton
<b>Material Costs:</b>			
Cultivating Fee	-	-	Kw1,950
Seed	Kw543	Kw205	65
Initial Fertilizer	2,756	1,378	1,378
Additional Fertilizer	2,262	-	-
Subtotal	5,561	1,583	1,443
<b>TOTAL</b>	<b>Kw10,537</b>		

Note: It is assumed that the average family has a 2.5-man work force (husband (1.0), wife (0.5), children 0.5 x 2) and that one man can cultivate about 1 ha of land. The remaining land is to be cultivated by employing cattle.

Table 3.3.18 Living Expenditure

Item (consumption per person)	Annual Consumption	Unit Price	Amount
Sugar 1.5 kg/month	18 kg	Kw37/kg	Kw666
Salt 0.8 kg/month	9.6 kg	Kw25/kg	240
Soap 3 each/month	36 each	Kw25/each	900
Cooking Oil 2 litres/month	24 litres	Kw150/litre	3,600
Kerosene 3 litres/month	36 litres	Kw30/litre	1,080
Clothing			1,000
Transportation	6 times to Lusaka	Kw100/round trip	600
Medical Expense			0
Education Fee			0
Others			1,000
<b>TOTAL</b>			<b>Kw9,086</b>

Note: By regarding a child as 0.5 person, living expenditures for one family will be Kw9,086 x 4.5 = Kw40,887 per year.

Table 3.3.19 Farming Gross Revenue (introduction of tomatoes)

Name of Crop	Maize	Groundnuts	Tomatoes
Item			
Cultivating	1.3 ha	1.3 ha	1.3 ha
Yield	3,250 kg	1,107 kg	19,500 kg
Home Use	630 kg	50 kg	
Surplus (to be sold)	2,620 kg	850 kg	19,500 kg
Unit Price	K500/90 kg	K1,107/80 kg	K10/kg
Selling Price	K14,556	K11,762	K195,000
<b>TOTAL</b>			<b>K221,318</b>

Table 3.3.20 Farm Production Costs (introduction of tomatoes)

Name of Crop Item	Maize	Groundnuts	Tomatoes
Material Costs:			
Cultivating Fee	-	-	Kw1,950
Labour Cost			11,440
Seed	Kw543	Kw205	369
Initial Fertilizer	2,756	1,378	5,875
Additional Fertilizer	2,262	-	2,262
Agricultural Medicine			4,550
Marketing Cost			3,538
Subtotal	5,561	1,583	29,985
<b>TOTAL</b>	<b>Kw37,129</b>		

Note: 1. It is assumed that an average family has a 2.5-man work force (husband (1.0), wife (0.5), children (0.5 x 2)) and one man can cultivate about 1 ha of land. The remaining land is to be cultivated by employing cattle.

2. Hired labour will be used when the family's work force is not enough for replanting seedlings and harvesting tomatoes.

### (3) Management System of the Resettlement Area and Training Farm

The executing organization of the Project is the Department of Resettlement. This department will assign the managers and staff members of the Kanakantapa resettlement Office and the training farm.

#### 1) Department of Resettlement

The Department of Resettlement undertakes the following work in the Kanakantapa Resettlement Area :

- a. Construction of internal roads within the Resettlement Area
- b. Farmland reclamation (750 ha)
- c. Construction of public facilities
- b. Management and maintenance of the above works



## 2) Management Office

The management office undertakes the management of the entire resettlement programme under the supervision of the Department of Resettlement. In a nutshell, work to be undertaken by the management office follows :

- a. Supervision of farmland development and road construction
- b. Supervision of public facility construction
- c. Monitoring of the Resettlement Area's situations and request for improvement items
- d. Handling of settlers who violate the rules of the Resettlement Area.

## 3) Settlers' Self - Governing Organization

There is presently no self-governing organization in the resettlement Area. However, the Department of Resettlement is planning to organize settlers' self - governing associations.

The resettlement Area is divided into three blocks : A block; B block; C block. There are 11 villages in A and B blocks (settlement in C block has yet to take place). According to the Department of Resettlement's plan, each village will have a chairman, a secretary, a production committee, and management committee. The entire Resettlement Area will have a chairman of the self-governing organization, a secretary, and a management committee that is made up of village chairmen.

