THE REPUBLIC OF MALAWI
MINISTRY OF AGRICULTURE

JAPAN INTERNATIONAL
COOPERATION AGENCY

FEASIBILITY STUDY ON BWANJE VALLEY SMALLHOLDER IRRIGATION DEVELOPMENT PROJECT

VOLUME II

ANNEXES

I ASSESSMENT OF DEVELOPMENT POTENTIAL

II FEASIBILITY STUDY FOR FIVE SELECTED PROJECTS

FEBRUARY 1994

NIPPON KOEI CO., LTD.
PACIFIC CONSULTANTS INTERNATIONAL

FEASIBILITY STUDY ON BWANJE VALLEY SMALLHOLDER IRRIGATION DEVELOPMENT PROJECT
V. II ANNEXES
FEBRUARY 1994

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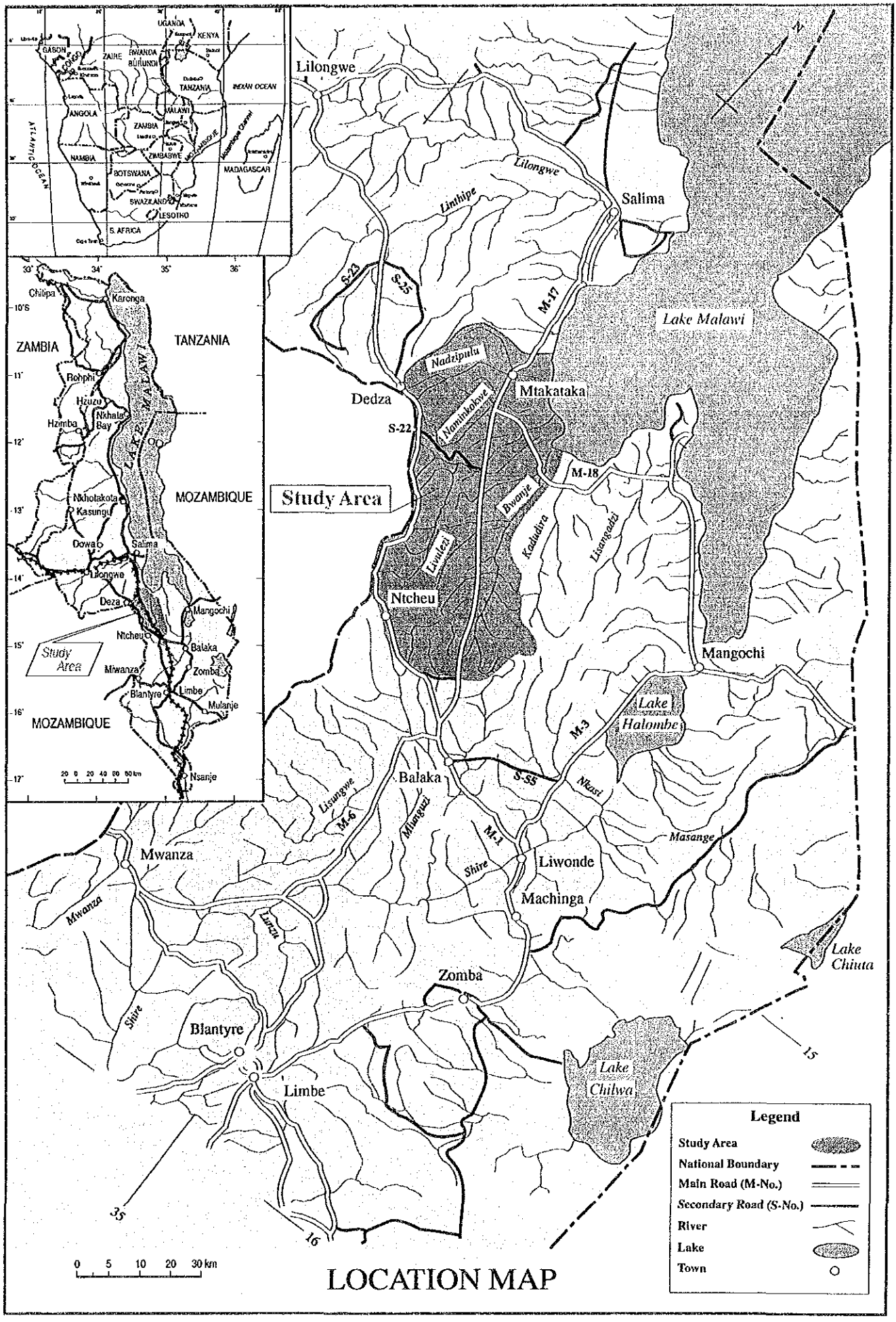
I. ASSESSMENT OF DEVELOPMENT POTENTIAL

II. FEASIBILITY STUDY FOR FIVE SELECTED PROJECTS


Lilongwe
Salima
Lilongwe
Linthipe
S-23
S-25
M-17
Lake Malawi
Nadzipulu
Dedza
Mtakataka
Namimkolowe
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Study Area
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Kaludzra
Livulezi
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Nkasi
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Shire
Liwonde
Machinga
Mwanza
Lunzu
Lake Chiuta
Zomba
Shire
Blantyre
Lake Chilwa
Limbe
35
16
15
0 5 10 20 30 km
LOCATION MAP
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National Boundary
Main Road (M-No.)
Secondary Road (S-No.)
River
Lake
Town
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KENYA
GABON
ZAIRE
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S. AFRICA
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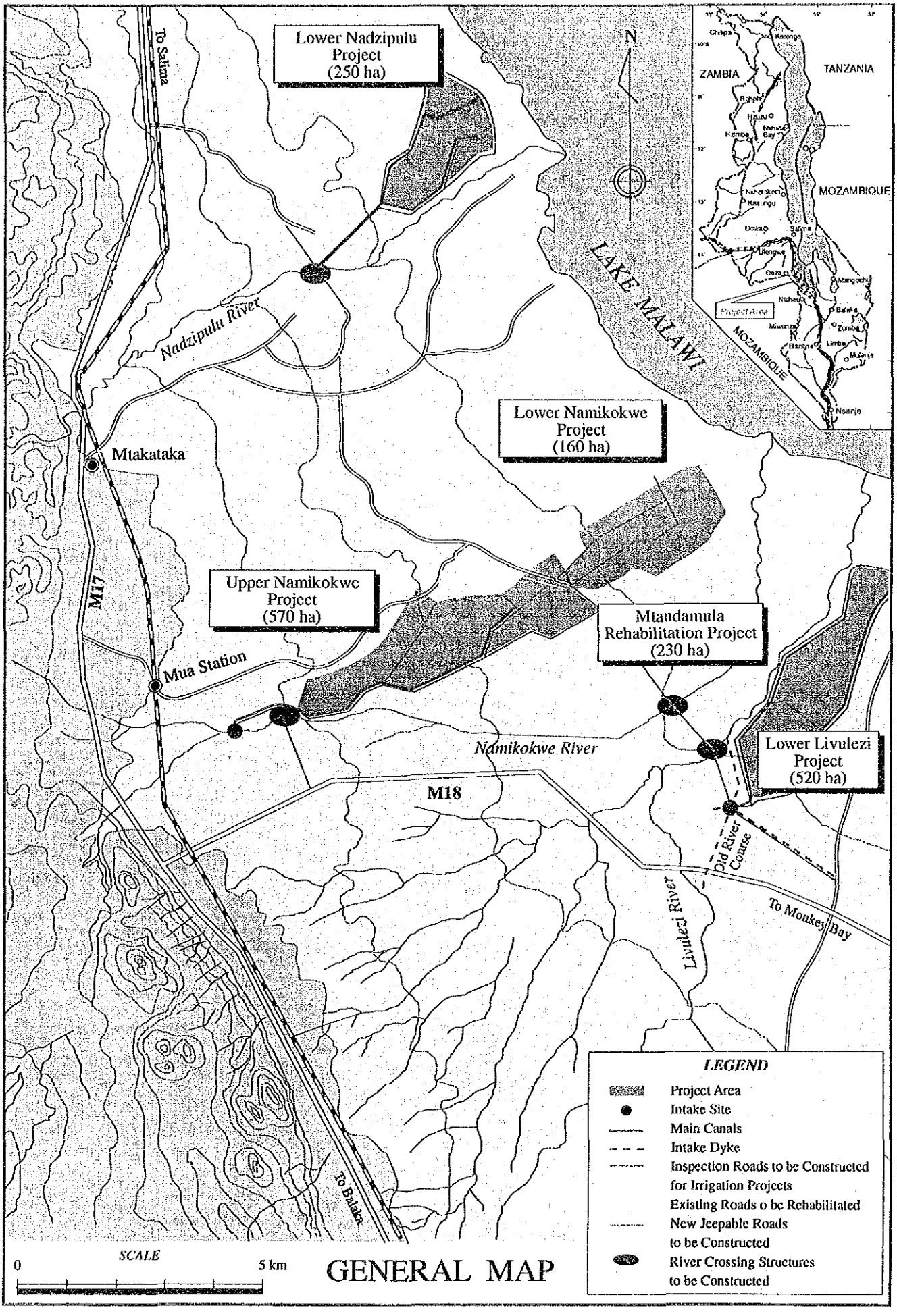
Rohphi
Hzuzu
Nkhata Bay
Hzimba
Nkhotakota
Kasungu
MOZAMBIQUE
Dowa
Salima
Lilongwe
Deza
Mangochi
Ntcheu
Balaka
Study Area
Mwanza
Zomba
Blantyre
Limbe
Mulanje
MOZAMBIQUE
Nsanje
20 0 20 40 60 80 km


