# CHAPTER 1 INTRODUCTION

## 1.1 Authority

This Final Report is prepared pursuant to Clause VI of the Scope of Work (hereinafter referred to as "S/W") for the Study on the Meki Irrigation and Rural Development Project in Oromia Region, Ethiopia (hereinafter called the Study) agreed between Oromia Irrigation Development Authority (OIDA) and the Japan International Cooperation Agency (JICA) on 28th March, 2000. The S/W and the Minutes of Meeting on the S/W are attached to this report as Attachments 1-1 and 1-2, respectively.

The Study consisted of (i) data collection, (ii) identification of constraints and potentials including formulation of the draft master plan, (iii) execution of a verification study and (iv) finalization of the master plan in accordance with Clause IV in the S/W. This report presents all the results from the Study consisting of the Field Work in Ethiopia and the Home Office Work in Japan carried out from August 2000 to March 2002.

## 1.2 Study Area

The study area is shown in the location map of the study area (see the opening page of this report). The study area administratively falls in Dugda Bora Wareda (district) in East Shewa Zone of Oromia Region.

The study area is located in the center of Oromia Region, the largest region in Ethiopia with a total coverage of 353,007 $km^2$ or 34% of the national territory and provides livelihood to 22.35 million or 37% of the total national population. The study area is situated on the bottomland of the Rift Valley (El. 1,650 m) with a total area of 400 $km^2$ around Meki town located 130 km south of Addis Ababa.

## 1.3 Objectives of the Study

The objectives of the Study are;

(1) To formulate a master plan for rural development in the Meki area of the Oromia Region considering its irrigation potential, and its overall goal is to be a model rural development area in the Region, and

(2) To conduct technology transfer to the Ethiopian counterpart personnel, aiming to contribute to institutional building of OIDA in the course of the Study.

## 1.4 Scope of the Study

The overall scope of the Study was defined in Clause V of the S/W as follows.

[Phase 1]

(1) Data collection

1) Collect and review the existing information relevant to the Study
2) Carry out field surveys and interviews together with supplementary data collection on the following aspects;
   i. Natural conditions, i.e. topography, meteorology, hydrology, geology, soils, etc.
   ii. Social and economic conditions, i.e. social and economic indices, land tenure, health and water supply, farmers' economy, etc.
   iii. Present activities and potential of agricultural and livestock production
   iv. Present conditions of post-harvest procedures and marketing channels of agricultural produces
   v. Rural economy and rural credit
   vi. Extension services/system
   vii. Others relevant to the Study

(2) Identification of constraints and potentials

1) Analyze the collected information, and identify major constraints, problems and potentials
2) Conduct the Initial Environment Evaluation (IEE)
3) Prepare a draft master plan, taking into account the following components.
   i. Water resources development
   ii. Improvement of agricultural production
   iii. Improvement of people's livelihood
   iv. Public intervention (extension services, rural credits, etc.)
   v. Institutional building
   vi. Others
4) Select pilot activity/activities for a verification study.

[Phase 2]

(3) Formulation of Master Plan

1) Conduct a verification study by implementing selected activity/activities proposed in the draft Master Plan
2) Verify the rationality and effectiveness of the draft Master Plan
3) Finalize the Master Plan

(4) Conclusion of the Study and Recommendations

## 1.5 Steering Committee

A Steering Committee has been established for smooth and efficient execution of the Study. The Committee consists of the following organizations.

Ethiopian organisations represented:

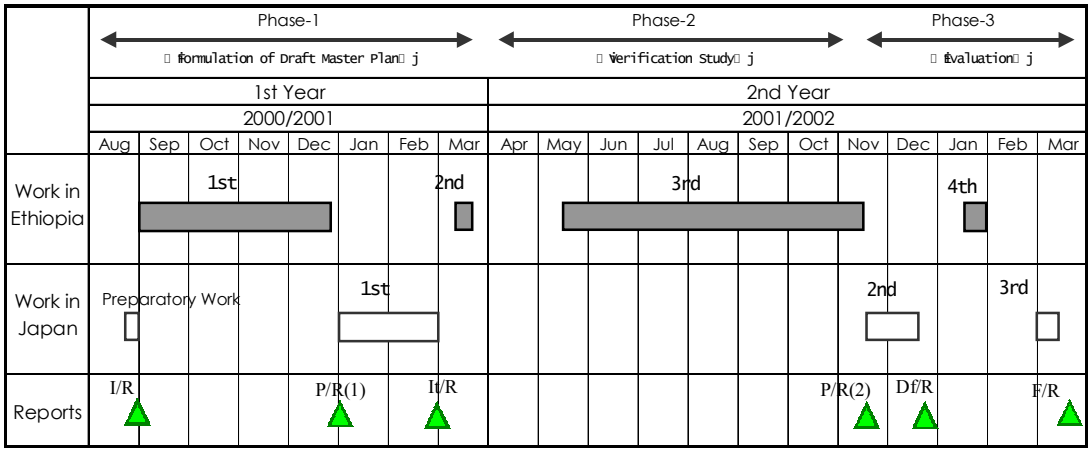
1) Oromia Irrigation Development Authority (OIDA)
2) Bureau of Agriculture
3) Water, Mining, Energy Resource Development Bureau
4) Cooperative Promotion Bureau
5) Oromia Women Affair's Sector
6) Bureau of Health
7) Bureau of Planning and Economic Development
8) Ministry of Economic Development and Cooperation (MEDaC)

Japanese organisations represented:

1) JICA Study Team
2) Advisory study team
3) JICA Ethiopia office
4) Embassy of Japan

## 1.6 Study Schedule

The Study was executed according to the time schedule presented below.




(1) Preparatory Work and First Field Work

The Study was officially commenced in August 2000. The JICA Study Team arrived in Addis Ababa on 2nd September 2000 and submitted the Inception Report to the Ethiopian representatives. The report was explained and discussed on 5th September 2000. The Ethiopian representatives agreed to proceed to the Phase-I Study. The relevant Minutes of Meeting are attached to this report as Attachment 1-3.

The First Field Work in Ethiopia of the Phase-I Study was officially commenced on 8th September 2000. The Ethiopian representatives appointed counterpart personnel for each member of the Study Team. The members of both the Study Team and the Counterpart Team are listed in Table 1.1.1.

The Study has been carried out by joint efforts of the JICA Study Team and the

Counterpart Team throughout the study period. A weekly meeting was held between both parties every Monday in order to confirm mutual understanding on the work progress and schedule. The First Field Work was successfully performed as scheduled and was completed on 21st December 2000. At its completion, a steering committee meeting was held that discussed the work results stipulated in the Progress Report (1). The minutes of that meeting are attached to this report as Attachment 1-4.

(2) First Home Work

The Study Team performed the detailed studies on the draft master plan through the First Home Office Work in Japan from December 2000 to February 2001. The full results of the Phase-I Study are incorporated within this Interim Report.

(3) Second Field Work

The Study Team was sent to Ethiopia to execute the Second Field Work, in which the Interim Report was discussed by both Ethiopian and Japanese representatives and accepted on 9th March 2001 as Attachment 1-5. In addition, the discussion was held on the plan of operation of a verification study to be executed in Third Field Work of the Phase-II Study. The note of understanding was signed as presented in Attachment 1-6.

(4) Third Field Work

The Third Field Work commenced in May 2001 in order to carry out a verification study consisting of six (6) programs. The verification study was completed in November 2001. The results of the verification study was analyzed and compiled into the Progress Report (2). The minutes of that meeting are attached to this report as Attachment 1-7.

(5) Third Home Work

The Study Team reviewed and elaborated the draft master plan taking the results of the verification study into consideration. The project evaluation was made for all the 21 projects proposed under the master plan. The Draft Final Report presents all the study results.

# CHAPTER 2 PROJECT BACKGROUND

## 2.1 Agricultural Sector in Ethiopia

The agricultural sector of Ethiopia plays a leading role in the growth of the national economy. It contributes employment opportunities to 74% of the total workable population and generates approximately 50% of Gross Domestic Product (GDP). The prevailing rainfed agriculture is prevalent in the country, therefore, food production fluctuates greatly due to erratic rainfall. Moreover, the food shortage is becoming chronic and will be accelerated by rapidly expanding population pressure in the years to come.

The Government of the Federal Democratic Republic of Ethiopia (hereinafter referred to as "FDRE") attaches the development priority to the agricultural sector and envisaged achievement of (i) improvement of food sufficiency ratio, (ii) supply of raw materials to domestic industries, (iii) creation of employment opportunities, (iv) foreign currency saving and (v) environmental conservation.

Due to the substantial government's efforts, the GDP has grown at an annual average rate of 5.5% in the periods of 1992/93 to 1997/98 with sectral growth rates of 3.4% for agriculture (4.9% for crop production).

## 2.2 Development Policies and Targets

The Five Year Programs of the Ethiopian Peoples Revolutionary Democratic Front (EPRDF) for Development Peace and Democracy are officially accepted as the primary policy papers to direct the national development strategies in Ethiopia. The first five year program covered the period from 7$^{th}$ July 1995 to 6$^{th}$ July 2000, which was followed by the second five year program from 7$^{th}$ July 2000 to 6$^{th}$ July 2005. Both Programs envisage to encourage small holders by means of more intervention of crop credit schemes integrated with the research - extension linkage, rural infrastructural development, improvement of rural amenity and capacity building of human resources.

The Programs define the principles of small holder focus policies. However, only a few documents have set rigid development plans and targets for the agricultural sector at the national level. In this regard, the Study focuses on the development plans at the regional level.

## 2.3 Key Issues

### 2.3.1 Poverty Reduction Strategic Paper (PRSP)

(1) Poverty in Ethiopia

Ethiopia falls among the five poorest countries in the world. The UNDP Human Development Report ranks Ethiopia as 171 out of 174 countries. Poverty in Ethiopia is widespread and multi-faced. Poverty manifests itself in society through poor health, ignorance, environmental destruction, low education, unemployment, malnutrition, short life expectancy and high mortality ratios both for mothers and children. Therefore, poverty alleviation may be defined as improvement of important amenities of life including land, housing, food, employment, education, other social services as well as the ability of decision making on important matters in life. It is noted that poverty problems in Ethiopia widely range with the complex structure of cause-effect relationship.

FDRE embarked on a number of household surveys in 1995/96 to verify the household characteristics and to monitor the impact of its development policies and programs on the welfare of the people. According to the Household, Income, Consumption and Expenditures (HHICE) in 1995/96, the per capita income in Ethiopia was US$ 167, which was one of the lowest in the world. The urban and rural imbalance in the per capita income was also obvious, i.e. US$217 for the urban area and US$ 159 for the rural area.