## 4) Training Farm

The management and operation of the training farm will be conducted by the staff members under the direction of the manager. However, as the training farm is basically the settlers' farmland, it would be desirable for the settlers to manage and operate the training farm by themselves.

### 3-3-6 Operation and Maintenance Plan

#### (1) Operation and Maintenance System

14 staff members, including the manager, will conduct the operation and maintenance of the administration office, training farm, and machinery units.

The operation and maintenance system includes training farm management, Agricultural Machinery, Agricultural Extension, and Irrigation Facility divisions. Machinery operators and repair mechanics will be stationed at the training farm.

#### (2) Operation and Maintenance Costs

The costs necessary for operating and maintaining Project facilities are estimated to be kw 2,600,000/year for the first year. The costs are as follows:

##### 1) Management Office:

Personnel expenditure	kw451,000
Office maintenance Cost:	151,300
Management use vehicle fuel	<u>117,100</u>
Subtotal	kw719,400

##### 2) Training Farm:

Labour cost:	kw960,000
Production cost:	874,200
Electricity fee for irrigation pump	<u>97,500</u>
Subtotal:	kw1,931,700

The costs of management office will be financed from budget of the Government. The costs of training farm will be financed from benefit of training farm since second year. Therefore operation and maintenance cost will be estimated to be kw 719,400/yer since second year.

### (3) Cost of Land Reclamation

Cost of land reclamation for remaining 750 ha will be varied depending on the construction schedule as shown in Table 3.3.21. Those are summarized below:

for three years	kw 8,588,000/year
for four years	kw 6,579,000/year
for five years	kw 5,374,000/year

As repairing cost was counted in the management office cost, it is not included in above cost.

### 3-4 Technical Cooperation

The success of the Project and the Kanakantapa Resettlement Programme will greatly depend on the training farm. Thus, technical cooperation by dispatched Japanese expert will be indispensable. the dispatchment of a cropping and farm management expert and a machinery expert would be necessary.

#### (1) Cropping and Farm Management Expert (Two)

As most of the settlers do not have farming experience, the provision of cropping technique guidance (particularly vegetable planting) will be very important.

The expert will select the crops to be introduced into the training farm and will give cropping technique guidance to Zambian counterpart personnel who are Government employees. The expert will lead the counterpart personnel and conduct the operation and management of the training farm. In a nutshell, the expert is required to prepare the annual cropping plan, irrigation water distribution and management plan, labour mobilization plan, farm product marketing plan, agricultural machinery utilization plan, and the farm management plan. Thus, the expert must not only be familiar with cropping techniques, but must have experience in a variety of fields.

Table 3.3.21 Required Expenses for Land Reclamation of 750 ha

Item	Horse Power	Fuel for unit and 1 hour	Fuel for machine and 1 hour	Required time for reclamation of 750 ha	Annual time for Three years Land reclamation	Annual time for Four years Land reclamation	Annual time for Five years Land reclamation	Annual time for Three years Fuel	Annual time for Four years Fuel	Annual time for Five years Fuel	Note
Type	Hp	l/hp/hr	l/hr	hr	hr/year	hr/year	hr/year	1/year	1/year	1/year	
Bulldozer	320	0.1171	37.44	12,316	4,105	3,079	2,463	153,835	115,376	92,301	D8 × 2
Motor grader	155	0.065	10.08	6,450	2,150	1,513	1,290	21,861	16,246	12,997	
Vibrating roller	130	0.110	14.30	4,053	1,351	1,013	811	19,319	14,489	11,592	10 t
Back hoe	80	0.114	9.12	4,746	1,582	1,187	949	14,428	10,821	8,657	0.4m <sup>3</sup>
Spallkier truck	185	0.036	6.66	(1,600)	1,600	1,600	1,600	10,656	10,656	10,656	with 6.8kl tank ( ) : Annual time
Total					219,899	167,589	136,202	219,899	167,589	136,202	*0.2: Portion of Expenses for oil

<p>Personal expenses of operator</p> <p>219,899 l × 32 × (1+0.2) = 8,444,122</p> <p>167,589 × 32 × (1+0.2) = 6,435,418</p> <p>136,202 × 32 × (1+0.2) = 5,230,157</p> <p>Personal expenses of operator</p> <p>24,000 × 6 = 144,000 kw/year</p>	<p>Personal expenses of operator</p> <p>8,568,000</p> <p>6,579,000</p> <p>5,374,000</p>
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## (2) Machinery Expert (one)

The machinery expert to be dispatched to the training farm in the Kanakantapa Resettlement Area shall be responsible for the equipment to be provided. This will include ① operation and maintenance of land reclamation equipment, and ② management, operation, and maintenance of agricultural machinery for the training farm. The expert will conduct the technical transfer to Zambian counterpart personnel.