Lower Nadzipulu Project (250 ha)
To Salima
N
ZAMBIA
TANZANIA
MOZAMBIQUE
LAKE MALAWI
Project Area
Nadzipulu River
Lower Namikokwe Project (160 ha)
Mtakataka
M17
Upper Namikokwe Project (570 ha)
Mtandamula Rehabilitation Project (230 ha)
Mua Station
Namikokwe River
Lower Livulezi Project (520 ha)
M18
Old River Course
Livulezi River
To Monkey Bay
To Balaka
LEGEND
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Intake Site
Main Canals
Intake Dyke
Inspection Roads to be Constructed for Irrigation Projects
Existing Roads o be Rehabilitated
New Jeepable Roads to be Constructed
River Crossing Structures to be Constructed
SCALE
0
5 km
GENERAL MAP

FEASIBILITY STUDY
ON
BWANJE VALLEY SMALLHOLDER IRRIGATION DEVELOPMENT PROJECT

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FEASIBILITY STUDY FOR FIVE SELECTED PROJECTS

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ACRONYMS

ACLCO	Land Resources and Conservation Branch
ADB	African Development Bank
ADD	Agricultural Development Division
ADMARC	Agricultural Development and Marketing Corporation
ARNC	Adaptive Research National Coordinator
ARO	Adaptive Research Officer
CAARO	Department of Agricultural Research
CAETO	Department of Agricultural Extension and Training
CAN	Calcium Ammonium Nitrate
CAS-NRDP	Controller of Agricultural Services
CAS-I	Controller of Agricultural Services
CDC	Common Wealth Devilment Corporation
CEC	Cation Exchange Capacity
CIF	Cost, Insurance and Freight
CONGOMA	Council for Non-Government Organizations in Malawi
CVO	Department of Animal Health and Industry
CIO	Department of Irrigation
DANIDA	Danish International Development Agency
DAP	Di-Ammonium Phosphate
DAR	Department of Agricultural Research
DET	Department of Agricultural Extension and Training
DO	Development Office
DOI	Department of Irrigation
EC	European Community
EC	Electric Conductivity
EPA	Extension Project Areas
EPD	Economic Planning and Development
ESCOM	Electricity Supply Commission of Malawi
ETo	Evapotranspiration
EXST	Estate Extension Services Trust
FA	Field Assistant
FAO	Food and Agricultural Organization of the United Nations
FES	Farming Equipment and Engineering Services
FHA	Farm Home Assistants
FHH	Female Headed Households
GDP	Gross Domestic Product
HESP	Health Education and Sanitation Promotion Programme
JICA	Japan International Cooperation Agency
Kc	Crop coefficient
MK	Malawi Kwacha
MOA	Ministry of Agriculture
MOH	Ministry of Health
MOWS	Ministry of Works and Supplies
MRL	Malawi Railways Ltd.
NEWS	National Early Warning System
NGO	Non-governmental Organization
NOIL	National Oil Industries
NRC	national research coordinators
NSCM	National Seed Company of Malawi
NVRC	National Variety Release Committee
O&M	operation and maintenance
OPC	Office of the President and Cabinet
PFNO	Food and Nutrition Unit
PHA	Private Hospital Association

PM	Programme Manager
PO	Project Officer
RDP	Regional Development Project
SA	Sulphate of Ammonium
SACA	Smallholder Agricultural Credit Association
SADCC	Southern African Development Coordination Conference
SCF	Save the Children Fund
SFFRFM	Smallholder Farmers' Fertilizer Revolving Fund of Malawi
SFHA	Senior Farm Home Assistants
SLADD	Salima Agricultural Development Division
SMO	Seed Multiplication Officer
SMS	Subject Matter Specialists
STWPC	Seed Technology Working Party Committee
SUCOMA	Sugar Company of Malawi
TA	Traditional Authority
UNDP	United Nations Development Program
USAID	United States
UT (M)	United Transport of Malawi
WFP	World Food Program

STANDARD ABBREVIATIONS

m^3	Cubic metre
m^3/sec	Cubic metre per second
d	Day
°C	Degrees Celsius
El.	Elevation above mean sea-level
ha	Hectare
kg	Kilogram
km	Kilometre
lit	Litre
lit/sec	Litre per second
m	Metre
mm	Millimetre
m^2	Square metre
ton	Tonne

CURRENCY EQUIVALENTS

US$ 1 = MK 4.33= Japanese Yen (¥) 104

MK 1 = US$ 0.231 = ¥ 24.0

as of August, 1993

ANNEX I

ASSEEMENT OF DEVELOPMENT POTENTIAL

1. INTRODUCTION

This is Annex I on Assessment of Development Potential for Feasibility Study on the Bwanje Valley Smallholder Irrigation Development Project (the Project). This report deals with study results worked out mainly through the Phase I study which was carried out in the period from September 1992 to March 1993, and partly modified by incorporating the latest data and information obtained through the Phase II study.

Chapter 2 presents the national background as well as agricultural and socio-economic circumstances of the Project which prove the needs of irrigation development in the Bwanje Valley area from the viewpoint of national and regional development.

Chapter 3 mentions the present conditions of the study area, which is defined as an aggregated watersheds of 2,500 km^2 consisting of the four (4) river basins, namely Nadzipulu, Namikokwe, Livulezi and Bwanje. The comprehensive study was made to verify the past and present conditions including social and economic aspects, physiography and soils, agro-climate, hydrology, geology, land use, land tenure system, crop production, livestock and fishery, agricultural support services, marketing and pricing, rural infrastructure, etc. The Chapter outlines the rural sociological features of the study area on the basis of the farm interview.

Chapter 4 presents the results of the irrigation development potentials from land and water resources points of view. Development opportunities with alternative water resources, i.e. groundwater and lake water, were also studied on preliminary basis. Water balance was analysed in order to estimate an potential extent of irrigable area by river basin under the conditions with introduction of double cropping system with rice and maize. The development potential area were selected and the preliminary layout of the Project was drawn. The irrigation areas in each river basin were primarily delineated.

Chapter 5 describes approach to the project formulation and basic development concepts. In this Chapter, firstly, the constraints prevailing in the study area were identified and analyzed. Secondly, the basic concepts of the Project were set up taking into consideration elimination of the constrains.

2. AGRICULTURAL BACKGROUND

2.1 GENERAL CONDITIONS

(1) Geography and Physiography

Malawi is a long, narrow, landlocked country located between latitudes 9°22' and 17°03' S and longitude 33°40' and 35°55' E with a total territory of 119,140 km^2, of which 24,000 km^2 or 21 % are lakes. Geographically, Malawi is situated on the most southern end of the Great African Rift Valley which stretches from the Red sea in the north to the Zambezi river in the south. The country is bordered by Tanzania in north and east, Mozambique in south and east and Zambia in west.

As a result of the plate tectonic movement during the Mesozoic and Tertiary eras, the specific physiographic features of the country was formed. The landscape of Malawi is classified into four (4) physiographic regions, namely Rift Valley floor, Escarpment, Plateau and Highland. Two-thirds of the total land consists of the Plateau lying between El. 900 m and EL. 1,300 m. The Rift Valley floor extends over the land along the lakeshore and Shire Valley in the elevation range between El. 100 m and EL. 600 m. Between the Plateau and the Rift valley floor, there are many grassy valley floors and depressions called "*dambos*", which are flooded during the wet season. The Escarpments extend between the Plateau and the Rift Valley floor with the N-S direction from El. 600 m to EL. 900 m. The Escarpments are seriously eroded out and dissected by the rivers draining mostly into the Lake Malawi. The Highland lies above El. 1,300 m. It is recognized that this Highland is the surface of the Gondowana continent in the Paleozoic era and is highly resistant against erosion.

According to the National Physical Development Plan, 55 % of the total land area of Malawi is suitable for agricultural farming. Those suitable lands extend mainly on the Plateau and the Rift Valley floor in Central and South Regions.

(2) Meteorology and Hydrology

Globally speaking, the climate of Malawi is classified into the tropical savannah. In general, rainfall is apt to increase as elevation increases. Its national average is about 1,000 mm, of which over 90 % occurs in the wet season from November to April. In the northern part of the country, annual rainfall along the lakeshore ranges from 1,500 to 2,000 mm and decreased with distance away from the Lake Malawi to less than 900 mm in the Plateau and Highland. In the central and

southern parts of the country, rainfall in the lakeshore and low-lying areas ranges from 800 to 900 mm, the Plateau from 900 to 1,300 mm and the Highland over 2,000 mm. Annual mean maximum and minimum temperature on the Plateau is about 23°C in November and 10°C in July. Annual mean maximum and minimum temperature on the lowland and the lakeshore are 32°C and 14°C, respectively.

There are 17 main river basins in Malawi. The mean annual run-off for the whole country is 196 mm with a runoff coefficient of about 19 %. Among the basins, the Shire River basin is the largest. Only the Shire River is an outlet of the lake Malawi with annual mean discharge of 395 m^3/sec at Liwonde gauging station. Its discharge does not fluctuate throughout the year. On the contrary, most of the rivers other than the Shire River are seasonal and their discharge in the dry season drops to 5 to 10 % of that in the wet season. This is one of the limiting factors for development of year-round irrigation farming in Malawi.

For groundwater development, two (2) main aquifer types were identified in Malawi, namely (i) weathered basement aquifers of the Plateau with extensive but relatively low yielding (1 to 2 lit/sec) and (ii) alluvial aquifers of the lakeshore plains and the Shire Valley with higher yielding (up to 15 lit/sec).

(3) Demography

The population census for Malawi has been conducted at a 10-year interval. The total population of the country was 7,950,000 according to the latest census in 1987. The annual population growth rate was estimated at 3.7 % in the period from 1977 to 1987. Sex ratios are 49 % for male and 51 % for female. The population by age group accounts for 46% of the total population for below 14 years old, 50 % for 15 - 64 and 4 % for over 65. About 50 % of the total population is concentrated in the southern part of the country, 39% in the central and 11% in the north. The national average population density is 85 persons/km^2, i.e. 34 persons/km^2 in the north, 35 persons/km^2 in the central and 125 persons/km^2 in the south. Though about 90 % of the people lived in the rural area in 1987, the rural population has tended to flow into the urban areas according to the previous population census.