As for the minimum nutrition requirement of 2,200 calories per adult per day, the overall average of per capita nutrition intake was only 1,954 calories and 45.5% of the population were below the poverty line. The incidence of malnutrition among children is more crucial. The 1998 Health and Nutrition Survey revealed that 52% of all children aged 3 to 59 months were stunted and under acute malnutrition.

In 1994, the life expectancy at birth was 50.6 years of age. The current infant and child mortality rates were 105 per 1000 and 172 per 1000, respectively, which are the highest in the world.

The overall adult literacy rate was 22.3% in 1996. There is a significant gender gap in literacy rate. The female and male adult illiteracy rates were 77% and 55%, respectively. Imbalance between urban and rural areas is also recognized. Some 61% of the urban population were literate, while only 16% were literate in rural areas. The gross enrollment ratio at the primary level of education was 23%.

(2) Poverty Reduction Strategic Paper (PRSP)

Poverty reduction continues to be the core agenda of the country's development. The government policy is to be incorporated into Poverty Reduction Strategy Paper (PRSP). It will consist of four (4) building blocks, namely agricultural-development-led industrialization (ADLI), judiciary and civil service reform, decentralization and empowerment, and capacity building in public and private sectors. Among the four

(4) blocks, achievement of substantial progress of ADLI is probably the most urgent issue.

Ethiopia has been following a long-term strategy of ADLI adopted in the mid-1990s within the framework of draft PRSP. ADLI places the emphasis on agricultural growth as the first stage of the national economic development to encourage industrialization as the final goal of the country. To start with ADLI, agricultural growth is firstly envisaged to raise the level of national food self-sufficiency and followed by producing both export-oriented and industrial crops. FDRE attached the development priority for the improvement of food security at the household level as the most effective and direct way of poverty reduction in the country.

The zero draft (interim) of PRSP was prepared by FDRE was prepared in November 2000 and is currently under scrutiny by both the governmental and donor agencies. The final PRSP will be worked out in the coming months before the Study is completed in March 2002. However, it is believed that the Project will contribute to substantial parts of the PRSP' core objectives, namely poverty alleviation through food production and improvement of rural living conditions.

### 2.3.2 Sector Development Programs (SDPs)

The social infrastructure development in Ethiopia and the Region is basically under the control of FDRE and the Regional State Government. Currently, FDRE exerts the national budgetary arrangement for some sectors in line with the sector development programs (SDPs), in particular, the three sectors of education, health and roads. Besides, FDRE has recently embarked on preparation of the SDP for the water sector. The current position of SDPs is summarized below.

(1) Education

FDRE adopted a new Education and Training Policy and Strategy (ETPS) in 1994. The policy and strategy focus on expanding access to educational opportunities to meet future needs in the social and economic development as a whole. The First Five-Year Education Sector Program (ESDP) is currently under implementation for the target year of 2001/2. The ESDP has been implementing construction and up-grading of primary schools and increased enrollment nationwide including the Oromia Region.

(2) Health

The Health Sector Development Program (HSDP) is also under implementation for the target period of 1997-2002, in which primary health care and referable hospitals are reinforced with medical staff training.

(3) Roads

The Road Sector Development Program (RSDP) set up a 10-year development plan to expand the road network by 80% by 2007. The priority is given to trunk roads, of

which the design is completed for 7,300 km and construction for 2,100 km (asphalt road). Rural road expansion will be carried out in line with the next RSDP period to synchronize with construction of national and regional road networks.

### 2.3.3 Gender in Development

The prevalence of gender imbalance is pointed in several economic and social indicators in Ethiopia as well as Oromia Region. Following the adoption of the constitution in 1995, the national policy has aimed to remove discrimination of all forms against women and barriers to their advancement. To implement the national policy on women, FDRE has also established the necessary institutional framework at the government level, regional, zonal and wareda levels. Accordingly, a women's affairs subsector was established within the Office of Prime Minister and women's affairs departments were established in key sector ministries. Similarly, Women's Affairs Bureau was established under the Oromia Regional State Government in order to implement gender mainstreaming, advocacy, capacity building, empowerment and grassroots group formation.

Several activities are currently performed by Oromia Women's Affairs Bureau in cooperation with other bodies concerned. The performances in 1999/2000, which were presented in the regular meeting with the Prime Minster's Office held in August 2000, are summarized below.

1) Advocacy and education of women

Workshops, seminars and conferences were organized in 12 locations of the Region in association with donors, NGOs and the other government agencies such as Women's Affaires Department of Oromia Education Bureau. The activities aimed at advocacy and education on harmful traditional practices, family planning, women harassment and measures to be taken, horticulture, saving and credit, income generation, etc. In total, 14,700 women and men attended the functions.

2) Capacity building and community-based projects

Educational programs were provided on credit operation and income generation activities to 3,300 women at eight locations of the Region. The total credits released amounted to Birr 2.09 million directly assisted by donors and NGOs.

Nine (9) skill-training programs were organized at several locations. The training focused on tailoring, handicrafts, coffee seedlings raising, home economics, etc. Among them, 21 days training program was conducted in the Ziway training center to train 135 women in capacity building, income generation and cooperation.

3) Promotion of gender-oriented projects

With financial assistance of Ethiopian Social Rehabilitation and Development Fund (ESRDF), the existing 164 flourmills were either rehabilitated or replaced. The

farming (22 ha), sheep raising, bakery, tearoom and poultry farming.

### 2.3.4 Environmental Conservation

Ethiopia's economy depends almost entirely on its renewable natural resources. These resources are being depleted at unprecedented rate for subsistence living. A century ago, closed forest covered 40% of the country, but barely 4% is left today, suggesting that the deforestation rate has been, and continues to be, very high. The country's current biomass is estimated to vary between 10 and 50 $m^3$/ha for woodlots, but due to open harvest system, their harvest has exceeded their annual incremental yields of 1.2 $m^3$/ha due to expansion of agriculture, infrastructure and urban development.

At issue also is the threat of desertification, which is attributed to destructive developmental activities, inadequate and erratic rainfall and frequent droughts. With an average annual rainfall of between 300-500mm, drought is a recurring feature in many parts of the country, where up to 50% or more of the livestock is decimated. The most devastating droughts were those of 1972-74, 1975-76, 1978-79, 1983-84 and 1990-91, during which over 2.7 million people in Oromia Region alone were affected.

Deforestation and unsustainable land husbandry have resulted in accelerated runoff, reduction of ground water resources, increased sediment load in rivers, siltation of reservoirs and irrigation canals, and increased incidence of flooding. Both sheet and gully erosion is widespread in the country. Fertile soil losses are estimated at 42 tons/ha. It is estimated that soil erosion amounts to 1.5 billion tons per year in the whole country, and 0.5% of the highlands of Ethiopia is being eroded annually.

Increasing water degradation and unavailability are also serious development issues in Ethiopia. This includes problems of high salinity and fluoride in water resources. Water degradation can be attributed to lack of water management practices, lack of policy guidelines that should specify the modalities of water use for proper water and land management, the rights of downstream water users, water charges, and conservation of watersheds and watercourses. There is also inadequate monitoring and regulation of development activities that compete for water resources.

As for wildlife conservation, there is no policy for this sub-sector, such that elements that contribute to wildlife degradation are not effectively monitored or regulated. Major wildlife development issues include uncontrolled overgrazing and encroachment from nomadic pastoralists, uncontrolled fires, deforestation, poaching and illegal hunting, lack of infrastructures or communications, and inadequate compensation of local communities for conservation efforts.

The Ethiopian Rift Valley System has unique environmental issues. It is characterized by localized and limited quantities of water with fair to poor chemical qualities. All

streams are intermittent except for few perennials, which are often turbid with high sediment yield. Fluoride content in ground water is known to be the highest in the country, i.e. up to 10 ppm compared to WHO permissible level of 1.5 ppm, and salinity levels are as high as more than 3,000 ppm. Another problem is represented by high rates of sedimentation. For instance, sediment yield of the Koka lake in the northern fringe of Dugda Bora Wareda is the highest in the country, i.e. 2,300 tons/km$^2$/year. In the Mojo area, the reservoir of the Metallitia dam was completely filled in two years as a result of gully erosion in the watershed.

Over-exploitation of natural resources is mainly because the net revenues currently being earned by the local population for conserving natural resources are quite inadequate to cover the opportunity costs of the land, i.e. the forgone benefits of alternative land uses. This creates economic incentives to destroy watershed including soil, water and vegetation at the expense of conservation. This is because the current economic and environmental policies in Ethiopia do not generate the scale of revenues needed to prevent the wide spread water and land degradation. Unless the compensation to landowners for not developing say, land in watersheds is raised adequately, significant water and degradation will continue as the opportunity cost of conservation increases.

## 2.4 Irrigation Sector of Oromia Region

### 2.4.1 Oromia Irrigation Development Authority (OIDA)

(1) Organization and Staffing

The Government of Oromia Regional State (the State Government) was officially established in July 1996. It currently comprises five sectors, namely social, economic, administration and legal, military and women's affairs. The economic sector is further divided into eight (8) bureaus and two (2) authorities including OIDA. The organization chart of the State Government is presented in Figure 2.4.1.

OIDA was established in July 1999 through reform of Oromia Water, Mines and Energy Resources Development Bureau. The establishment of OIDA aims at streamlining overall irrigation development services under the sole organizational framework. The main role of OIDA is to develop small and medium scale irrigation schemes in line with the national policy of food security. According to "Oromia Regional State Irrigation Development Authority Establishment Proclamation, No. 30/1999," the major objectives of OIDA are to:

1) Undertake study, design and construction of irrigation schemes in suitable areas of the Region,
2) Contribute towards hastening the socio-economic development of rural community, and
3) Enable rural community to benefit from irrigation projects through

participation in study, construction and administration.

All the activities of OIDA are under the control of the General Manager at the head office in Addis Ababa. Then, the zonal operation is entrusted to four (4) branch offices, namely Central, Eastern, Western and Southern branch offices, and further to the wareda offices as shown in Figures 2.4.2 and 2.4.3. The Meki area is located within the coverage of the Central Branch Office.

The OIDA head office is organized into four (4) departments for study and design, construction, extension and watershed management and community participation, and four (4) service units for planning and programming, research and laboratory, administration, and finance and audit. Similarly, the branch offices are also organized into four (4) teams, namely study and design, construction, extension and water management, and community mobilization, and three (3) service units, namely planning and programming, administration and finance, garage and transport. Under the branch offices, the wareda extension offices are established at 69 districts out of 180 waredas in the Region.

OIDA is organized by 720 staff in total, consisting of 102 staff for the head office, 407 staff for four branch offices and 211 staff for 69 wareda offices as of November 2000. The technical staff accounts for 430 or 60% of the total staff. The staff having college diploma or degree comprises around 52% of the total staff. Engineering staff such as agricultural and irrigation engineers, hydrologists, geologists, etc. accounts for 195 staff or 84% of the total technical staff. The details of the staff structure are summarized in Table 2.4.1.