### 1) Expert's Work Related to Land Reclamation Equipment

The expert will provide counterpart personnel technical guidance for the safe and appropriate operation of the reclamation equipment and for the equipments' maintenance and management. He will teach counterpart's operators and mechanics how to safely operate the equipment and how to manage it at the site. He will also teach the personnel how to perform the daily maintenance through periodic inspection and maintenance work.

### 2) Expert's Work Related to Agricultural Machinery for the Training Farm

The expert will provide counterpart personnel with technical guidance in the safe operation of agricultural machinery and for its appropriate maintenance and management. He will also teach them about mechanized farming. With the cooperation of the cropping and farm management expert, he will prepare and effective machinery utilization plan for the operation of the training farm.

## (3) Responsibility of Each Expert

### 1) Cropping and Farm Management Expert

The Expert will take part in the operation and management of the training farm by assisting the manager and will direct the

Zambian counterpart personnel in the performance of the following work. He will also give advice and guidance to concerned divisions of the Zambian Government in the preparation of the training farm's annual budget draft.

1. Farming During the Dry Season (Irrigated Farming)
  - ① Selection of crops
  - ② Selection of seeding method
  - ③ Selection of fertilizing method and prescribe the amount
  - ④ Growth management
  - ⑤ Selection of irrigation method and irrigation operation
  - ⑥ Determination of harvesting and marketing methods and timing.
2. Farming During the Rainy Season
  - ① Selection of new cash crops and examination of their cropping system
  - ② Improvement of fertilized farming
  - ③ Guidance of organic fertilizer application
  - ④ Examination and improvement of harvest and post-harvest activities.
3. Environmental Conservation
  - ① Conservation of forest area and establishment of measures against fuel logging.
  - ② Study of utilizing fruit trees for windbreaks
  - ③ Study of measures against wind damage to crops during the dry season (after the rainy season harvest)
4. Farming Mechanization (with the cooperation of a machinery expert)
  - ① Guidance of tractor farming method
  - ② Guidance of safety precautions through actual operation and maintenance of machinery
  - ③ Establishing and adopting a mechanized farming plan
5. Farm Management
  - ① Conducting market studies, such as farm product prices and market demand
  - ② Improvement of farm product marketing and preservation methods

- ③ Study of an agricultural cooperative association
- 6. Establishment of Training Farm's Management plan and Settler Training Programme

## 2) Machinery Expert

The machinery expert will supervise Zambian counterpart personnel in carrying out the following work as well as conducting the technical transfer when preparing an operation plan and when performing actual equipment operation work. He will also give advice and guidance to officials concerned of the Zambian Government in the preparation of the training farm operation's budget draft (repair shop, farm, etc. ).

### 1. Land Reclamation Machinery

- ① Establishment of a machinery land reclamation plan and, based on the plan, prepare a machinery use schedule and implement the land clearing work and exercise schedule control.
- ② Establishment and enforcement of a safe machinery operation plan
  - a) Conducting daily pre-operation inspections
  - b) Conducting daily post-operation inspections and daily maintenance work
  - c) Confirmation of daily accomplished work according to the work schedule
  - d) Conducting periodic inspections (250-hour operation inspection), replacing expendable parts (based on inspection results), and lubricating (periodically).
- ③ Conducting repair work and determining large repair work
- ④ Give lectures on how to improve operating techniques
- ⑤ Appropriate management of the repair shop.
- ⑥ Preparation of operating standards for the multipurpose use of land reclamation equipment and the enforcement of the standards.

## 2. Agricultural Machinery

- ① Cooperation with a cropping and farm management expert for establishing a training farm operation plan and the preparation of an annual machinery use plan based on the training farm operation plan.
- ② Establishment and enforcement of a safe machinery operation plan
- ③ Machinery repair
- ④ Improvement of operating techniques
- ⑤ To conduct machinery (including land reclamation equipment ) maintenance and management work
- ⑥ supervising and advising counterpart personnel in the making of small farming tools an in bicycle operation and management rules
- ⑦ Providing guidance and advice to counterpart personnel in the correct maintenance and operation of irrigation facilities
- ⑧ Providing guidance and advice to counterpart personnel in the correct maintenance and operation of maize hammer mills.