There is no up-to-date information for the present population. The National Statistical Office projected the national population at 8.75 million as of mid-1991 under the assumption of an overall average annual population growth rate of 3.3%. Such a rapidly increasing population might force the rural population to flow into the urban areas of Blantyre, Lilongwe, Mzuzu and Zomba.

Further, the rate of migration from the neighbouring countries has considerably increased during the last decade. Mozambican refugees flowing into Malawi reached about 800,000 in 1989. The number of refugees often exceeds the number of Malawians in the southern region which borders with Mozambique and this cause serious social problems. Although it is expected that Mozambique will have political stability and the refugees will go back to their country, such uncertain social situation in Malawi will continue for years to come.

The rate of education attendance is about 45 % consisting of 42 % for primary school and 3 % for secondary and above. Literacy rate is 42 % for the whole country. The literacy rate for female is as low as 32 %.

2.2 ECONOMY

Gross Domestic Product (GDP) has shown a real growth rate of about 3.6 % in the second half of the 1980s. By 1990 the GDP growth rate had increased and reached 4.8 %. In 1991 the real GDP registered record growth of 7.8 % and declined by 7.9 % in 1992. GDP in 1991 was MK 6,100 million at current market prices. Agriculture has played a dominant role in Malawis' economy as a whole, contributing about 30 % of GDP and about 85 % of the total employment. Further, about 70 % of the agricultural sector are derived from the smallholder agriculture, while the rest estate agriculture.

Exports of Malawi are largely derived from estate agricultural commodities such as tobacco, tea and sugar, which account for about 80 % of the total value of the agricultural exports. During the 1980s, the increasing rate of export had been seriously depressed due to stagnant international market prices of agricultural commodities, rising transportation costs as well as stagnant agricultural production caused by unfavourable weather conditions. In addition, Malawi was not able to use the international trade harbours of Beira (360 km from Malawi) and Nacala (615 km) in Mozambique due to the internal conflict in Mozambique and had to use Durban (3,500 km) in South Africa and Dar-es-Salaam (2,500 km) in Tanzania as alternative harbours for export. Thus transportation costs for commodities soared by over 40 % of CIF margin, which reduced the international competitive power of Malawis' exports. In 1991 the total export value was MK 1,377.9 million.

The main imported commodities in Malawi are petrol, diesel, oil, coal, fertilizers and paraffin. The import value has increased year by year. The total import value in 1991 was MK 2,014.7 million. As a result, the visible trade deficit was MK 636.8 million in 1991. The outlook for 1992 is an increase in merchandise trade

deficit. This will be due to an expected increase in maize import due to inadequate rain this year. Annual inflation has shown significant declines, from 31.5 % in 1988 to 11.5 % in 1990.

2.3 AGRICULTURE AND AGRICULTURAL DEVELOPMENT POLICY

2.3.1 LAND USE

According to the National Physical Development Plan, about 20 % of the total land area of Malawi is used for agricultural farmland as presented below.

	Land use categories	Area (km^2)	(%)
(1)	Agricultural land	20,143	21.4
	(a) smallholder	13,833	14.7
	(b) estate	6,310	6.7
(2)	Village area	885	0.9
(3)	Infrastructures	566	0.6
(4)	National reserve	10,913	11.6
(5)	Forest	7,238	7.7
(6)	Hills/Swamps/Barren land	54,531	57.8
	Total	95,276	100.0

2.3.2 LAND TENURE

There are four (4) categories of land tenure status, (i) customary land, (ii) leasehold land, (iii) private land and (iv) public land among which customary land occupies 79 % of the total area followed by public land (17.3 %), leasehold land (3.1 %) and private land (0.6 %). Customary land is the under jurisdiction of the Traditional Authority (TA) or local headman. Most of the smallholder farmers depend on customary land. Public land is government-owned and currently used as game reserves, forest reserves and so on.

2.3.3 IRRIGATION SCHEMES

There are about 22,000 ha of irrigated land in Malawi or about 10 % of the total potential irrigation area, which are categorized into the estate irrigated land and the smallholder irrigated lands. The estate irrigated lands amount to 18,000 ha consisting of (i) 15,000 ha for sugar estates of Nchalo in the lower reaches of the Shire river and Dwangwa along the lake-shore, and (ii) 3,000 ha for tea, tobacco and wheat estates. The smallholder irrigated lands cover about 4,500 ha in total under government run

irrigation schemes and self-help irrigation schemes. There are 16 government run schemes which cover 3,500 ha, while the remaining 1,000 ha are covered with eight (8) self-help schemes.

The government supported schemes were constructed from the late 1960s to the late 1970s mainly by Taiwan and Britain. The main crop is rice. Most of those schemes are deteriorated due to inadequate operation and maintenance (O&M) funds. A heavy O&M cost of these systems is a financial burden for the Government at present. The self-help schemes have been implemented since 1980s. Since the irrigation facilities of these schemes are simple, their maintenance requires much farm labour. It turned out that some self-help schemes do not function well.

2.3.4 CROP PRODUCTION

Many kinds of crops are grown in Malawi. The main staple crops are maize, cassava, sweet potatoes, beans, rice and Irish potatoes. The estate crops include tobacco, tea, sugarcane, coffee, and cotton. The food crops are cultivated mainly by smallholders, these account for 70 to 80 % of the total crop production. Except for crop failures caused by drought years, production of food crops has been adequate in the past to meet the the rapidly increasing food demand although the nutritional value still remains low.

Crops are selected so as to fit soils and climate conditions and the government regulations on cropping policy. Maize covers about 70 % of the total cultivated land. Rice is grown on the lakeshore. Tobacco cultivation is made according to the government instructions. Cassava and cotton growing are practiced mainly in Salima ADD. Sugarcane is cultivated in the Shire valley and Dwangwa. With exception of rice and sugarcane, most of the crops are cultivated under the rainfed conditions. The national averages of crop production, cultivated areas and yields in 1991 in Malawi are summarized below;

Crop	Cultivated area (ha)	Production (ton)	Yield (ton/ha)
Maize	1,392,000	1,589,000	1.14
Rice	32,800	57,900	1.76
Millet	15,000	7,800	0.6
Sorghum	31,000	18,600	0.6
Pulses	190,100	68,500	0.36
Cassava	61,500	144,800	2.35
Groundnuts	67,000	30,900	0.44
Sweet potato	29,800	94,900	3.18
Sugarcane	14,600	174,500	11.95
Tea	1,800	400	0.22
Coffee	1,800	400	0.22
Tobacco	33,167	18,300	0.55
Cotton	53,700	42,800	0.79

Maize is grown under rainfed conditions. The varieties used are broadly classified into (i) local, (ii) composite and (iii) hybrid ones, of which local varieties occupy 80% of total maize. Fertilizers are applied mostly to hybrid maize. The unit yield of local maize is depressed at 0.8 to 1.0 ton/ha, composite 1.2 to 1.8 tons/ha and hybrid about 3.0 tons/ha.

Maize production has seriously been affected by drought and production did not meet the food demand in the drought years such as 1970/71, 1975/76 and 1980/81. In recent years, the maize production has increased due to favourable price setting for producers under the government marketing policy. This increased production is dependent fully on increasing cultivated areas, but not on increasing yield. In 1991/92 the most serious drought hit the country and maize production remained at only 692,000 tons as of April 1992, which is below 50 % of the average annual production.

Rice is cultivated under both rainfed and irrigated conditions. Rainfed rice is planted in "*Dambos*" and the floodplain along the main rivers. Irrigated rice is cultivated in the government run irrigation schemes and the self-help irrigation schemes. There are three (3) prevailing varieties in Malawi, namely Faya, Blue Bonnet and IET, of which Faya is the most common and occupies about 70 % of paddy field. The current rice yield ranges from 1.0 to 1.5 tons/ha for Faya, 2 to 3 tons/ha for Blue Bonnet and 4 to 5 tons/ha for IET. Rice production has been increased due to an expansion of the cultivated areas year by year. About 10 % of the total production has exported to the neighbouring countries and more export will be expected in the future.

Other cereal crops are represented by millet and sorghum grown in the semi-arid regions where maize can not be grown properly and adequate yield can not be obtained due to poor rainfall. About 60 % of the total production comes from the Shire

Valley. These crops are used for food as well as materials for beer breweries. Most of the variety are local one. The production and yield of these crops are seriously affected by climatic conditions and pests and diseases.

Pulses are the second staple crop as a protein source. These are cowpeas, sugar beans, chick peas, field peas, and pigeon peas. The Government has endeavoured to improve seed and distribute new varieties to farmers. Due to shortage of staff and budget for seed multiplication programmes, however, certified seeds are very limited and available only to a small percentage of farmers. Pulses are grown under rainfed conditions. The production has increased year by year because of increasing cultivated areas. It is expected that these crops will be exported to the neighbouring counties in the future.

Groundnuts is one of the most important exported crops and also plays an important role in domestic consumption. The varieties used are Chalimbana and Chitembana for snacks and Manipintar and Mawanga for edible oil. The production of this crop has seriously been affected by drought and pests/diseases, and has not been stable.

Sugarcane is one of the important export crops. Two estate companies, i.e. SUCOMA and Dwangwa, are the main producers. Sugar production has exceeded domestic demand for the recent nine years and 50,000 to 100,000 tons of sugar have been exported mainly to EC and U.S.A. Recently, however, the exported amount has decreased due to unfavourable price setting in international market and sharply increasing transportation costs. The varieties used are NC0376 and N14 and are grown under irrigated conditions. The yield and the total production of sugarcane have remained constant in recent years.