(2) Budget Allocation

The budget allocation in 1997-1999 of the Region is stipulated below.

**Annual Budget of the Oromia Region**

| Sector/Organization | Average in 1997-1999 (Million Birr) | | | |
|---|---|---|---|---|
| | Capital Budget (A) | Salary and Recurrent Budget (B) | Total (A+B) | (B)/(A+B) % |
| I. Economic Sector Total | 228.0 | 108.9 | 336.9 | 32.3 |
| Agriculture | 59.2 | 11.9 | 71.2 | 16.8 |
| **Irrigation** | **7.3** | **5.9** | **13.2** | **45.0** |
| Water, Mining and Energy | 72.9 | 11.4 | 84.3 | 13.6 |
| Industry and Tourism | 0.2 | 9.3 | 9.5 | 97.9 |
| Rural Road | 85.9 | 16.1 | 101.9 | 15.8 |
| Transport | 2.7 | 12.0 | 14.7 | 81.8 |
| II. Social Sector Total | 149.0 | 515.4 | 664.5 | 77.6 |
| Total (I and II) | 377.1 | 624.3 | 1,001.4 | 62.3 |
| Regional State Total | 384.2 | 870.1 | 1,254.3 | 69.4 |

Source: Department of Finance, Oromia Region

Annual capital budget (investment) for the irrigation development during the period from 1997 to 1999 in the Region was about Birr 7.3 million on average that accounts

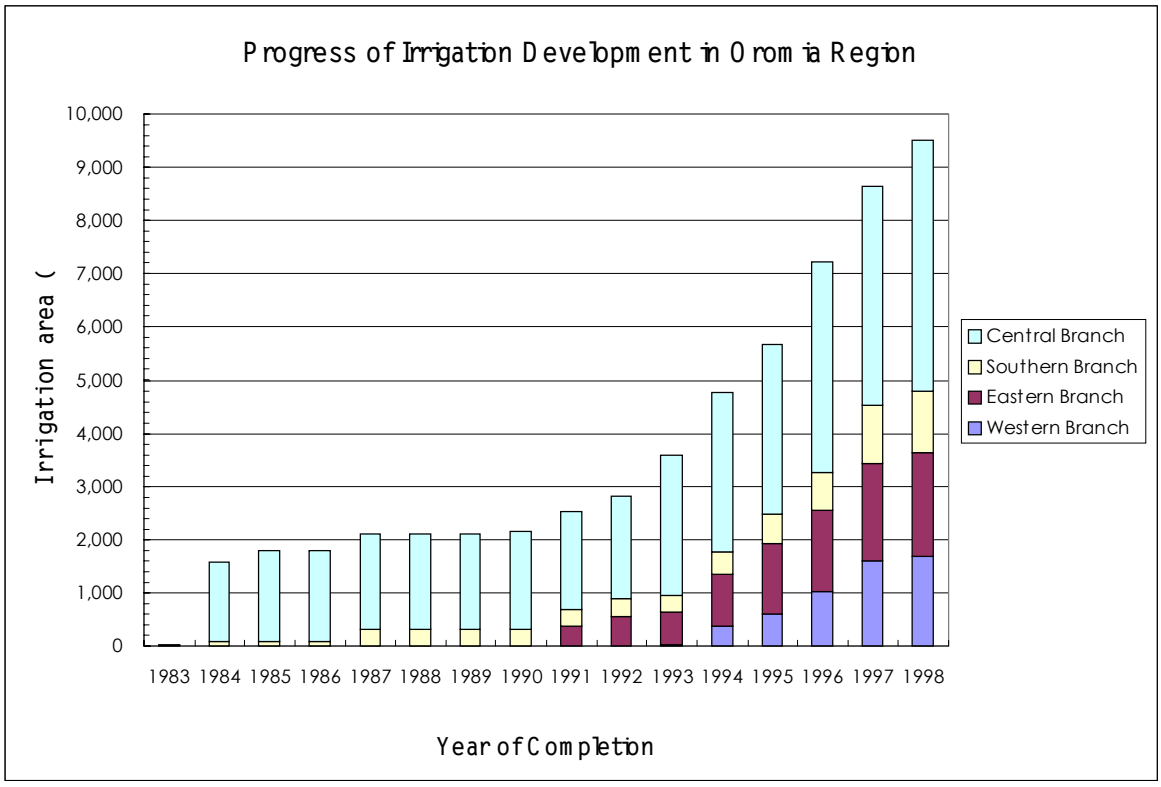
for 2% of the total economic sector investment of the Region, i.e.Birr 228.0 million. Both budget and share of irrigation development have been decreased year by year. from 22.5 million (6%) on average. In the period from 1993 to 1995, the average annual budget of the irrigation sector amounted to Birr 22.5 million or 6% of the annual capital budget.

Staff salary occupies the largest portion of the recurrent budget. As seen in the above table, the salary in the irrigation sector is as high as 45% of the total budget. This implies that staff recruitment for OIDA has to be carefully planned and executed taking into consideration expansion of financial loads.

### 2.4.2 Irrigation Schemes in the Region

(1) General

In Oromia Region, the Government constructed 96 irrigation schemes during the last few decades. The total command area of 96 schemes amounts to 9,644 ha giving an average of 100 ha per scheme.




Source: Small Holders Modern Irrigation Schemes Evaluation Report, OIDA, 2000

The irrigation development has been accelerated since 1992, when the regime was changed and MNRDEP took full responsibility for the irrigation development.

In the year 2000, OIDA conducted the field investigation to evaluate the present performance of the existing irrigation schemes and to identify constraints and problems encountered each of the schemes. The existing irrigation schemes are listed

in Table 2.4.2 and their location is illustrated in Figure 2.4.4.

(2) Irrigation Schemes and Area

The distribution of the existing irrigation schemes is shown below.

**Irrigation Area by Branch Office**

| Branch Office | Nos. of Schemes | Planned Irrigation Area | | Actually Irrigated Area | | Achieve-ment (%) |
|---|---|---|---|---|---|---|
| | | (ha) | (%) | (ha) | (%) | |
| Western | 24 | 1,685 | 17% | 514 | 9% | 31% |
| Eastern | 23 | 1,948 | 20% | 1,456 | 26% | 74% |
| Southern | 12 | 1,188 | 12% | 556 | 10% | 47% |
| Central | 37 | 4,823 | 51% | 3,034 | 55% | 63% |
| Total/Average | 96 | 9,644 | 100% | 5,560 | 100% | 58% |

Source: Small Holders Modern Irrigation Schemes Evaluation Report, OIDA, 2000

The Central Branch Office is the largest among four (4) branch offices. This branch currently controls 37 schemes with 4,823 ha or 51% of the OIDA's irrigation area. It is noted that only 58% of the area has been actually irrigated. This low performance implies that all the schemes are functioning well and need urgent repairs and rectification. The size of the Meki-Ziway irrigation schemes ranges from 20 ha to 1,500 ha with the average area of 100.46 ha. However, the actual irrigated area falls in a range between 0 ha and 518 ha with an average area of 57.9 ha. The most serious case is the Meki-Ziway irrigation scheme, which currently irrigates only 33 ha against the planned area of 1,500 ha.

In contrast, the actual irrigated areas exceed the planned area at some of the schemes, particularly in the Eastern Branch office area. It is reported that some of these schemes were extended by farmers without considering dependable water potential.

Out of 96 schemes, 63 schemes have a command area of less than 100 ha. The irrigation schemes are categorized by size of irrigation area as presented below.

**Classification of Irrigation Schemes by Size**

(Unit: Nos. of scheme)

| Branch Office | Planned Irrigation Area (ha) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A< 50 | 50•A <100 | 100•A <150 | 150•A <200 | 200•A <250 | 250•A <300 | 300•A | Total |
| Western | 8 | 10 | 3 | 3 | 0 | 0 | 0 | 24 |
| Eastern | 8 | 10 | 2 | 1 | 1 | 0 | 1 | 23 |
| Southern | 1 | 6 | 3 | 0 | 2 | 0 | 0 | 12 |
| Central | 6 | 14 | 11 | 2 | 3 | 0 | 1 | 37 |
| Total | 23 | 40 | 19 | 6 | 6 | 0 | 2 | 96 |

Source: Small Holders Modern Irrigation Schemes Evaluation Report, OIDA, 2000

(2) Water Sources and Irrigation Systems

River water is the main water resource of irrigation schemes in Oromia Region. Out of 96 schemes, 72 schemes obtain water from rivers. Only in the Eastern Branch office area, spring water is the main source. The intake facilities are represented by headworks. Among 96 irrigation schemes, 67 schemes are run-of-river type with headworks. This means that the gravity irrigation system is predominant in the Region, while pumping irrigation is adopted to a limited extent.

**Classification of Irrigation Schemes by Water Source and Irrigation System**

| Branch Office | Water source | Spring | River | | | | | Lake | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Intake facility | Head Works | Pump | Head Works | Dam | Free Intake | Pump & Headworks | Pump | |
| Western | Scheme (Nos.) | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| | Planned Area (ha) | 0 | 0 | 1,685 | 0 | 0 | 0 | 0 | 1,685 |
| Eastern | Scheme (Nos.) | 15 | 0 | 8 | 0 | 0 | 0 | 0 | 23 |
| | Planned Area (ha) | 861 | 0 | 1,087 | 0 | 0 | 0 | 0 | 1,948 |
| Southern | Scheme (Nos.) | 0 | 0 | 11 | 0 | 1 | 0 | 0 | 12 |
| | Planned Area (ha) | 0 | 0 | 1,156 | 0 | 32 | 0 | 0 | 1,188 |
| Central | Scheme (Nos.) | 8 | 0 | 24 | 3 | 0 | 1 | 1 | 37 |
| | Planned Area (ha) | 515 | 0 | 2,204 | 404 | 0 | 200 | 1,500 | 4,823 |
| Total | Scheme (Nos.) | 23 | 0 | 67 | 3 | 1 | 1 | 1 | 96 |
| | Planned Area (ha) | 1,376 | 0 | 6,132 | 404 | 32 | 200 | 1,500 | 9,644 |

Source: Small Holders Modern Irrigation Schemes Evaluation Report, OIDA, 2000

### 2.4.3 Five Years Development Plan

In connection with provision of infrastructures, the Five-Years Irrigation Development Plan in Oromia Region (2000-2004) to be undertaken by OIDA set an achievement targets as shown below.