## CHAPTER 4 Basic Design



## CHAPTER 4 BASIC DESIGN

### 4-1 Design Policy

#### 4-1-1 Natural Conditions

##### (1) Site Location

The Kanakantapa Resettlement Area is located approximately 10 km northeast of a point that is some 38 km away on National Road T-4 eastward from Lusaka City's railroad station. The 10.5 km is the access road that is to be improved.

##### (2) Climate

Climate in the Project Area can be clearly classified into the rainy season (November to March) and the dry season (April to October). 98% of annual rainfall occurs during the rainy season. In particular, it concentrates during the December, January, and March periods.

Rainfall data obtained at Kasisi Mission Observation Station -- the closest observation station to the Project Area -- and at the Lusaka International Airport was used for rainfall analyses.

The average annual rainfall during the 1980 - 1989 period was 873 mm. During that period, the smallest annual rainfall was 427 mm in 1983; the largest one was 1,128 mm in 1985. The maximum monthly rainfall was 443 mm in January 1981.

The average monthly temperature was 21.1°C; the maximum was 25.4°C in October

The maximum monthly humidity was 82% in February; the minimum was 41% in September.

There are 2,800 hours of annual sunshine. The maximum daily sunshine of 9.8 hours is during November; the minimum of 5.2 hours is during December.

#### 4-1-2 Social Condition

This year is only the third since the resettlement programme began in the Project Area and the settlers' living conditions remain unstable. Presently, the main means of transportation in the Area is either by walking or riding a bicycle.

#### 4-1-3 Construction Field Situation

##### (1) General Situation of the Construction Field

Modern high-rise buildings can be seen in Lusaka. Most of the buildings are from low to medium height. The building structure types are mainly reinforced concrete, brick, or concrete block. There are only a few steel-frame type buildings.

There are a number of contractors who have relatively advanced construction capabilities. But, for special foundation construction, only a limited number of them have suitable construction equipment.

Generally, design and construction work is conducted according to British Standards.

The following are Zambia's own standards:

- General Specifications (Interim Metric Edition, Director of Buildings Department, Ministry of Works and Supply)
- Standard Specifications for Roads and Bridges (Road Department, CES)
- Code ZS 016 1975
- Code of Basic Data for the Design of Buildings, Loading, Dead and Imposed Load

Other than the above, the Zambian Standard Association has established standards for cement, slate, and concrete blocks.

In 1984, 11% of all employed workers in the country were construction labourers. They are classified as either Class 1, 2, or 3 depending upon their skills. There are only a few Class 1 workers.

Zambia produces such basic construction materials as sand, gravel, bricks, and concrete blocks. Structural steel material is imported from Zimbabwe. Aluminum and stainless steel products are unobtainable. Electrical equipment, such as transformers and distribution panels, are imported from Europe.

(2) Item To Be Given Attention at the Project Site

Construction materials for the Project will be shipped from Lusaka. There are two roads leading from National Road T-4 into the Project Site.

One, the western route, is considered as the Project's access road. It is comparatively good condition, but vehicles cannot cross the Chongwe River during rainy seasons. The other road, the eastern route, enters from National Road T-4 at a point approximately 10 km east of the western route. Vehicles using this route can cross the river even during rainy seasons, but the road condition is poor and substantial improvement work would be necessary before construction materials could be transported over it.

For the above reason, it would be desirable to transport as much of the construction materials as possible to the Project site during dry seasons.

4-1-4 Use of Local Contractors and Locally Procurable Equipment and Materials

Zambia produces such basic construction materials as cement, sand, gravel, crushed stone, bricks, concrete blocks, and slate. Other construction materials must be imported from foreign countries.

The domestic construction materials will be fully used in Project construction. Since the quality of the bricks and concrete blocks varies to a great extent, these materials must be carefully selected.

Local contractors have comparatively high construction capabilities; therefore, it will be possible to use them as subcontractors for Project construction.

#### 4-1-5 Scale and Level of Project Facilities and Equipment

##### (1) Basic policy for Building Facilities

- ① The building facilities shall be appropriate for the Project.