Tobacco is the biggest export earner for Malawi. Six kinds of tobacco are grown in Malawi. Burley and flue-cured are the main types grown under the estates in the north and the south of the country, whilst about 60,000 smallholder farmers grow the Malawi Western dark fire-cured types. The production of Burley considerably has increased four folds during the past 10 years. In contrast, the production of the local varieties has decreased. Out of the total income of the tobacco sales, Burley variety accounts for 80%. The main varieties of Burley are Hawaiian and Burley 37 Barnett' special for Burley, flue cured for Kutsaga series, Coker 347, and Speight G-28, and the fire cured for Malawi western, DRV7. The yield of flue-cured and Burley varieties is 1.0 to 1.2 tons/ha, and fired/dry cured varieties 0.2 to 0.5 ton/ha. There is the problem of the residual chemicals in the exported tobacco to be urgently solved.

2.3.5 MARKETING AND PRICING

(1) Marketing System of Major Crop Products

Agricultural products are traded through three marketing channels, namely Agricultural Development & Marketing Corporation (ADMARC), private traders and estate sector marketing bodies.

ADMARC was established in 1971 as parastatal body under the control of MOA by expanding roles and responsibilities attached to Farmers Marketing Board. Its main objectives are to encourage smallholders crop production and to ensure purchase of smallholder crops. Currently ADMARC is not a monopoly buyer except for tobacco but still an official and primary purchaser of smallholder crops nationwidely regardless of location and quantity of products.

The private traders are licensed buyers who are registered with MOA. The estate sector has different marketing systems. The Government continues to leave the estate sector to organize its marketing system both for traditional crops such as tea, sugarcane, and fire-cured and Burley tobacco and for any new crops such as perishable fruit and vegetables.

(2) Marketing System of Farm Inputs

ADMARC had controlled all the activities for fertilizer supply from its import to distribution to local markets up to 1983, when Smallholder Farmers' Fertilizer Revolving Fund of Malawi (SFFRFM) was established by financial arrangement between the Government, IBRD and ADMARC. Currently SFFRFM is the primary supplier of farm inputs to smallholders. The main objective of SFFRFM is to ensure fertilizer import and buffer stocking of 70,000 tons for the whole country aiming at stable supply and regional allocation. Prior to crop seasons, SFFRFM delivers fertilizers to ADMARC's parent markets. Under the current system, ADMARC is responsible only for its sales through ADMARC's marketing channels.

Improved seeds of maize are produced, stocked and supplied by National Seed Company of Malawi (NSCM). Seed multiplication of rice is conducted also by smallholders on contract basis under the supervision of ADDs in order to produce quality seeds of lower cost. Seed multiplication by contracting farmers in 1970's and quality seeds have been sold to ADMARC and distributed in domestic markets. Except

for rice, the amounts of seeds produced by smallholders are, however, far below their requirement and the main seed source is still NSCM.

Import of pesticides is dealt with by private companies, i.e. Shell Chemical Ltd., Agrimal, Agricultural Trading Company and Press Group. Prevailing chemicals are Sevin and Dimethoate for pest control in cotton, e.g. American bollworm, Spiny bollworm, Pink bollworm, Stainers, etc.

Inputs supply is operated in accordance with seasonal credit schemes by ADDs utilizing the financial assistance from IBRD, EDF, Germany, etc. Smallholders can avail those credits through farmers club. Inputs can also be bought in cash. The estate sector has different marketing arrangement. It independently arranges necessary inputs by obtaining seasonal credits through the commercial banking system.

(3) Price Mechanism for Major Crops

The Government through ADMARC maintains a policy of providing a guarantee minimum prices for smallholder crops. The Government set up farm gate prices for smallholder crops prior to planting season every year based on the following factors.

i. Estimates of import/export parity prices
ii. Gross margin estimate to show relative returns to labour
iii. Impact to other sectors and ADMARC's trading accounts

In recent years it becomes more difficult to use import/export parity prices in setting crop prices because of sharply increased transport costs of imported and exported products caused by the security problems in Mozambique. Transportation costs have increased markedly as freight has had to be transported by much longer routes via Zambia or Tanzania.

The Government emphasizes food security in its agricultural policy. Therefore the efforts have been made to keep prices of food crop competitive with the ones of the industrial crops. In particular, maize prices are monitored and adjusted to ensure that gross margins per unit labour input are competitive with other crops. Prices of maize are thus fixed at a level where marketed production is to satisfy domestic demand including the requirement of strategic food reserve.

Since the mid 1980's, prices have tended to steadily increase reflecting inflation and changes in exchange rates. The producer prices at farm-gate during the recent five (5) years are presented in **Table 2.3.1.** It is notable that maize price increase in the 1992/93 crop season by 44.8 % of the 1991/92 price. This is the highest price adjustment made and will provide an incentive to smallholders to grow more maize.

Given official permit by the Government in 1987, private traders have participated in marketing of agricultural products except for cotton and tobacco. They have influenced price mechanism of agricultural products. Private traders can set up their purchasing prices higher than ADMARC's minimum guarantee prices due to the background mentioned below.

i. Targeting higher paying consumers, private traders can outbid products of higher quality. In contrast, ADMARC can only apply the base prices for one quality standard.
ii. Private traders are targeting convenient markets where they can offer higher prices than ADMARC, while ADMARC has to service all markets at the same price.
iii. In poor harvest years, private traders can target higher paying consumers and consequently can pay a higher farm-gate price.

The current marketing activities of private traders induces a cost increase in ADMARC because it has to services at the same price. In future, it will be more difficult for ADMARC to deploy marketing activities without a differential pricing system in which prices in more remote areas reflect higher collection and transport costs.

No local fertilizers are available. All the fertilizers for smallholder farmers are imported by SFFRFM and sold at subsided prices to smallholder farmers. Although the programme to eliminate government subsidy commenced in 1986, it has been disrupted by the impact of higher transport costs because of the Mozambique problems.

In recent years, the cost of fertilizers to farmers has also risen sharply due to currency depreciation, increasing overland transportation cost, and as a consequence of a policy decision in 1983 to phase out all subsidies on this item over five years to 1988. Under the fertilizer subsidy removal programme, the smallholders were expected to pay the full cost of their fertilizers by 1988. In order to minimize the cost and maximize the availability of fertilizer, several efforts have been made: blending imported fertilizers and local materials, e.g. phosphate and lime, buffer stocking to

mitigate logistical risks and to facilitate saving in procurement and transport costs, extension of appropriate manner of fertilization, small package for small farming units. The input prices in 1991/92 and 1992/93 are listed in **Table 2.3.2.**

2.3.6 DEMAND AND SUPPLY BALANCE OF CEREALS

Under the initiative of the Planning Division of MOA in association with FAO, the Government has been monitoring and monthly reporting the overall cereal balance through National Early Warning System (NEWS). The main objectives are to improve national food security and provide advance information on crop production and arrangement of food import. The NEWS is technically assisted and coordinated within the frame of the SADC Regional Early Warning Unit for Food Security in Harare, Zimbabwe.

The NEWS estimates the position of overall cereal balance at the end of September, 1992 as presented in **Table 2.3.3.** The quantities shown in this table relate to Malawi only and additional requirement and supplies for Mozambique refugee population are included. The current situation of cereal balance is summarized below:

(1) Annual per capita requirement of cereals applied to the NEWS is 213 kg consisting of 200 kg for maize, 3.7 kg for rice, 5.4 kg for wheat and 3.6 kg for sorghum and millet.

(2) Cereals requirements are based only on Malawi population. Ones for Mozambique refugees are set aside from the total domestic consumption and counted as "export" from the Government/ADMARC to WFP.

(3) It is estimated that the total consumption requirement is 1,723,000 tons. In addition to the total consumption requirement, 92,000 tons of strategic grain reserve (closing stock requirement) and 30,000 tons of requirements to be transferred to Mozambique refugees. Including these requirements, the total cereal requirement is estimated to be 1,845,000 tons.

(4) Given the total availability of 941,600 tons, the domestic balance indicates a need to import 903,400 tons, of which 772,200 tons or 85 % are planned to be imported. Out of 772,200 tons, 596,600 tons (77 %) are expected to be provided by donors, of which 361,400 tons has been pledged by the end of September, 1992. Besides, 175,600 tons (23 %) are to be commercially imported by both the Government and private sector.

(5) The uncovered shortfall of 131,200 tons or 15 % of import required (903,400 tons) is less than the assessed need caused by the recent serious drought. So far no source to cover this requirement has been identified.

The NEWS estimates that about 6,100,000 persons or 75 % of the total population are adversely affected by the drought. The Government planned to provide 9 kg of grains per person per month. This established a monthly distribution target of 55,000 tons, but only 8,500 tons of free maize were actually provided to them during the past five months.

In addition, the NEWS estimates 12,400 tons of monthly maize requirement for Mozambique refugees in Malawi, i.e. 988,560 persons at the end of September, 1992. To cover this requirement, the donors pledged provision of "free" maize. It is uncertain, however, when any of the maize will arrive in Malawi because the shipping arrangements are not yet made.

Apart from the NEWS, MOA also analyzed the spatial distribution of maize availability and surplus/deficit conditions throughout the country. Based on population size and per capita demand of maize at 180 kg/year, self sufficiency ratio of maize was estimated by each of the RDPs as presented in **Table 2.3.4.** The national production of the crop season 1991/92 is 692,006 tons as of April 2, 1992 against the demand of 1,456,355 tons giving only 48 % of self-sufficient level. Eight (8) RDPs in Lilongwe, Kasungu and Mzuzu ADDs are in surplus of maize, whereas RDPs in Southern Region suffer from serious deficit.