**5-Years Plan for Irrigation Development**

| | Description of Activities | Target | | |
|---|---|---|---|---|
| | | Nos. | Area in ha | Others |
| 1 | Study and Design | | | |
| | Reconnaissance | 348 | 27,460 | - |
| | Feasibility Study | 224 | 17,440 | - |
| | Detailed Design | 182 | 14,240 | - |
| 2 | Construction | 100 | 7,865 | |
| 3 | Expected Beneficiaries | - | - | 31,460 HHF |
| 4 | Watershed Management | | | |
| | Study | 98 | - | - |
| | Implementation | 69 | - | - |
| 5 | Water Management | | | |
| | Review of activities | 110 | - | - |
| 6 | Project Identification Survey | - | 48,000 | - |

Source: Oromia Region 5-years Development Plan

The plan envisages that the irrigated areas will be increased by some 90% in the next 5 years. So as to achieve the target, the annual plan is set for branch offices and for project activities as presented below.

**Project Development Activities under 5-years Plan**

| Branch Office | Reconnaissance Study | | Feasibility Study | | Detailed Design | |
|---|---|---|---|---|---|---|
| | Proposed Schemes (Nos.) | Potential Development Area (ha) | Proposed Schemes (Nos.) | Potential Development Area (ha) | Proposed Schemes (Nos.) | Potential Development Area (ha) |
| Western | 109 | 9,175 | 77 | 6,275 | 52 | 4,275 |
| Eastern | 104 | 8,350 | 72 | 5,625 | 58 | 4,650 |
| Southern | 66 | 4,865 | 34 | 2,515 | 33 | 2,440 |
| Central | 69 | 5,070 | 41 | 3,025 | 39 | 2,875 |
| Total | 348 | 27,460 | 224 | 17,440 | 182 | 14,240 |

Source: Oromia Region 5-years Development Plan

Other than construction of the infrastructure, activities of OIDA include extension, watershed management, water management, and community participation. Those main activities in the plan are as follows.

**5-years Plan for Irrigation Development Activities**

| | Description of Activities | Target | |
|---|---|---|---|
| | | Nos. | Area in ha |
| 1 | Extension | | |
| | Selection of demonstration field | 143 | - |
| | Training for staff | 520 | - |
| | Multiplication of selected seeds | 20 | - |
| 2 | Watershed Management | | |
| | Nursery center | 45 | - |
| | Follow-up of watershed management activities | 295 | - |
| | Training | 520 | - |
| 3 | Water Management | | |
| | Follow-up study for irrigation schemes | 617 | - |
| | Training | 69 | - |
| 4 | Community Participation | | |
| | Establishment of WUA | - | 698 |
| | Training for members of WUA | - | 1,570 |
| | Community participation for development | 65,854 | - |

Source: Oromia Region 5-years Development Plan

# CHAPTER 3 THE PROJECT AREA

## 3.1 Natural Resources

### 3.1.1 Physiography and Geology

(1) Physiography and topography

The study area is located between latitudes 8•03'N and 8•24'N and longitudes 38•32'E and 39•02'E in the Ethiopian Rift Valley; a huge volcano-tectonic sunken block basically formed in the Tertiary period. The Ethiopian Rift Valley traverses in the SW-NE direction incising between the Ethiopian plateau and the Somalian plateau with a formation of a 35 to 80 km wide corridor between the faults. In the north of Nazarethe, this corridor opens out into a triangle on the Afar, which is the junction of three tectonic directions, namely the Red Sea, the Gulf of Aden and the Ethiopian Rift. In the Quaternary, occurrence of heavy rains led to the formation of large lakes including the Ziway lake, which is charged by the Meki river.

The study area lies on the flat valley floor at an elevation of 1,655m. The vicinity of the Meki town comprises a plain sloping gently southeast towards the Ziway lake at an elevation of 1,636 m. The plain generally has a rather flat topography, varying its slope from 0.5 to 2.0 %. Within the plain, to the left bank of the Meki river, there is the Cheleleka swamp. The Meki river, which passes through the center of the town, has cut a steep sided narrow gorge of 10 to 20 m. The river originates in the Guraghe Mountains located in the northwest Meki town and flows southeast before draining into the Ziway lake. On the eastern side of the Ziway lake, the land rises to higher elevations up to the heights of Badda and Kada Mountains of Assela piedmont. On the western side of the lake, the slope is gentler.

(2) Geology

The geological foundation of the upper Meki basin includes ignimbrites, tuffs, waterlain, pyroclastic and occasional lacustrine deposits. The northwestern corner of the basin is underlain by ignimbrite, unwelded tuffs, ashflow, rhyolites and trachyte.

The geology in the lower Meki basin is composed predominantly of recent lacustrine deposits overlaying the Tertiary igneous rocks. Thin clayey soils overlie these deposits on the plain. The tertiary rocks are likely to consist of ignimbrites, tuffs and pyroclastics of the Dino Formation. The lower part of this formation comprises ignimbrites, tuffs, water lain pyroclastics and occasional lacustrine beds. The upper part consists of coarse, unwelded, pumiceous pyroclastics. Thickness of the Dino Formation generally exceeds 200m. The lacustrine deposits, which overlie the tertiary volcanic probably, exceed 50 m in thickness.

### 3.1.2 Climate

The climate in the study area and around the lakes is arid or semi-arid. However, it is humid to dry sub-humid in the river catchment areas in the highlands, west of Butajira and east of Assela. The climate of the basin is governed mainly by the movement of Equatorial low-pressure zones as summarized below.

**Rainfall Season in the Area**

| S.N. | Season | Month | Location of Low Pressure | Wind Direction | Rainfall Condition |
|---|---|---|---|---|---|
| 1 | Dry | November to February | South of the Equator | Dry northeast Trade winds from the Arabian Peninsula | Dry |
| 2 | Light rain (*Belg*) | March to June | Southern Sudan | Southeast winds from the Indian Ocean | Light and less reliable rainfall |
| 3 | Rainy (*Meher*) | July to October | Arabian Peninsula & Central Asia | Moist southwest winds from the south Atlantic ocean and central Africa | Area receives most of its rains from July to September |

Monthly rainfall data of 18 meteorological stations are collected and an annual isohyetal map is prepared in Figure 3.1.1. Average annual rainfall increases with altitude, it ranges from about 650 mm in the rift valley floor around the lakes to over 1,100 mm in the east and west highlands of altitude more than 2,000 m.

The Meki meteorological station is located at the center of the study area; it receives an average annual precipitation (1966-1999) of 774 mm. The rainfall data of the Meki station from 1966 to 1999 are plotted in Figure 3.1.2. The annual rainfall is rather erratic. It ranges from a low of 344 mm in 1995 to a high of 1,091 mm in 1983. About 64% of the annual rainfall is recorded during the period from June to September. The drier months are from November to February, only 8% of the annual rainfall is recorded during this period. The heaviest precipitation usually falls during August, as much as 21% of the annual precipitation occurring during this period. The seasonal variation of rainfall at the Meki station is illustrated in Figure 3.1.3.

The Meki meteorological station is categorized into a Class III station, which records only rainfall data. However, a complete set of data is recorded at the Class I Ziway meteorological station, located at almost the same altitude as that of Meki and about 30 km south of Meki town. The climate of the study area is characterized by the data from the Ziway meteorological station as presented in Figure 3.1.2. The mean annual temperature is 20.3•C at Ziway station with mild temperature prevailing throughout the year, which is suitable for a wide range of tropical and sub-tropical crops. Mean monthly air temperature varies from 18.8 •C in December to 22 •C in May. Period from March to June is relatively warmer, when the mean temperature is generally above 21 • C. The air relative humidity is 66% on average, varying from 60%

(November) to more than 70% (July-September) on the monthly average. Average monthly wind speed varies from 1.48 m/s in September to 2.56 m/s June. Sunny months are from November to February, with duration, generally, from 9 to 10 hours/days; whereas in the rainy season sunshine duration decreases to around 6 to 7 hours/day. Average annual potential evapotranspiration is 1,658 mm, which is more than two times the annual rainfall.

### 3.1.3 Hydrology and Water Use

The northern rift valley sub-catchment has 7 major water bodies in its hydrologically closed basins; Meki river, Katar river, Ziway lake, Bulbula river, Horakelo river, Abijata lake, and Langano lake. There are also other numerous streams that drain into both Abijata and Langano lakes. The location of water bodies and streamflow gauging station is shown in Figure 3.1.4. Main features of the lakes are shown in the following table.

**Main Features of Lakes**

| S.N. | Lake | Lake Area ($km^2$) | Storage Volume (MCM) | Mean Depth (m) | Altitude (m) | Catchment Area ($km^2$) | Annual Inflow (MCM) |
|---|---|---|---|---|---|---|---|
| 1. | Ziway | 440 | 1,466 | 2.5 | 1,636 | 7,380 | 704 |
| 2. | Langano | 230 | 3,800 | 17.0 | 1,590 | 2,006 | |
| 3. | Abijata | 180 | 954 | 7.6 | 1,580 | 10,740 | 227 |
| 4. | Shalla | 370 | 37,000 | 86.0 | 1,567 | 2,300 | |

Source: Water Resources Base Line Survey, Oromia Economic Study, 1999

The Meki and Katar rivers replenish the Ziway lake, which in turn give rise to the outflow to the Bulbula river that flows south for 30 km before draining into the terminal Abijata lake. Other rivers, which flow into Abijata, are the Horakelo river from the Langano lake and the Gogessa river, a branch of the Gidu river draining from west of the Abijata. These lakes and rivers have interconnected systems and the constraints for water resources are complex. Therefore, the water resources development of the basin requires a judicious planning for protection of the fragile eco-system. The main features of rivers are presented in the following table.

**Main Features of Rivers**

| S.N. | River | Station | Catchment Area ($km^2$) | Annual Rainfall (mm) | Annual Discharge (MCM) | Runoff Coefficient | Drain Into Lake |
|---|---|---|---|---|---|---|---|
| 1 | Meki | Meki Village | 2,433 | 1,006 | 291 | 0.12 | Ziway |
| 2 | Katar | Abura | 3,350 | 874 | 413 | 0.14 | Ziway |
| 3 | Kekersitu | Adamitulu | 7,488 | | 180 | | Abijata |
| 4 | Horakelo | Near Bulbula | 2,050 | | 47 | | Abijata |

Source: Water Resources Base Line Survey, Oromia Economic Study, 1999

(1) Meki river

The Meki river originates in the highlands of Guraghe and travels a distance of about 100 km from the highlands at altitude of 3,600 m to 1,636 m before draining into the Ziway lake. The upper reaches of the basin are steep and mountainous, while the lower basin is flat with a broad valley. The total catchment area of the river near Meki town is 2,433 $km^2$. According to discharge data recorded near Meki town (1965-1999), average annual discharge of the river is 291 MCM or 9.18 $m^3/s$. Monthly discharge of the river at Meki town station is summarized in the following table.