By analyzing the contents of the Government of Zambia's request and by taking into consideration the future plan and the contents, the scales and levels of the building facilities suitable for the Project will be decided upon.

- ② The building facilities and equipment shall be types that will allow easy management, operation, and maintenance work.

The facilities' arrangement plan that has simplified moving lines will allow easy facility operations.

By using local materials, facility maintenance work will be simplified.

- ③ The facilities shall be designed by taking into consideration the natural and social conditions in Zambia.

Natural conditions include the concentrated rainfall during rainy seasons and the frequent thunderstorms and must be given careful consideration. As for the social condition, consideration must be given to devise measures to provide protection against thieves.

- ④ Zambian construction methods shall be adopted as much as possible.

By adopting construction methods that are familiar to the local contractors and labourers construction costs will be lower and the construction period will be shorter.

⑥ The building facilities shall have minimum necessary scales.

#### 4-1-6 Facilities' Management and Maintenance System and Capability

The management and maintenance of Project facilities will be undertaken by the Kanakantapa Resettlement Office organized by the department of resettlement of the Government of Zambia. Fourteen (14) staff members, including a manager, will be assigned.

Until the completion of the resettlement programme, personnel of the Department of Resettlement will manage the Office. After completing the resettlement programme, the ministry of Agriculture will take care of the Office.

The Department of Resettlement's personnel responsible for machinery are dispatched from the Ministry of Works and Supply. Its personnel concerned with agriculture are dispatched from the Ministry of Agriculture.

This year no budgetary fund was allocated for the Department of resettlement. However, funds will be allocated to the Department starting next year (in Zambia, the fiscal year and calendar year are the same).

A budgetary fund of kw8,224,700 has been allocated for 1991's Project related expenditures.

Repairmen and operators for Project equipment will be dispatched from the Ministry of Works and Supply.

Thus, no Project facility management problems can be foreseen.

As this will be the first case for organizing a management system for the training farm in Zambia, Japanese technical cooperation for the Project will be needed.

#### 4-1-7 Construction Period

Bearing in mind that more than 70% (621 families) of the settlers have already settled and that no employment opportunity are given during dry seasons, it is desirable that the Project be implemented as soon as possible.

As the project comprises road construction, construction of training farm and administration facilities, and provision of equipment, the most effective implementation schedule must be prepared considering technical and economic points of view.

#### 4-2 Study and Examination of Design Criteria

##### 4-2-1 Road Facility

After examining the following items it was decided upon to adopt Zambian rural road standards for Project roads:

- ① Traffic for 800 settler families (approximately 10,000 people)
- ② Delivery of farm products yielded from 3,200 ha of farmland
- ③ Movement of 100 families (about 1,000 people) residing along the road and farm products yielded from farmland along the road
- ④ Road standards established by the Ministry of Works and Supply of the Government of Zambia
- ⑤ Japanese road Structure Standards

Features of the Project's road are as follows:

- New construction: 4.3 km; improvement section: 6.2 km
- Carriageway width: 5.5 m; shoulder: 1.0 m; formation: 7.5 m
- Gravel pavement
- Crossfall: 5%

Related structures include one bridge (Chongwe River crossing) and one submersible bridge (Kanakantapa River Crossing). The design and



Related structures include one bridge (Chongwe River crossing) and one submersible bridge (Kanakantapa River Crossing). The design and construction of these bridges shall be based on the River Structure Standards of the Japanese Ministry of Construction.

#### 4-2-2 Training Farm

##### (1) Determination of training Farm Location

The most important requirement for the training farm is the type of soil. Other requirements include the availability of electricity and water from sources nearby the resettlement area.

By taking into account these requirements, the location of the training farm was decided upon as being at a point approximately 8 km away from National road T-4. The site is within the resettlement area and is bounded by the Chongwe River and the Kanakantapa River.

##### (2) Size of the Training Farm

It would be desirable to accept many settlers at the training farm during dry seasons. But, to do so, a large training farm would be needed. Conversely, in view of the technical guidance and training of the settlers and the management, operation, and maintenance of the training farm, a smaller size farm would be preferable.

Since the training farm is planned to be used during dry seasons, an irrigation system should most certainly have to be installed.

Water resources in the Project Area during dry seasons are limited. The amount of available water is an important factor in determining the size of the training farm. Thus, careful analyses of available water resources were made (the following section refers). As a result, the size of the training farm was decided upon as being 30 ha.