2.3.7 AGRICULTURAL DEVELOPMENT POLICIES AND PROGRAMMES

The economy of Malawi had successfully developed till the end of 1970's. However, the economy has gone down since the beginning of the 1980s because of the following reasons:

i. The foreign debt increase due to by investment for industry exceeded domestic saving and investment for public works.
ii. The international market prices for agricultural commodities fell.
iii. Increasing transportation costs as a result of the internal conflict in Mozambique
iv. The prices of imported commodities went up due to the second oil crisis, and

v. Balance of payment became worse due to increasing food imports and low agricultural production due to drought

To alleviate the situation, the Government performed a series of structural adjustment programmes under the World Bank and IMF from 1981. As a result, the economy of Malawi recovered to some extent. These programmes made it possible to postpone payment for the debt and to invest financial development fund to the estate sector of agriculture. The Government increased production of the export-oriented crops such as tobacco, tea and sugar for the modernization of the country. In 1988, about 85 % of the total export amount was from three crops.

The government efforts, however, affected seriously the smallholder sector which most of the farmers belong to. Access to the agricultural credit and selection of crops to be cultivated had been limited for the smallholders. Also the subsidy programme of fertilizers for the smallholders was abolished. The internal conflict in Mozambique made the economic situation worse, the production of main food crops, mainly being produced by the smallholder farmers, declined. The total maize production decreased to 1,295,000 tons in 1986/87.

Under such situation, the Government made the Statement of Development Policies 1986-1996, in which the highest priority is given to the agricultural development, with particular attention to the smallholders. The overall objective is to enhance the social welfare and income of the agricultural community and the prosperity and stability of the nation as a whole by means of both improving self-sufficiency in foods and expanding and diversifying export receipts from agricultural produce. This statement emphasizes about improvement and development of research, marketing, crop development, livestock, irrigation and agro-industry.

In the irrigation sector, the following strategy was adopted: (i) rehabilitation of the existing rice irrigation schemes, (ii) a full feasibility study of the irrigation development in the lower Shire Valley with a total extent of about 20,000 ha, (iii) development of smallholder irrigation schemes in which full-cost recovery will be expected, and (iv) the institutional arrangements for planning and support services in this sector.

The Government prepared an adjustment programme for the agricultural sector at the end of 1987 as a first action programme. This programme aims at (1) land reform, (ii) introduction of the improved seed, (iii) improvement of the existing market channels of farm inputs and outputs and the existing credit system, and (iv)

introduction of subsidy of fertilizers for the smallholders. About US $ 160 million were invested for this programme by the assistance of the World Bank and the other donors. In this program, special attention was paid to restricting the rights and responsibilities of ADMARC and transferring them into the private sector to increase operation efficiency of the public sector.

The Government has realized the agricultural development projects in line with the policy of the statement. The implementation of the 1991/92 development programmes was successfully conducted in spite of transport bottle-necks. Total development expenditure of MK 64 million in 1991/92 was allocated to the agricultural sector. The major projects are : (i) Smallholder agriculture credit administration, (ii) Agricultural research and extension, (iii) Malawi agriculture research and extension Project, (iv) National livestock development project, (v) National rural development program and (vi) Rehabilitation of smallholder irrigation schemes.

There are four (4) main irrigation programmes for the smallholder irrigation schemes as follows; (i) Smallholder irrigation rehabilitation project by DANIDA, (ii) Study on self-help irrigation communities by EC, (iii) introduction on irrigation technologies in smallholder irrigation scheme development by USAID and (iv) Kasungu water resources and irrigation potential study by IFAD. In addition, the regional irrigation development strategy is being studied by SADCC and the detailed design of the Lower Shire Valley irrigation development project was carried out by France.

2.4 INSTITUTIONAL SUPPORT

2.4.1 GOVERNMENT ORGANIZATION

(1) Overall Structure of the Ministry of Agriculture

The organizational structure of the Ministry of Agriculture (MOA) is shown in **Figure 2.4.1.** There are four (4) wings under Principal Secretary such as (i) Controller of agricultural services (CAS-NRDP), (ii) Controller of agricultural services (CAS-I), (iii) Deputy secretary and (iv) Planning division.

Under CAS-NRDP there are seven (7) departments, units and administrations. These are (i) Department of Agricultural Research (CAARO), (ii) Department of Agricultural Extension and Training (CAETO), (iii) Department of Animal Health and Industry (CVO), (iv) Department of Irrigation (CIO), (v) Food and Nutrition Unit

(PFNO), (vi) Land Resources and Conservation Branch (ACLCO) and (vii) Smallholder Credit Administration (SACA).

Under CAETO, there are eight (8) agricultural development divisions (ADDs) headed by Programme Manager (PM) which are the executing bodies for all field activities concerning the agricultural and rural development. These ADDs are Ngabu, Liwonde, Blantyre, Salima, Mzuzu, Karonga, Kasungu and Lilongwe. Under the ADDs, there are 30 Regional Development Projects (RDPs) headed by Project Officers, 141 EPAs headed by Development Officer and 1,760 Sections nominated by Field Assistant in the whole country.

In addition to the organization to perform the above activities, the MOA has several statutory authorities. They are (i) Smallholder Coffee Authority, (ii) Smallholder Tea Authority, (iii) Smallholder Sugar Authority and Agricultural Development and Marketing Corporation. Controller of agricultural services for institution (CSA-I) manages these authorities.

In 1990, the total number of staff of the MOA was 6,230. The established posts were 7,275, of which 1,045 posts were vacant. The staff members are composed of the followings: (i) Superscale 140, (ii) Professional 217, (iii) Technical 552, (iv) Executive 129, (v) Secretarial 181, (vi) Nursing 1, (vii) Clerical 951, (viii) Technical assistant 3,399 and (ix) Subordinate 660.

(2) Extension and Training Sector

The activities of extension and training are the most important roles in the MOA. The Department of Agricultural Extension and Training (DET) is fully responsible for these activities. The DET consists of the sections of extension and training, crops, inputs and marketing, agricultural communication and women's development. Under the DET, the ADDs exist. Each ADD is divided into several RDPs which are further subdivided into Extension Planning Areas (EPA) having Sections in the lowest subordinate field unit. All information on extension and training comes up and down through the above channels.

Recommendations and guidance in farming technology to farmers is prepared by the DET in the headquarters and the ADDs apply these farming technology with some modifications to the farmers.

The agricultural extension staff consists of Subject Matter Specialists (SMS) in the ADD, RDP and EPA, and extension workers or field assistant in Sections. The extension work is mainly done by field visit by SMSs and extension workers (field assistants). In addition, field demonstration, film shows (once or twice a year) and distribution of leaflets also are given. In line with the extension work, the farmers training is carried out through two kinds of programmes, (i) the day training and (ii) the residential training. The day training is carried out 26 times a year in EPA offices mainly by Development Officers. The residential training is carried out for the selected farmers in the training centres of each ADD. In addition to the training course, there is in-service training course for high ranked officers to work in the new field such as horticulture, rice, land husbandry and irrigation.

In addition to the above organizations, the following institutions are available for the training.

(i) Teacher's college,
(ii) Domasi college,
(iii) Management institute,
(iv) Natural resources college (Lilongwe),
(v) Forestry college (Dedza),
(vi) Malawi institute for management (Lilongwe),
(vii) Computer skills centre (Lilongwe and Blantyre),
(viii) University of Malawi Bunda college of agriculture (Lilongwe),
(ix) Kamuzu college of Nursing (Lilongwe),
(x) Chancellor college (Zomba),
(xi) Polytechnic college (Blantyre), and
(xii) Land husbandry training centre (Zomba).

(3) Irrigation Sector

The Department of Irrigation (DOI) under the MOA is responsible for all the irrigation activities. Its present organization is illustrated on **Figure 2.4.2.** The DOI was re-formed within the MOA in 1988. The headquarters of DOI in Lilongwe consists of three (3) sections such as (i) Engineering, (ii) Irrigation Agronomy and (iii) Support services. The fourth section is in the Irrigation section or branch located in all the ADDs except the Kasungu and Lilongwe ADDs. The total staff of DOI headquarters are 41. There are only two (2) irrigation professional irrigation engineers in the headquarters who cover all irrigation activities in the whole country.

(4) Research Sector

The Department of Agricultural Research (DAR) is responsible for all the research works. There are the agricultural research stations, research coordinators and technical services coordinators in DAR. There are four (4) main research stations, seven (7) sub-stations and seven (7) trial sites as follows:

Region	Main research station	Sub-research station	Trial site
North	Lunyangwa	Baka	Meru
		Mbawa	Nchenachena
		Mkonderi	Bolero
Central	Chitedze	Lifuwu	Bembeke
		Chitala	Tsangano
South	Bvumbwe	Kasinthula	Nsanje
	Makoka	Ngabu	Likangala

Table 2.4.1 indicates the details of duty and staffing of the agricultural research stations in Central Region in which the study area is located. The Chitedze station conducts research work on upland. The Lifuwu and the Chitala stations carry out research on both rice and upland crops. Total staff in the Central region are only 33, of which 30 work in the Chitedze and three (3) in the Lifuwu. The Chitala station and two (2) trial sites are managed without researchers.

There are seven (7) national research coordinators (NRC) in the DAR, headquarters nominated to the specific agricultural fields as shown in **Figure 2.4.3.** These are (i) Cereals NRC, (ii) Grain legumes, oil seeds and fibres NRC, (iii) Livestock and pasture NRC, (iv) Soils, agricultural engineering and land husbandry NRC, (v) Horticulture NRC, (vi) Agricultural technical services NRC and (vii) Adaptive research NRC. The adaptive research NRC supports direct the adaptive research team leader (adaptive research officer) in the ADDs about technical matters. The planning of research work is made by seven (7) NRCs. The adaptive research officer in each ADD receives information from the NRCs in the headquarters and makes the research work based on this information. All results obtained in the ADDs flows into the NRCs.

In addition to the DAR, there are the following major organizations on research work in Malawi: (i) Tea research foundation at Mulanje, (ii) Tobacco research institute of Malawi at Lilongwe, (iii) Sugar corporation of Malawi at Chikwawa and University of Malawi at Lilongwe and Zomba

(5) Seed Multiplication Sector

Seeds are produced under four (4) systems in Malawi at present. (i) by the agricultural research stations under the DAR, (ii) through the National Seed Company of Malawi (NSCM), (iii) direct intervention of the MOA through its smallholder seed multiplication programme (SSMP) and (iv) by farmers themselves.