**Monthly Discharge of Meki river Near Meki Town**

| Average River Discharge ($m^3/s$) | | | | | | | | | | | | | Annual Volume (MCM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year | |
| 0.94 | 2.28 | 5.01 | 7.01 | 7.31 | 6.29 | 18.75 | 29.64 | 19.93 | 8.77 | 3.29 | 0.90 | 9.18 | 291 |

Source: Ministry of Water Resources

The high discharge occurs during the months of August and September, while low discharge generally occurs during the dry season from December to February. The river discharge sometimes becomes zero during these months.

(2) Ziway Lake

The main water sources for the lake are the flows of the Katar and Meki rivers. The Meki river is gauged at Meki town (CA = 2,433 $km^2$), while the Katar river is gauged near Abura (CA = 3,350 $km^2$). The mean annual flows recorded at the two stations are 291 MCM and 413 MCM, respectively. The total catchment area of the Ziway lake is about 7,380 $km^2$. The remaining catchment that is surrounding lake passing through swamp contributes little as the large part of the water evaporates before it contributes to the lake effectively. The total annual average inflow in the lake can be safely estimated by the sum of the Katar and Meki river flows as recorded at the gauging stations, which is about 704 MCM.

The water balance of the Ziway lake consists of inflow, outflow from the lake (Bulbula river) and evaporation from and precipitation on the lake surface. The water level of the lake is plotted in Figure 3.1.5.

(3) Bulbula River

The water level of Ziway lake influences the outflow to the Bulbula river. The upper part of the Bulbula river is also known as the Kekersitu river. The water level of the Ziway lake is controlled by a natural basalt bar on the Bulbula river lying some 6 km downstream from the river outflow at the lake. An average annual flow of 180 MCM flow down to the Abijata lake. The average lake water level and monthly discharge of the river recorded at the Adamitulu station are shown in the following table.

**Average Water Level of Ziway Lake and Outflow to Bulbula River**

| Station Unit | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ziway Water Level (m) | 1.06 | 0.95 | 0.85 | 0.80 | 0.76 | 0.74 | 0.83 | 1.19 | 1.50 | 1.53 | 1.34 | 1.23 | 1.07 |
| River Q at Adami ($m^3/s$) | 4.07 | 2.56 | 1.23 | 1.34 | 1.27 | 1.38 | 1.98 | 6.16 | 13.68 | 15.09 | 11.84 | 7.50 | 5.70 |

Source: Ministry of Water Resources

(4) Abijata Lake

The Abijata lake is located in the Abijata-Shella National Park and particularly known for its migratory pelican and flamingo birds. The lake is recharged mainly by the Bulbula and Horakelo rivers. These rivers outflow or spill from the Ziway and Langano lakes respectively, therefore, the three lakes form an interconnected sub-system. The Bulbula river contributes about 125 MCM annually to the Abijata lake, while the Horakelo rivers from the Langano lake contributes about 46 MCM to the Abijata lake. The rest of the Abijata catchment contributes relatively little. The Gogessa river, which is a small eastern tributary of the Jidu river, has some old data from which the yield is estimated at 10 MCM. The other wetter catchment between Shala and Abijata with a catchment area of 60 $km^2$ and a runoff coefficient of 20% yields about 7 MCM. The remaining catchment of Abijata does not have any permanent drainage and only contribute water to the lake during heavy rains as overland flow. The Abijata lake is highly mineralized and is not important for use in irrigated agriculture. However, the Abijata Soda Ash Enterprise is extracting about 2 MCM of water annually for soda ash production from the lake water since 1990.

(5) Water Use

There are several small and medium scale irrigation schemes and state farms developed by abstraction of water from the Ziway lake, Bulbula, and Katar rivers. Figure 3.1.6 shows the water use for irrigation in the Meki-Ziway water resources system. Most of irrigation schemes in the area pump water from the Ziway lake or the Bulbula river. There is also some abstraction from the Meki and Katar rivers. The following table shows the irrigation system utilizing the water abstraction from lakes and rivers.

**Water Use in the Meki-Ziway System**

| No. | Irrigation System | Irrigation Area (ha) | Water Source |
|---|---|---|---|
| 1. | Katar Irrigation | 420 | Katar River |
| | Sheled | 75 | |
| 2 | Pumping Schemes on Meki | 157 | Meki river |
| 3. | Meki Ziway Project | 380 | Ziway Lake |
| | Ziway Prison Farm | 265 | |
| | Others | 300 | |
| 4. | Ziway State Hort. Farm | 733 | Bulbula |
| | Dodicha | 69 | |
| | Gerbi and Bochessa | 40 | |
| | Others | 100 | |

Source: Water Resources Base Line Survey, Oromia Economic Study, 1999

### 3.1.4 Soils

The soils of the study area were surveyed by the Land Use Planning Project, which were carried out by Land Use Planning and Regulatory Department of the Ministry of Agriculture in 1989 in association with FAO/UNDP. The survey was systematically carried out on the basis of physiographic interpretation of aerial photography and satellite imageries. The major soils of the study area are classified broadly into four (4) groups according to the legend of the FAO/UNESCO system, namely Vertisols, Andosols, Fruvisols and Solonetz.

1) Vertisols

Vertisols are clayey soils that shrink and crack when dry. Pelli-Calcic Vertisols (Hidi series) are the most predominant in the hilly area (valcano-lacustrine terrace) in the northern study area. They are very deep, black, fine textured, partly sodic phase.

2) Andosols

Andosols originate from volcano lacustine deposits with ashes, cinders, pumice (gravels) lapilli or other vitric pytpoclastic materials. Vitric Andosols (Meki series) are predominate on the Rift Valley floor. The soils are neutral to slightly alkaline, calcareous, deep, and have a coarse loamy texture. They cover the central part of the study area.

3) Fluvisols

Fluvisols are derived from alluvium lying on the lakeshore and along the Meki river. Gleyic-Mollic Fluvisols (Abay series) are derived from lacustrine alluvium and cover the lakeshore of Ziway. They are deep, black, poorly drained, have a fine loamy texture, partly sodic and seasonally flooded for approximately 4 months. Calcaric Fluvisols and Mollic Fluvisol are also observed along the Meki river. They are well-drained loamy soils.

4) Solonetz

Solonetz soils cause problems for management as they have a high sodium content. They are common in the study area. They occur sporadically in the bottomlands and slight depressions within the flood plains. In both Meki and Alem Tena towns, Mollic Solonetz derived from lacustrine deposits widely covers the flat land.

To confirm the existing study results, the Study conducted soil profile observations at three (3) representative sites and collected nine (9) soil samples for detailed laboratory tests to verify their physical and chemical properties. In parallel, 275 topsoil samples were collected to verity the spatial distribution of saline and alkaline soils across the entire Dugda Bora Wareda. The survey density is one sample per 600 ha. The samples were transported into the laboratory and analyzed for texture, soil pH and soil $EC_{2.5}$. Soils are sand to sandy loam in texture, neutral to slightly alkaline (pH 5.5 to 7.2) and moderate in salinity.

### 3.1.5 Natural Vegetation

The natural vegetation of the study area is mainly tropical savanna dominated by acacia species occasionally interrupted by riverine broad trees and shrubs. Many of the acacia species provide valuable browse to goats but due to deforestation the density of these trees has diminished considerably. Under semi-arid climatic conditions, most grasses are greenish only in the rainy seasons. They provide huge grazing sources to the rural communities.

Where grass has been preserved for oxen grazing, a tall grass, *Hyparrhenia ruffa*, is predominant. Due to deterioration of the rangelands, palatable and digestible species have disappeared in most places and been replaced by unpalatable and indigestible species of low nutritional value.

### 3.1.6 Land Use

The present land use of the Wareda is classified into four (4) categories, namely (i) farmland, (ii) forest, shrub and bush, (iii) grazing land and (iv) others including residential, roads and swamp. The extent of each land use category is summarized below.

**Present Land Use of Dugda Bora Wareda**

| Land Use Category | Coverage (ha) | Proportional Extent (%) |
|---|---|---|
| 1) Farmland | 67,828 | 46 |
| 2) Forest, shrub and bush | 19,971 | 14 |
| 3) Grazing land | 36,326 | 25 |
| 4) Others | 9,758 | 7 |
| Total | 146,882 | 100 |

Source: Dugda Bora District Agriculture Bureau Office

## 3.2 Socio-economy

### 3.2.1 Demography

(1) Population

The Oromia Region is administratively divided into 12 zones and 180 waredas, which are further subdivided into about 10,000 peasant associations (PA), i.e. the lowest administrative unit. The study area administratively comes within the Dugda Bora Wareda of East Shewa Zone.

The Wareda contains two (2) urban centers and the rural areas divided into 54 Peasant Associations (PAs). The latest 1994 population census by the Central Statistical Authority verified the population and households of the Wareda to be 134,454 and 28,688, respectively as presented in Table 3.2.1. The population projection estimates the wareda population in 2000 to be about 163,000 as presented below.

**Population Project for 2000**

| Category | Population ('000) | Family Size | Land Area ($km^2$) | Population Density (person/$km^2$) |
|---|---|---|---|---|
| Ethiopia | 63,495 | 4.83 | 1,097,000 | 58 |
| Oromia Region | 22,354 | 4.84 | 353,007 | 63 |
| East Shewa Zone | 1,990 | 4.82 | 13,624 | 146 |
| Dugda Bora District | 163 | 4.69 | 1,468 | 111 |
| 54 PAs | 125 | 4.74 | 1,452 | 86 |
| Meki Town | 28 | 4.51 | 14 | 1,993 |
| Alem Tena Town | 10 | 4.52 | 2 | 4,843 |

Source : 1994 population census, Central Statistical Authority

Dugda Bora Wareda as well as East Shewa Zone is rather densely populated in comparison with both the regional and the national averages. Within the Wareda the population densities vary widely among the PAs, between 169 and 36 according to the 1994 census. Spatial distribution patterns of the wareda population in 1994 is illustrated in Figure 3.2.1.

(2) Ethnic groups and religion

Major ethnic group in the Wareda is Oromo that comprises 73% of the total population followed by Guragie (14%) and Amhara (8%). Around 95% of the wareda population believe Orthodox followed by Muslim (2%), Traditional (1.3%), Catholic (0.8%), and Protestant (0.6%) as summarized below.