The National Variety Release Committee (NVRC) checks and recommends new/improved cultivars of crops and the Seed Technology Working Party Committee (STWPC) authorizes their multiplication. The seed services (SS) is responsible for the coordination of seed activities in the country. The SS is institutionally in the DOR of the MOA and coordinated by Technical services coordinator. The headquarters of the SS are located in the Chitedze agricultural research station.

The Lifuwu sub-research station performs the pre-basic seed multiplication for three rice varieties of Faya, IET 4094 and IR 1561/250/2/2 for the field of 15 ha. The pre-basic seed is also multiplied in Bvumbwe in the south and Baka in the north

The NSCM produces hybrid maize. The NSCM was established in 1979 as a joint venture of ADMARC and the Commonwealth Development Corporation (CDC). In 1988/89 it was restructured and its overseas loans replaced with equity from Cargill, which gave Cargill majority share holding, with ADMARC and CDC as minority shareholder. The NSCM also produces composite maize, tobacco seed and many kinds of cultivars of crops to small extent.

(6) Credit Sector

There are 16 organizations in Malawi to provide credit for the agricultural sectors. The main organization among them are two (2) commercial banks, two (2) development private investors and SACA in the MOA. The organization except the SACA provides credit to the field of the estate sector and the middle scaled agro-industries.

The SACA is the main source of credit for the smallholders. The credit is distributed through "Farmers Club" which is voluntarily made up by farmers themselves under guidance of the SACA. There are two (2) kinds of credit such as short term loans and medium term loans. The short term loans are applied to farm inputs of fertilizers, seeds and chemicals for seasonal crop production with an annual interest rate of 18 %. The medium term loans are applied to livestock, agricultural

machinery and tools, etc. with an annual interest of 20 %. These credits are supplied in kind. The total amount of both loans to the smallholders in the whole country amounted to MK 76,532,000 in 1990/91. The participated farmers clubs and farmers in 1990/91 were 333, 750 and 12,891, respectively. It is said that these amount of loans cover about 90 % of the total loan amounts for the smallholder farmers. Most of the financial sources for these loans depend on the supply from the World Bank, FAO, ADB and the donor countries.

2.4..2 PRIVATE ORGANIZATIONS

In addition to the government organizations, there are several private organizations to support agricultural activities as follows; (i) Farming Equipment and Engineering Services (FES), (ii) Estate Extension Services Trust (EEST), (iii) Commonwealth Development Corporation (CDC) and (iv) Council for Non-Government Organizations in Malawi (CONGOMA).

The FES is one of the largest private companies to manufacture, distribute and maintain farming equipment. The EEST is also an organization to support the operation and maintenance of irrigation equipment employed by the private estate sector. The CDC provides advice and assistance on the agricultural development. Established in the Economy and Planning Division in OPC, the CONGOMA tries to coordinate the NGOs activities in the country and has a possibility to involve in irrigation scheme development .

2.5 TRANSFORMATION OF SACA INTO MALAWI RURAL FINANCIAL COMPANY (MRFC)

2.5.1 CURRENT SITUATION OF SACA

SACA was established on 1st April, 1988. It aims at transforming the smallholder credit system into a better managed more efficient low cost, and financially viable national credit delivery system. It brought large benefit to a greater number of smallholder farmers. The establishment of SACA was intended to be first step towards the establishment of any independent viable and sustainable rural financial institution providing credit to smallholder farmers and the entire agricultural sector.

Although SACA has been successful in serving smallholder farmers, its activities have been heavily subsidized by the GOM through the support of extension services. Under such conditions, the GOM envisages the transformation of SACA to

private sector in future. Since it will strongly affect the smallholder farmers, the Study was directed to grasp and analyze the current conditions of transformation of SACA.

Malawi Rural Financial Company (MRFC) will take over all activities of SACA, including its infrastructure assets and liabilities and existing SACA staff. The change if the formalities are finalized may be effected from 1st April, 1994. At the moment, the GOM and World Bank have jointly made a decision not SACA be transformed into a commercial rural financial company which would commercialize and expand the activities now currently carried out by SACA.

The fundamental objective of the transformation of SACA is to improve access to financial services to rural sector including women on sustainable basis. It would also assist the GOM towards improving the policy and institutional framework for rural financial intermediation by supporting the development of linkages between the formal and informal financial institution serving the rural sector.

The transformation of SACA was negotiated in Washington from 1st - 5th March, 1993. The Agreements were ratified by Parliament in Malawi at 1993 budget session and World Bank approved the Agreements on 15th June, 1993. The transformation was to become effective by 1st October,1993 and hope to start operation by 1st April, 1994.

2.5.2 TRANSFORMATION OF SACA

The project would be implemented in three years and would have the following three main components:

- Institutional building, which would have a pilot programmes component which would support income generating activities for women,
- Transformation of SACA into a limited liability finance company and the use of DEMATT to assist in preparing investments proposals for Agricultural, small and micro enterprises, and
- Aline of credit component to finance seasonal medium term and non-agricultural loans.

Funds amounting to MK 68 million will be used for (a) short term loans to be utilized in three year period. The fund will be channelled to MRFC though the Reserve Bank of Malawi, the bulk of the funds will be used for:

(i) smallholder seasonal credit,
(ii) small estates and medium term loans,
(iii) agro-processing industries in rural areas, and
(iv) vehicles for rural industries transport fishing equipment and other micro enterprises.

A large number of MRFC clients may lack bankable collateral sufficient to cover the value of their loans, therefore clubs will be requested to deposit at least 10 % of their credit requirements in an interest bearing account with any commercial banks.

Withdrawals below the minimum 10 % of loan volume will not be allowed without approval from MRFC. Where the club will fail to raise the minimum reserve fund amount, MRFC, will extend a loan to the club to the reserve fund at the prevailing interest rate. The project will also support women in development engaged in the agreed income generating projects. The interest rate structure will be based on cost of funds operating expenses, perceived risk and reasonable return on investment. Therefore, the interest rates will be at least equal to the prevailing market interest rates in Malawi.

2.5.3 MANAGEMENT

The management of MRFC will follow the normal commercial and private sector practices. All power will be vested in the Board of Directors. The general manager will be the Chief Executive. He will be assisted by two (2) Deputies and other senior staff. At branch level, the activities of the Branch will be co-ordinated by branch manager who will also be assisted by town deputies.

2.5.4 PROJECT BENEFITS AND RISK

The project would support additional new investments by improving the availability and accessibility of financial services to rural households for viable farm and non-farm activities. The number of households that would benefit from the project would be expanded from 384,000 currently served by SACA to more than 500,000 beneficiaries.

Profitability of agricultural production might decline resulting in an increase in the loan default and/or insufficient demand for farm inputs to ensure profitable rural lending. The gradual removal of fertilizer subsidies which will result in the increased process may cause a decline in prediction which may make the company not viable.

Given the benefits and risks there is strong reason to proceed with caution if the project is to be successful.

- MRFC which has not yet started will completely be private and expected to be highly commercialized regardless of adverse weather conditions faced by smallholder farmers.

- Government Extension workers will be delinked from credit activities and credit accounting procedures will almost be carried by company staff. Field extension staff will play an advisory role.

It is not yet known whether this company will highly consider the welfare of the smallholder farmers. It should be seriously considered by the concerned authorities, whether farmers from the Bwanje Valley Smallholder Irrigation Project will be given their farm loans form MRFC.

3. THE PRESENT CONDITIONS OF THE STUDY AREA

3.1 ADMINISTRATION, DEMOGRAPHY AND SOCIOLOGICAL CONDITIONS

3.1.1 ADMINISTRATION AND DEMOGRAPHY

Malawi has three strands of public administration, Central Government, Local Government and traditional authorities (TA). The Traditional authorities system has a hierarchy of village group headmen and village headmen in general. Administratively, the study area is under the jurisdiction of two (2) regions, three (3) districts, 10 traditional authorities and one (1) city fully and/or partly. These are listed below;

Region	District	Traditional Authority/city
1. Central	(1) Dedza	(1) TA. Kasumbu
		(2) TA. Kachindamoto
		(3) S.T.A. Kamenya Gwaza
		(4) Dedza city
	(2) Ntcheu	(1) TA. Kwataine
		(2) S.T.A Makwangwala
		(3) TA. Njolomole
		(4) TA. Chakhumbira
		(5) S.T.S. Goodson Ganya
		(6) TA. Masasa
2. South	(3) Mangochi	(1) TA. Mponda

In addition to the above administrative structure, there is another administrative structure based on demarcation of integrated rural development projects, namely Agricultural Development Divisions (ADDs) of the MOA. There are eight (8) ADDs in the country, of which such two (2) ADDs as Salima ADD and Lilongwe ADD are concerned with the study area with the proportional extents of 47 % and 53 %, respectively.

The demographic conditions of the study area and its related administrative units are summarized in **Tables 3.1.1** and **3.1.2**. The demography of the study area is estimated on the basis of "the Malawi Population and Housing Census in 1987" conducted by the National Statistical Office. The total population of the study area in 1987 is estimated to be about 294,000 or 3.7 % of the total population of Malawi. It increased by 160% during 10 years from 1977 to 1987. The population of Dedza Town has drastically increased by 240 % in the same period as a result of inflow of refugees from Mozambique as well as the urban areas suffering from high population pressure. The relatively high population increase in such TAs as Chakhumbira, Masasa and Njolomole in Ntcheu District might be due to the inflow of refugees.

The total number of households in the study area is estimated at 68,400 as of 1987. The average family size is 4.3. It is estimated that the female headed households occupy about 30 to 40 % of the total households in the study area according to the hearing survey with farmers and officers in the study area. The population density is 118 persons/km^2, which is higher than that of the national average, i.e. 85 persons/km^2, and less than that of the Central region, 125 persons/km^2. The sex ratio is 46 % for male and 54 % for female.

The population by age group consists of 18% for 0 to 4 years old, 30 % for 5 to 14, 47 % for 15 to 64 and 5 % for above 65. Although the population census by religion is not available for the study area, the majority are Christian, followed by Moslem and non-religion, known as 'Pagans' according to the field interviews in the TA. Kachindamoto and S.C. Goodson Ganya areas. The population census in 1977 verified that the majority are engaged in self-employment in the agricultural sector including crop production, animal husbandry, hunting, forestry and fisheries. The census shows that the farmers in the three districts of the study area account for 85 % of the total population for Mangochi district, 90 % for Ntcheu district and 94 % for Dedza district. The main tribes in the study area are Ngoni and Chewa.

The crude birth rate in the districts concerned ranges from 39.3 to 45.4 birth number/year/1,000 person, while a national average is 41.2. The crude death rate in the three districts is from 16 to 17.3 death number/year/1,000 persons. It considerably exceeds a national average of 14.1. The infant mortality rate in the three districts is 167 to 169 which is also higher than the national average.

3.1.2 COMMUNITY LEADERSHIP

In order to grasp the present general community leadership, the interview survey was conducted in the study area although the number of interviews were small due to time limitation. The interview were done with (i) Kachindomoto traditional authority, (ii) two group village headmen Msunduzeni and Mtembanji, (iii) several village headmen and (iv) several farmers and two scheme managers in the two existing self-help irrigation schemes in the study area

As mentioned in Section 3.1.1 on Administration and Demography, the local people in the study area are controlled through the traditional authorities system that has a hierarchy of village group headmen and village headmen. Traditional authority (TA) is normally appointed by the hereditary system and comes from the Ngoni tribe in the study area. A group village headman is normally appointed by TA. The village headman is

elected in the traditional village committee called as "Kabungwe" and is approved by the TA. The membership of this committee is generally six (6). In case of villages of Nkhondolike and Bwanamakoa, 50 % of the members are women.

The main roles of TA, group village headmen and village headmen in each respective administrative area are:

(i) Personnel control management for the local people,
(ii) Engouraging the local people in the village, particularly men to pay tax,
(iii) Organizing the people in any self-help development work,
(iv) Arbitration in disputes and conflicts among the local people and villages,
(v) Allocation of land to local people, and
(vi) Attendance to the official meeting at each level.

The main administrative and social problems in the study area are (i) land allocation for farming and (ii) use of grazing land for cattle feeding. TA is responsible for cultivated land and village boundaries. However, when some farmers do not cultivate due to labour shortage or other reasons and if the power of balance between villages has collapsed, other people invade the land to cultivate and the problems occur. About 30 cases concerning land disputes occur every year within one TA. Any farmer can use the grazing lands in the village. In a drought year such as this year, there is very little grass for grazing the animals.

Arbitration in disputes and conflicts among the farms is done firstly by the village headman, secondly by the group village headman and thirdly by the TA. If these disputes and conflicts can not be solved by the TA, the district commissioner solves them finally.

The TA receives a salary from the district commissioner's office and has an office supported by several clerical assistants and messengers whose salaries are paid by the district commissioner's office. Also other necessary facilities are provided by the district commissioner. A group village headman and a village headman voluntarily perform their duties without pay.

The official meetings between the TA and the group village headmen are held three times a year at the TA's office. Due to lack of transportation means, it takes a long time to communicate between the TA, group village headman and village headman.

This traditional hierarchy system is the most powerful one for managing the local people in the study area because it not only controls administrative matters but also plays

an important role in making up the existing irrigation scheme committees for their smooth running. The chairman of the scheme committee is appointed by the group village headman.

3.1.3 SOCIAL LIFE AND WOMEN'S ROLE

Although there are partly patrilineal societies in the study area, most of the societies are matrilineal with matrilocal marriages. Husband lives in the wife's home village. In matrilineal society, property is owned by the matrilineage and descendance and inheritance are traced and passed through the female lineage. An uncle is the overall supervisor of everything concerning his nephews and nieces.

Each tribe speaks each specific tribal language at home though Chichewa language is the national lingua franca.

Generally the people in the study area take two meals a day, lunch and dinner. The main meal is called as "*Nsima*". It is made from maize flour.

There is a special traditional rite (called Chinamamwali) for the young people who are about to become adults. Every year it is held in June or July and its duration is about one week. In this rite, young people are taught general traditional manners on behaviour, customs, rules, etc. Also there is a traditional dance (called Gule wamkulu) when there is a special function in the village , e.g. important meetings, celebrations, funerals, etc..

To grasp the present constraints of the life of the local people in the study area, a sociological investigation has been undertaken for 120 samples along with the agro-economic survey. The main items surveyed are (i) conditions of fetching water and firewood, (ii) condition of drinking water, (iii) diseases and the medical services and (iv) access to the market for shopping. The results of the survey are summarized in **Table 3.1.3.**

With respect to drinking water, most of the people use shallow wells except the people living by lake Malawi. About 70 % of respondents answered good for water quality. 47 % of the respondents replied that water quantity is enough for a daily life. About 200 households share one well. These figures vary considerably from location to location. Globally, availability of water in the wells trends to increase as an altitude of location of the wells increases. Water quality is apt to make worse on the contrary. Especially the people along the lakeshore are forced to take lake water which is unsuitable for drinking and as a result the people contact many diseases.

Fetching water and firewood is one of the important jobs in a daily life of women and children in the study area. The results of the survey indicate that the people fetch water 4.3 times a day and the distance covered is 0.9 km per trip on an average. Also fetching firewood is performed 1.7 times a week and its distance is 3.1 km on an average.

The respondents reported that they go to the hospital 3.4 times a year on average. A distance to the hospital averages 8.1 km ranging from 5 km to 12 km. The people are obliged to walk to the hospital due to lack of transport. The common diseases are malaria, followed by cold, diarrhea and headache. In addition, body pain, eye diseases, toothache and stomach-ache are some of the diseases which , to a lesser extent were reported to be quite common.

Access to the market and the shopping centre for daily requirements takes 1.7 km on average and this varies depending on locations, ranging from 0.6 km for the people in TA Kachindamoto area to 8.5 km for the people along the lakeshore.

To find out the general pattern of daily activities of the local people during the farming season, a survey was conducted for rice-farmers in the existing irrigation schemes of Mwalawoyera and Mtandamula. The results are summarized below;

(1) Mwalawoyera scheme

Activities	Male	Female
getting out of bed	4:00	5:00
farming	4:00 to 12:00	5:00 to 10:00
fetching water/fuelwood	-	10:00 to 12:00
lunch	12:00 to 13:00	12:00 to 13:00
farming	13:00 to 17:00	13:00 to 17:00
fetching/other activity	-	17:00 to 18:00
dinner	18:00 to 19:00	18:00 to 19:00
other activity	-	19:00 to 20:00
sleeping	20:00	20:00

(2) Mtandamula scheme

Activities	*Male*	*Female*
getting out of bed	5:30	6:30
farming	5:30 to 12:00	6:30 to 11:00
fetching water/fuelwood	-	11:00 to 12:00
lunch	12:00 to 13:30	12:00 to 13:30
farming	13:30 to 18:00	-
fetching/other activity	-	13:30 to 19:00
dinner	19:00 to 20:00	19:00 to 20:00
fetching/other activity	-	20:00 to 21:00
sleeping	21:00	21:00

As shown in the above tables, the main activity for the local people is farming. Activities like land preparation, seeding, transplanting, weeding and harvesting are carried out by both male and female. Threshing, winnowing and milling by pounding are undertaken only by women.

With respect to other activities, fetching firewood and drinking water, cooking, house keeping and children care are the women's responsibility. Building and repairing houses are man's responsibility. Mat making is done by both. Contribution of labour to the project, when required, will be made by both male and female.

It may be concluded that women in the study area will undertake the majority of all daily activities and they have a very heavy work load.

As mentioned previously, about 30 to 40 % of the total households in the study area are estimated to be female headed households (FHH). The classification of these FHHs is dependent upon (i) traditional customs in the matrilineal society whether the husband lives together with the wife, (ii) widow, (iii) divorced one, (iv) polygamous status, (v) single and (vi) absence of husband because of his migrating to estates and cities for wage employment. FHHs who do not live with husbands in the study area face a biggest problem of shortage of farming labour force and it turns out that a scale of cultivated land is forced to be small and farm income becomes small.

The Ministry of Agriculture created the Women's Program Section in the Department of Agricultural Extension and Training to achieve the following three objectives: (i) to promote household income through income-generating activities related to agriculture or agro-business, (ii) to improve home and farm management skills and utilize available resources to improve family health and standard of living and (iii) to increase women's participation in rural extension for optimizing adoption and agricultural production.

The Programme, however, has got into trouble because of insufficient number of trained staff to undertake extension activities. In Salima ADD there is a women's programmer section under the Principal Agriculture Extension and Training Officer. This section headed by a Women's Programmer Officer is responsible for women's programs. The programmer officer technically supervises through the RDP office 3 senior farm home assistants (SFHA) and 22 farm home assistants (FHA) in extension in order to improve women's living standards in the rural areas. A rough estimation indicates that 2,000 FHHs are served by home assistant in Salima ADD. Due to shortage of trained field staff and management staff, the performance for the women's programs section in

Salima ADD has not been very effective. Also there is a shortage of transport. At the headquarters of the ADD, one vehicle is shared by two sections. Few motorcycles are available for some FHAs but none for SFHAs. This fact means that supervision of staff and farmers can not been done properly. Further, the budget allocated to women's program except personnel expenses was only MK 11,000 in 1991/92.