**Ethnic Groups and Religion (1994)**

| Item | Dugda Bora Wareda | East Shewa Zone | Oromia Region | Ethiopia |
|---|---|---|---|---|
| Sampled Population ('000) | 134.5 | 1,668 | 18,474 | 53,132 |
| I. Ethnic Groups (%) | | | | |
| Oromo | 72.8 | 69.6 | 85.0 | 32.1 |
| Amhara | 8.3 | 16.8 | 9.1 | 30.1 |
| Guragie | 14.1 | 3.7 | 0.9 | 4.3 |
| Tigraway | 0.8 | 1.3 | 0.4 | 6.2 |
| Others | 4.0 | 8.6 | 4.6 | 27.3 |
| II. Religion (%) | | | | |
| Orthodox | 94.9 | 58.8 | 41.3 | 50.6 |
| Muslim | 2.3 | 35.0 | 44.3 | 32.8 |
| Catholic | 0.8 | 0.9 | 0.6 | 0.9 |
| Protestant | 0.6 | 3.5 | 8.6 | 10.2 |
| Others | 1.4 | 1.8 | 5.2 | 5.5 |

Source : 1994 population census, Central Statistical Authority

(3) Literacy rate

The overall literacy rate in the Wareda was 22% in 1994. The gender gap in the literacy rates was remarkable, i.e. 29% for male and 15% for female. As observed nationwide, lower literacy rates in rural areas are also recognized within the Wareda. The primary education in the rural area is conducted in the Oromo language. The literacy rates of the Wareda are summarized below.

**Literacy Rate in Age Ten Years and Over ( 1994)**

| Item | Dugda Bora Wareda | East Shewa Zone | Oromia Region | Ethiopia |
|---|---|---|---|---|
| Total | 22 | 36 | 22 | 23 |
| Male | 29 | 42 | 29 | 30 |
| Female | 15 | 30 | 16 | 17 |
| Rural Total | 13 | 20 | 16 | 15 |
| Male | 19 | 27 | 23 | 22 |
| Female | 5 | 13 | 9 | 9 |

Source : 1994 population census, Central Statistical Authority

### 3.2.2 Administration at Wareda Level

All the administrative and development activities at the wareda level are performed by both the district administration office and nine (9) region's district offices.

(1) District administration office

The administration of Dugda Bora Wareda is under the control of an Administrator and 15 councilors, who are elected every 5 years. PAs are headed by chairpersons, who are officially appointed by the Administrator upon prior consent of villagers and act as coordinators for administration of the relevant PA without compensation.

Under the Administrator and the councilors, six units, namely (i) economy, (ii) social, (iii) peace and security, (iv) policy and administration, (v) women's affairs and (vi) administration and finance, perform the day-to-day operations. The total number of staff under these units is 14 as of November 2000. The councilors are responsible for coordination of such issues as economy, social, peace and women's affairs. The district administration office holds a monthly meeting with the entire PA chairpersons regarding peace and security, development, government revenue and credit services. The PA chairpersons have duties on community mobilization, security works and strengthening democracy. They report directly to the Administrator.

(2) Region's district offices

Oromia Regional State Government has the following nine region's district offices at the Dugda Bora Wareda, which deploy all the frontline activities on behalf of the Regional State Government. The total staff amounted to 226 officials in November 2000.

1) Agricultural Development Office, Agriculture Bureau
2) Irrigation Development Office, OIDA (Central Branch Office)
3) Cooperative Office, Cooperative Promotion Bureau
4) Health Office, Health Bureau
5) Education Office, Education Bureau
6) Finance Office, Finance Bureau
7) Police Office

8) District Court
9) District Attorney Office

The district administration office coordinates with the region's district offices on a weekly basis. The major issues include quality of education and drop-out issues with the Education Office, credit services and farmers' debt with the Agricultural Development Office, the government revenue with the Finance Office, peace and security with the Police Office, etc. Other meetings are also held on security problems with the Police Office, disease out-break with the Health Office, drought and hunger with the Agricultural Development Office, etc. The district administration office has no initiated projects at present.

The tax collection at the PA level is made directly by the Finance Office under the coordination with the district administration office and the PA chairpersons. The taxes comprise (i) direct tax for land use, business, and workers' income and (ii) indirect tax for service and sales. The Meki town municipality collects weekly market toll fees from traders and uses it as municipal revenue.

The district administration budget is allocated fully by the State Government. The annual budget execution in 1998 - 2000 was Birr 210,600 on average of which 61% were disbursed for salary of the staff and 39% for recurrent budget expenditures. Of the recurrent expenditure, 61% were spent for training, 28% for per diem, and 11% for office operation.

### 3.2.3 Economic Activities

The population engaged in economic activities in East Shewa Zone accounts for 68% of the age group of 10 years and above in 1994, and was lower than that of Oromia Region (75%) and Ethiopia (72%). On the other hand, the percentage of unemployed population in the same Zone was 6%, which was higher than that of Oromia Region (2%) and Ethiopia (3%). Although there are no statistics available for Dugda Bora Wareda, the 1994 census indicated the unemployment population ratio in Meki town as 12%.

In Oromia Region, 93% of the total employment was created by the agriculture, forestry and fishery sectors in 1994 followed by the service sector such as wholesale and retail trade (2%), hotel and restaurant (2%), government employees (1%) and so on. Employment in the manufacturing sector was limited, being only 1% of the total employment. There are no large-scale manufacturers in the Wareda, while agriculture including livestock and fishery in and around the Ziway lake is the major industry in the Wareda.

The number of industrial establishments registered in the Wareda was 421. They include grain processing (52), bakery (7), repair shop (12), traders (25), retailers (215), hotel (11), restaurant (36), hospital and clinic (13), fuel station (3),

government offices (12), schools (31), telecommunication and electric supply (4). These 421 establishments assumed to generate employment for around 1,300 persons in the Wareda. The majority of grain processing factories are located at Meki (34 mills) and Alem Tena (9 mills) towns except for nine flourmills located in six PAs.

### 3.2.4 Farm Economy and Poverty Line

The HHICES in 1995/96 verified the current positions of farm family economy in the Region as presented in Tables 3.2.2 and 3.2.3. The respective medium class annual income and expenditure for rural households were Birr 4,700 and 5,300, respectively. They were marginally higher than those of the national average, i.e. Birr 4,000 and 4,400. It is noted that income and expenditure have been estimated separately in the survey. Therefore, the HHICES results do not mean that average HHs accumulate debt due to over-expenditure. The HHICES results are summarized below.

**Results of Household, Income, Consumption and Expenditures (1995/6)**

| Items | Oromia Region (%) | Ethiopia (%) |
|---|---|---|
| I. Income | Birr 6,230 | Birr 5,420 |
| Household agricultural income | 72 | 70 |
| Income for gifts/obtained | 14 | 15 |
| Non-agricultural income | 6 | 6 |
| Others | 8 | 9 |
| II. Expenditure | Birr 6,540 | Birr 5,570 |
| Food | 53 | 54 |
| Rent, fuel, power, water, construction | 15 | 16 |
| Clothing, footwear | 10 | 10 |
| Others | 22 | 20 |

Source: HHICES in 1995/96

The income sources for rural households in the Region are agriculture (72%) of the total income) followed by gifts (14%) and non-agricultural income (6%). On the other hand, major expenditures are food (53% of the total expenditure) followed by rent, fuel, power and water (15%) and clothing and footwear (10%).

## 3.3 Crop Production

### 3.3.1 Agro-ecological Zones and Cropping Systems

(1) Agro-ecological zones

The agro-ecological zone of the study area is categorized into Semi-Arid 1 with erratic, unreliable and low rainfalls between 600 mm and 1,100 mm per annum (MoA 1998). The rainfall is characterized by a bimodal pattern with the long rainy seasons (*Meher*) from July to September and the short rainy seasons (*Belg*) from February to early May. The isohyetal map indicates higher rainfalls (from 850 mm to 1,100 mm) in hilly areas lying in the western to northwestern parts of the study area. On the

other hand, the western to northern shore of Ziway lake has explicitly more erratic and lower annual rainfall (700 to 750 mm). In particular, severe droughts are experienced in the southern shore of the Ziway lake.

Although several soil types are identified in and around the study area, they are generalized into two groups from an agricultural point of view. Clayey soils are more predominant on the hilly areas, while loamy sand to sandy loam soils occupy the valley floors. Soils on the lakeshores of Ziway and Koka are derived from volcanic lacustrine deposits, which are partly affected by seasonal inundation.

Crop selection by farmers is highly dependent upon soil type and rainfall. Teff is a leading crop on the hilly areas covered by heavy soils under higher rainfalls, while maize, wheat and barley are more prevalent on the valley floors with lower rainfalls. The distribution patterns of the leading crops were analyzed on the basis of cultivated acreage by PA for the 1999/00 cropping season. The crop distribution is schematically illustrated in Figure 3.3.1.

(2) Farming system

Farming system in the study area is represented by "traditional livestock-based mixed-farming system", in which crop production and animal husbandry are significantly complemented by each other. The predominant crops are food grains and pulses including teff, wheat, maize, barley and haricot beans. Crop residues are a vital supplemental fodder source for oxen, sheep, goats and donkeys. They are usually left on the farm after harvesting and available for the community. On the other hand, the crop production sub-sector relies highly on animals for drafting, transporting, and threshing as well as for manure sources. Furthermore, livestock provides animal products for home consumption and supplemental cash income.

An intensive farming system with commercial horticulture production has also been practiced to a limited extent along the Meki river and the lakeshores of Ziway, Elen and Koka. Horticultural production is managed mainly by private farmers, who are non-PA members.

Exchange of farm labour is prevalent in the study area as a traditional custom called "*Debo*", which is a reciprocal help system and compensates each other only with food and beverage by host farmers. Large landholders with 10 ha and above often employ a few permanent workers such as a family member. In contrast, the "*Debo*" is not common among an association of irrigation farmers.

### 3.3.2 Land Holding and Tenure System

The 1975 land reform legislation of the previous government made all lands as a public property and prohibited private land ownership. Farmers have been given only usufructuary rights up to 10 ha per household. The Constitution endorsed in December 1994 explicitly states that all rural and urban lands including natural

resources belong to the government and shall not be sold or exchanged. However, there are cases of illegal land leasing in the study area, especially in the highly demanded area where irrigation water is available. Land borrowers are either entrepreneurs, who are non-PA members living in the urban area or farmers eager to share the benefits with landowners. In common cases, offspring can not inherit farmland where no excess land is available in their PA. Consequently they are forced to make a lease agreement with landlords who are financially weak to manage their farmland.

Lease agreement is mainly on an annual-basis and the land rent varies from place to place and personal agreement. Thus in the study area the market price ranges from 100 to 200 Birr per ha in the rainfed area and from 300 to 800 Birr per ha in the irrigable area. This kind of lease agreement is not forwarded through the official channels. Therefore, it is difficult for the authority concerned to grasp the actual positions.

According to the sample survey conducted by the District Agricultural Office, the land holding size of farmers in the Wareda is presented below.