At present Salima ADD has undertaken the Malawi Agricultural Research and Extension Project and the Income Generation for Women Farmers Project by assistance of USAID and UNDP, respectively. The summary is shown in **Table 3.1.4.**

There is low participation of women farmers in agricultural courses, mainly due to lack of awareness of training opportunities and the inconvenient scheduling of training and time.

3.2 PHYSIOGRAPHY

The study area is located between latitudes 14°07' and 14°50' S and longitude 34°19' and 34°58' E with a total coverage of 25,000 km^2 consisting of four (4) river basins, namely Nadzipulu, Namikokwe, Livulezi and Bwanje from north to south.

Land Resources Evaluation Project (FAO, 1992) divided the study area into seven (7) natural regions according to the Agro-Ecological Zones system. These were further classified into 11 Zones based on physiography, topography and lithology as presented in **Table 3.2.1** and **Figure 3.2.1.** Although slight differences are recognized between Zones, in practical terms, the relief of the study area is divided into two (2) prominent units, namely (i) undulating to rolling plateau in association with inland valley and isolated hills and (ii) flat to almost flat lowlands and lakeshore. Both physiographic units are distinctly separated by the fault lines traversing with N-S to NNW-SSE directions. The main rift faults are Ntcheu fault and Bilila faults which were formed by frequent tectonic movements during Mesozoic and Tertiary eras and these show dissected bare-rocks of escarpments.

The plateau covers the western part of the study area with an elevation range from El. 600 to 1,500 m with isolated hills, e.g. Dedza Hills, whose peaks reach over 2,000 m. Gneiss is the predominant rock. All the four (4) rivers originate from this plateau and flow eastward by collecting small streams through scarps and rolling land. The Livulezi river forms a wide inland valley in the upper reaches, the north of Ntcheu, which has good agricultural potential. The rivers incise the escarpments which are covered by sparse forests and rapidly drop on the lowlands between El. 475 m and 550 m.

The escarpments form consecutive colluvial and alluvial fans which are less developed with limited debris and talus deposits. Therefore, the lowland lies immediately adjacent the pediment of the escarpments rather than the fan formations. The river courses are subject to change on lowland below this physiographic border. With gradients of 1/200 to 1/500, the rivers continue incision of the floodplain by connecting to either ephemeral streams or old river courses. Siltation by these rivers is prominent.

Currently development of river terraces and natural levees is not important. The surface configuration of the lowland is flat to almost flat in general although irregular meso- and micro-relief is significantly developed. There are seasonally inundated depressions called "*dambos*" on the lakeshore.

3.3 SOILS AND LAND SUITABILITY

3.3.1 SOILS

A wide range of information is available for the soils and land suitability of the study area in the following existing soil studies.

(i) Land resources appraisal of Salima Agricultural Development Division, Ministry of Agriculture (MOA), FAO/UNDP (1992)
(ii) Land resources appraisal of Lilongwe Agricultural Development Division, MOA, FAO/UNDP (1991)
(iii) Salima Lakeshore Project Land Use Planning Study, MOA, (1983)
(iv) Reconnaissance Soil Survey of the Soils of the Upper Bwanje Valley, Kingston J.D. (1973)
(v) Reconnaissance Soil Survey of the Salima Lakeshore Rural Development Project, Billing D.W. and Lowole M.W. (1978)
(vi) Salima Lakeshore Project Land Use Planning Study, MOA (1983)
(vii) National and Shire Irrigation Study, Annex D, MOA and Natural Resources

After an overall review of the above-mentioned study results, a field soil survey was carried out with aid of the latest aerial photography (1:12,500) in order to confirm the existing soil information paying more attention to coincidence between distribution of major soils and physiographic and present land use conditions. Through the field survey, soils were observed and described at 40 sites within the study area. At the representative profiles, 30 soil samples were collected for further laboratory test to verify physical and

chemical properties of the major soils. The laboratory test is now being undertaken at the Chitedze Agricultural Research Station (MOA) for 11 soil characteristics, i.e. pH, texture, organic matter content, total C, total N, total P, exchangeable cations, CEC and EC.

The parent materials of the soils in the study area are (i) fluvial, colluvial and/or lacustrine sediments, (ii) felsic and intermediate igneous and metamorphic rocks, and (iii) mafic igneous and metamorphic rocks, which cover 105,000 ha or 42.0 % of the study area, 132,000 ha or 52.8 % and 1,000 ha or 0.2 %, respectively. The soils of the study area are classified into seven (7) soil groups according to the modification of FAO legend (Soil Map of the World, 1988). The major characteristics of soil groups are as follows.

Eutric-fersialic soil group broadly covers the study area with a total extent of 110,000 ha (44 %) comprising 84,400 ha on the plateau and upland and 25,600 ha on the foothills and upper parts of Rift Valley floor. The soils are characterized by high CEC clay (>24 me/100 g soil) in most of the upper 100 cm and a high base saturation (>50 %) throughout the upper 50 cm.

Fluvic soil group extensively covers 45,000 ha (18 %) of the low-lying land of the Rift Valley floor and lakeshore. The soils are frequently rejuvenated by deposition of river alluvium. They show deep profiles with a considerable variation of particle size.

Gleyic soil group is the predominant soils of *dambos* with a limited extent only of 770 ha occurring in association with Fluvic soil group. The soils are characterized by impeded drainage with higher groundwater.

Mopanic soil group occupies 7,500 ha (3 %) of the study area. The soils have the upper horizon of 50 cm characterized by higher bulk density and low porosity which results in a very hard consistence and low permeability. This soil name is derived from Mopane tree (*Colophospermum mopane*) which is often grown on this soil group and has high tolerance to compact and dry natures of this soil group.

Paralithic soil group occurs mainly on the step slopes (>13 % slope) of the plateau with a total coverage of 33,300 ha (13 %). The soils have highly weathered rocks within 75 cm from surface which continue at least to a depth of 150 cm. The soils above the weathered rocks are often skeletal (>40 % coarse mineral fragments).

Vertic soil group can be observed in whole area, particularly flat bottomlands, with a total extent of 17,500 ha (7 %). The soils have more than 30 % clay, mainly montmorillonitic clay, in the upper 18 cm and develop wide cracks up to a depth at least 50 cm when dry.

Eutric-ferralic soil group occupies 7,300 ha (3 %). The soils are characterized by low CEC clay (<24 me/100 g soil) in most of the upper 100 cm and a high base saturation (>50 %) throughout the upper 50 cm.

The extent of the soil groups are classified by slope conditions as presented in **Table 3.3.1.** The soil groups are further divided into 27 soil families. On the basis of soil families and their physiographic positions, the semi-detailed soil map is prepared as shown in **Figure 3.3.1** for which legend is stipulated in **Table 3.3.2.** The characteristics and extent of each soil family are stipulated in **Table 3.3.3.**

3.3.2 LAND SUITABILITY

Land suitability for irrigation development was assessed for both paddy and upland crops and classified into five (5) classes, i.e. highly suitable (S1), moderately suitable (S2), marginally suitable (S3), currently not suitable (N1) and permanently not suitable (N2) according to the concept of the FAO's framework of land evaluation. The criteria applied for the present study is presented in **Table 3.3.4.** The land limitations taken into account in the present study include:

Suffix	Limitation
a	Low moisture holding capacity and excessive permeability due to coarse soil texture
c	Compactness of surface or upper sub-soil leading to difficulties in tillage and excessive run-off, and reducing penetration of water into the profile
d	Restricted soil depth due to bedrock or iron concretions
f	Flooding hazard
k	Fertility limitation due to low inherent nutrient status of soil
n	Sodicity/salinity hazard commonly associated with subsoil compactness and impermeability
t	Topographic limitation associated with steeper slopes and erosion hazard
v	Management difficulties associated with vertic soils, extreme physical properties and very slow internal drainage when wet
x	management difficulties associated with wide variations in soil texture and other properties over short distance

The results are presented in **Table 3.3.5.** The distribution pattern of each suitability class is shown in the land suitability maps in **Figures 3.3.2** and **3.3.3** for wetland paddy and for upland crops, respectively. The summary is:

Unit: ha (%)

Crop/Land Suitability	Nadzipulu	Namikokwe	Livulezi	Bwanje	Total	
Rice						
Suitable	2,630	5,000	11,670	28,120	47,510	(19.0)
Not suitable	33,490	30,680	58,540	79,780	202,490	(81.0)
Upland Crops						
Suitable	4,210	6,790	20,150	40,640	71,790	(28.7)
Not suitable	31,910	28,890	50,060	67,350	178,210	(71.3)
Total Area	36,120	35,680	70,210	107,990	250,000	(100.0)

The extent of land suitable for rice and upland crops are 47,510 ha (19.0 %) and 71,790 ha (28.7 %). The main limitation for both crops is unfavourable topographic conditions with over 2 % slope. Topographically unsuitable land occupies 156,310 ha or 62.5 % of the study area which extends mainly on the plateau. The other limitations are unfavourable soil conditions and flood hazard including poor drainage. The unfavourable soil conditions are high sodicity and salinity, compactness and low workability on vertic soils. The unsuitable land for rice consists of 11,700 ha (5 %) with problem soils and 2,500 ha (1.0 %) with flood hazard, while unsuitable lands for upland crops are 11,670 ha (4.7 %) with problem soils and 10,220 ha (4.1 %) with flooding hazard.

3.4 AGRO-CLIMATE

3.4.1 RAINFALL

The agricultural climatic condition in the study area is summarized in **Table 3.4.1**. Annual mean rainfall in the study are is estimated at about 800 mm to 1,000 mm with the exception of the hill lands near Ntcheu lying west of the study area having more than 1,000 mm. There is a considerable variation in rainfall year by year. The wet season extends over six months, generally from November to April. About 95 % of the annual rainfall precipitates in the wet season. The highest monthly mean rainfall occurs mostly in January, but according to the observation records, a few stations have their highest monthly precipitation in December or February.