**Percentage of Farm Households by Farmland Size in Dugda Bora Wareda**

| less than 1 ha | 1 – 2 ha | 2 – 4 ha | 4 – 6 ha | 6 – 8 ha | 8 – 10 ha |
|---|---|---|---|---|---|
| 25 % | 50 % | 10 % | 7 % | 5 % | 3 % |

Source: Dugda Bora District Agriculture Bureau Office

A typical farm household in the study area allocates the land to (i) homestead, (ii) crop production and (iii) fallow and grazing. Farmland usually consists of several scattered small plots. The farmers in the Wareda have an average of 1.5 ha of farmland.

### 3.3.3 Crops and Production

(1) Crop Selection

According to the District Agriculture Bureau Office, the major crops prevailing in the study area are as below;

1) Cereal crops : maize, teff (*Eragostis tef*), wheat, barley, and sorghum,

2) Pulse crops : haricot beans (*Phaseolus vulgaris*), horse beans (*Vicia faba L*), peas (*Pisum sativum L*), chickpeas (*Cicer arietinum L*), and lentil (*Lens culinaris Medik*)

3) Vegetables crops : tomato, red onion, cabbage, Ethiopian cabbage (*Brassica oleracea var virdis*), chili pepper, sweet pepper, carrot, beet root (*Beta vugaris*), watermelon, cucumber, eggplant, sugarcane and garlic

4) Fruits and tree crops : mango, avocado, papaya, orange, coffee

(2) Cultivated area, unit yield and production

The crop production in the Wareda is annually compiled based on pre-harvest and post-harvest evaluation carried out by the District Agriculture Office. The random sampling survey is carried out at 3 to 5 HHs per crop per each PA. The cultivated area, unit yield and production of major crops in the past 6 years period from 1994/95 to 1999/2000 are presented in Tables 3.3.1 and 3.3.2, and summarized below.

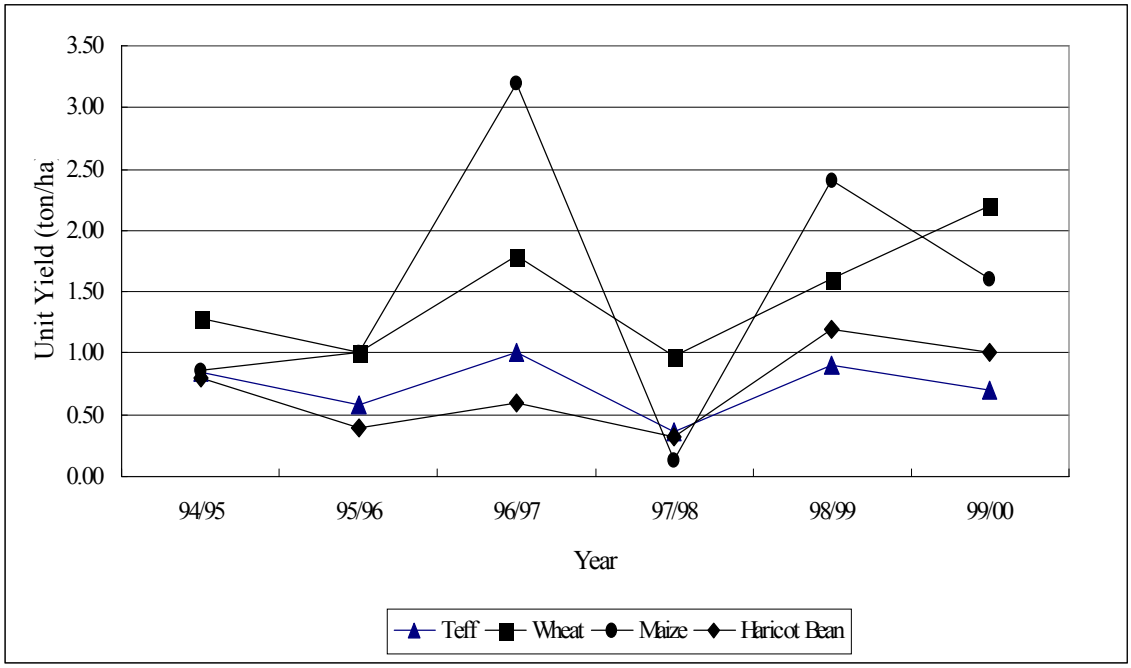
**Average Cultivated Area, Unit Yield and Production in Dugda Bora Wareda (94/95 – 99/00)**

| Crop | Cropped Area (ha) | Production (ton) | Yield (ton/ha) |
|---|---|---|---|
| Teff | 15,700 | 11,500 | 0.73 |
| Maize | 12,500 | 18,200 | 1.48 |
| Wheat | 12,200 | 20,700 | 1.53 |
| Haricot bean | 8,700 | 6,300 | 0.72 |
| Barley | 2,400 | 3,300 | 1.43 |
| Sorghum | 2,500 | 2,400 | 0.98 |
| Field Peas | 900 | 500 | 0.54 |
| Lentil | 200 | 100 | 0.21 |
| Chickpea | 800 | 200 | 0.41 |
| Total | 55,900 | 63,200 | 0.89 |

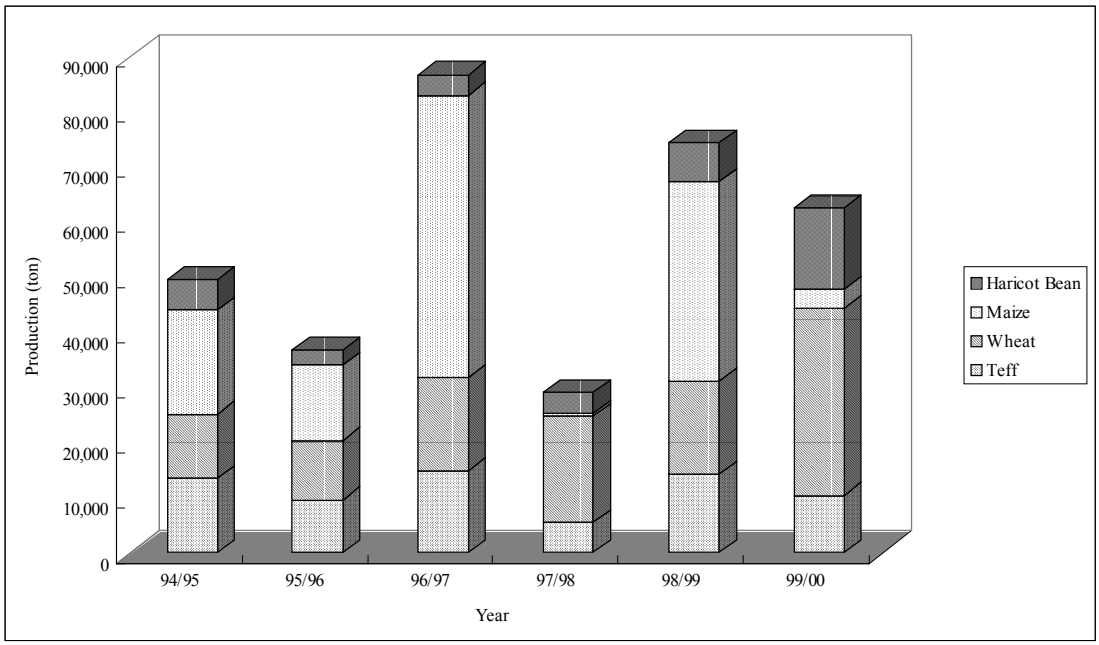
Source: Dugda Bora District Agriculture Bureau Office

The total cultivated area of Dugda Bora Wareda extends to 68,000 ha of which 55,900 ha (82 %) are allocated to cereals and legumes. Out of the total food crops, four major crops occupy 49,100 ha or 88% consisting of teff (28%), wheat (22 %), maize (22%) and haricot beans (16%). Horticulture crops occupy less than 3 % under irrigated conditions. It is noted that the crop intensity in the study area is as high as 83% in 2000/01.

As usual, in rain-fed agriculture, the crop yield fluctuates from year to year. The yield and production of major crops in the said period is illustrated below.




**Crop Yield in 1994/95 – 1999/2000**




**Crop Production in 1994/95 – 1999/2000**

### 3.3.4 Cropping Patterns

The cropping system is predominantly on a rain-fed basis and crop rotation is not systematically practiced. The cropping patterns are illustrated in Figure 3.3.2 and summarized as follows.

Hilly area : Teff and wheat represent the main crops in the hilly areas, and these are followed by maize and barley. Other crops such as haricot beans, sorghum, horse

beans, field peas, and chickpea are planted on a limited extent. Chickpeas are planted in early September and harvested at around the end of December with utilization of the residual soil moisture in the area where Vertisols are developed.

Central Meki area : Most of grain crops are planted in the months from May to June and harvested in October and November.

Lakeshore : The northern lakeshore of Ziway is covered by fertile heavy clays, which are locally known as "*Kotticha*". This low-lying area is seasonally flooded. Some local farmers adapt their cropping calendar to an inundation cycle and practice a double cropping per year. For example, maize and chickpeas are planted in dry season by utilizing soil residual moisture after the floods recede. A double cropping pattern is practiced in the inundation area around the Ziway lake, and single cropping with local cabbage and chickpeas in Lake Cheleleka.

In the Ziway lake, the extent of inundation area depends on annual rainfall amounts and is thus change from year to year. Farmers plant maize in early April and harvest in July and August. However, if floods come earlier before July, they rush to harvest green maize by the end of June. Then chickpeas or haricot beans are planted in the middle of October when substantial soil moisture is still available.

On the other hand, a single cropping with local cabbage and chickpea is practiced on inundation area around Lake Cheleleka (PA). Farmers start planting in mid-August after floods recede.

### 3.3.5 Farming Practices

The traditional rain-fed farming relies highly on draught animal for plowing, inter-tillage locally called "*Shilshalo*", transportation of farm produce and threshing operations. The sequence of the farming practices prevailing in the study area is summarized below.

(1) Plowing

Farmland is ploughed usually by a pair of oxen with traditional plow called "*Maresha*" three or four times for teff and two to three times for maize, barley and wheat and once or twice for sorghum and pulse crops. Minimum or conservation tillage is not common in the study area. Tractor hire service is available but is very expensive, e.g. 260 Birr/ha, for subsistent farmers.

(2) Sowing

Sowing is done manually with high seeding rates. The reason for high seeding rates has originated from farmer's traditional drought coping strategy to increase survival rate and secure a good crop stand. A higher rate increases a number of good stands and consequently increased biomass, which can be utilized as supplemental animal feeds in case of poor rainfalls.

(3) Weed control and application of fertilizers

Weed control is practiced by hand with limited use of herbicides such as 2,4 D and U-46 for teff and wheat. Maize and sorghum are treated at knee-high stage by hand weeding and inter-tilling by ox-plow "*Maresha*" in order to thin the plant population, suppress weeds and retain soil moisture by softening soils. Weeding is not practiced for pulses.

Most of subsistent farmers do not apply chemical fertilizers for sorghum and pulses but uses cow-dung manure. In contrast, chemical fertilizers are obtained through the Extension Package Program (EPP) or other credit source and used for grain cash crops such as teff and wheat. The details of EPP are mentioned in Appendix V on Agricultural Supporting System.

(4) Harvesting, transportation, threshing and winnowing

Except for maize and sorghum, most of the grain crops are cut with sickles and bundled. The bundles are sun-dried either on farm or in homesteads. Threshing is done by oxen trampling on spread bundles and cleaned by hand winnowing. Meanwhile, pulses are pulled out by hand and stacked on farm until dried or brought to threshing ground for drying. Threshing is done by oxen followed by hand winnowing as for grain crops. Maize is harvested by hand and brought to homestead by donkey carts for shelling by beating cob with stick or near motor-driven corn sheller place.

(5) Utilization of crop residue and cow-dung

Crop residues left on farm are utilized as open grazing sources for community. Maize and sorghum stalks are used as a fuel source or construction material for hut after feeding tender part to animals. Straws of teff, wheat and barley are also used as important supplemental feeding materials followed by threshing process and pulses as well. Thus, crop residues are rarely incorporated into soils. Cow-dung in the study area is used for plastering materials of traditional storage bin, hive and circular plot of threshing place and fuel source after drying. Most interviewed farmers reported that about 90 % of cow dung are returned to field.

### 3.3.6 Post-harvest

(1) Storing and milling

Majority of farmers have traditional storage bins called "*Gotera*", made of woven wood and bamboo splits, in homestead and with 15 to 20 quintals capacity. Harvested grains are stored in "*Gotera*" or sacs either in-house or open place. However, cash crops such as teff, wheat, haricot beans, and surplus of farm produce are immediately sold to middlemen after processing grains. Grains are milled at the nearest flourmills. They are cooked as main diet "*Injera*", locally brewed beer "*Tella*" and sprit called "*Areke*". Pulses are also used as an ingredient of "*Injera*",

soup or roasting.

(2) Agro-processing and storing

No agro-industries are observed in and around the study area. The post-harvest facilities are small-scale flourmills operated by private millers. There are also some flourmills, which are not registered. Concerning the post harvest facility, there are two large-scale storages in the study area which are operated by the Ethiopia Grain Trade Enterprise (ETGE), a profit-oriented state enterprise, which for 5,000 tons capacity and the wareda office of OADB for 500 tons capacity. The former is currently rented to the Ethiopia Food Security Reserve Authority (EFSRA).

### 3.3.7 Marketing and Pricing

(1) Major markets

There are four (4) primary markets in Meki and Alem Tena towns. On Monday and Thursday, weekly markets are held in Meki town, while daily markets are held in Meki and Alem Tena towns at small scale. The Monday and daily markets are dealt with farm produces and some daily commodities mainly for local consumers. The Thursday markets are controlled by the Meki Municipal Office and are operated with some 2,000 vendors for livestock, food grains, vegetables and daily commodities, which are purchased by traders from other large towns as well as local consumers. The Meki Municipal Office charges the registered middlemen a monthly rate of 6 Birr.

(2) Marketing

Out of 67,000 tons of the total grain production in 1999/2000, 9,420 ton or 14 % were traded through local marketing channels. Individual consumers trade about 70 % of marketed grains through the registered middlemen, while 20 % are through retailers and 10 % are through direct business. EGTE plays a pivotal role in the export of surplus grains and control floor prices of grains in the market, has occasionally participated to purchase food grains, especially haricot beans from Meki area.

Quantities of major grains annually traded in the study area can be estimated through the taxation system controlled by Meki Municipal Office. Vegetables and fruits are directly traded with local consumers as well as middlemen from outside. Thus no official census is available.

The Study Team, as presented in Table 3.3.3, surveyed the producers' prices of farm products in October and November 2000. Selling prices are seasonally changed but little difference among the buyers (middlemen) because of a tacit agreement made among the middlemen. The commission charge per quintal of grain usually ranges from 10 to 20 Birr.

### 3.3.8 Indigenous Knowledge for Drought Coping Strategy

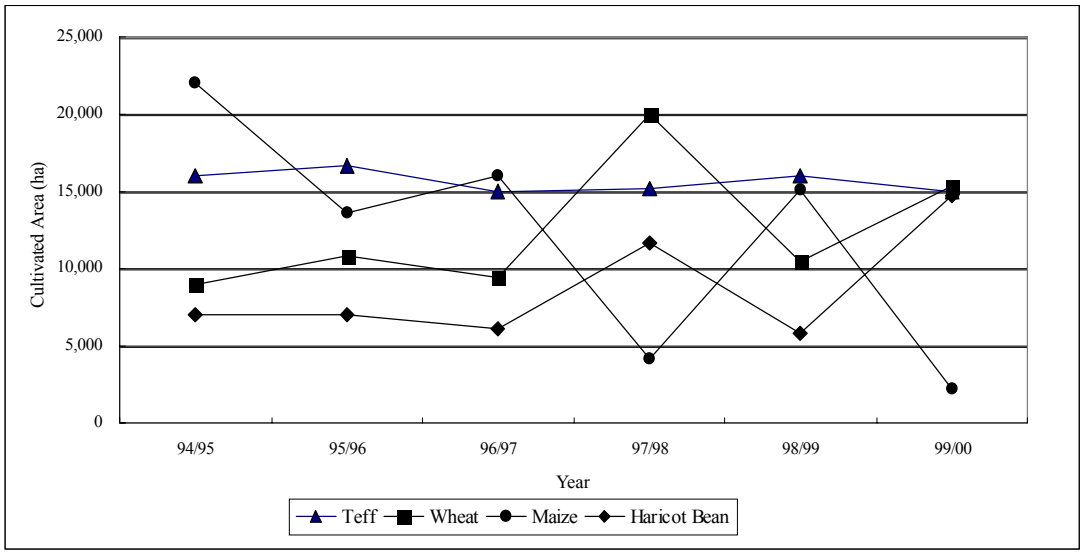
Local farmers have traditional knowledge to mitigate drought damages to crop. The indigenous drought coping strategies sustained among subsistent farmers are summarized below:

(1) Flexible sowing time adjusted to rainfall patterns

Farmers carefully select rain-fed crops taking into account the rainfall amounts during onset of the rainy seasons. Indigenous strategy to cope with drought problem is to adjust a sowing time of grain crops according to rainfall pattern. If the rains in the *Berg* season (short rainy season) are enough and dry spells occur later in the *Meher* season (long rainy season), severe moisture stress causes a mass mortality and no option to avoid drought at the silking/tasseling growth stage.

In the Meki area, except in hilly areas, maize is firstly sown between late April and early May but immediately incorporated into soils if sufficient rains are not anticipated during this period. Farmers generally sow barley, wheat or haricot beans, which have a lower crop water requirement than maize.

It can be seen from the crop area of haricot bean, which increased to 14,730 ha in the 1999/2000 season due to less rain, however, decreased to 6,350 ha in the 2000/01 year with good rains. Due to such an alternation in crop selection, the planted areas of crops fluctuate largely as shown below.




**Cultivated Area in 1994/95 – 1999/2000**

(2) High seed rate more than recommended rate

Most of the farmers interviewed by the Study Team employ higher seed rates as presented below:

**Seed Rates for Major Crops**

| Crop | Recommended (A) (kg/ha) | Farmers' Seed Rate (B) | |
|---|---|---|---|
| | | (kg/ha) | B/A (%) |
| 1. Maize line | 25 | - | - |
| broadcast | 30 | 40-120 | 133-400 |
| 2. Haricot beans | 20-30 | 100 | 333-500 |
| 3. Teff | 30 | 50 | 166 |
| 4. Wheat | 75 | 100 | 133 |

Source : JICA Study Team

Seed rates range from 133 % to 500% of the MoA's recommendation. Higher seed rates are believed to ensure good crop stand and to secure biomass production to be utilized as supplemental animal feed if a dry spell occurs later.

(3) Contour ditches

On sloping farmlands with teff, wheat and barley, even in flat fields, regular ditches are observed at 2 – 3 m intervals parallel to contour lines. Such ditches detain surface runoff to help infiltrate rainwater into soils and protect the soil from erosion. On flat fields, ditches serve as drainage to avoid death of seedlings due to water logging in the field.

(4) Traditional low terrace along contour lines – "*Fanya Juu*"

Low bunds of 30 cm to 50 cm high are mounded along contour lines within grain fields - especially for teff and wheat. They function to trap soil particles and cut down surface runoff.

(5) Process of rough thinning/weeding –"*Shilshallo*"

A rough thinning and weeding operation known as "*Shilshallo*" by using ox-plow is applied to sorghum and maize field at the knee high stage. This practice eliminates excess plants and weeds, conserves soil moisture by making soils softer, and prevents crops from lodging.

(6) Application of cow-dung to salinity affected area

In the area surrounding the Ziway lake, soil salinity problems are observed. Farmers often cope with the problems by applying cow-dung manure, which appears to have some effect to alleviate soil salinity and results in some harvest.

## 3.4 Irrigation

### 3.4.1 General

Several types of the irrigation schemes are recognized in and around the Meki area. They have different natures in terms of financial sources, irrigation system, water

resources, and development scale. In order to verify the current positions of the schemes and their constraints, five (5) representative irrigation schemes were selected. Their location is indicated in the next page. The major features of the schemes are summarized below.

**Five (5) Irrigation Schemes in and around the Study Area**

| Description | Meki – Ziway | NGO Schemes | | Dodicha | Areta Chufa |
|---|---|---|---|---|---|
| | | Melka Aba Godana | Oda Bokota | | |
| Wareda (Zone) | Dugda Bora (East Shoa) | Dugda Bora (East Shoa) | Dugda Bora (East Shoa) | Adami Tulu (East Shoa) | Ziway Dugda (Arsi) |
| PA | Bekela Girisa | Welida Kelira | Oda Bokota | Dodicha | Areta Chufa |
| Financial Source | The Democratic People's Republic of Korea | Self-Help International | Self-Help International | ESRDF | IFAD |
| Members of WUA | 150 | 18 (male) 1 (female) | 23 (female) | 150 | 370 |
| Year of WUA Establishment | 1985 | 1998 | 1999 | 1998 | 1996 |
| Commencement of Operation | 1989 | 1998 | 1999 | 2000 | 1996 |
| Water Resources | Ziway Lake | Meki river | Meki river | Bulbula River | Chufa River |
| Facility | 9 Pumps (5 $m^3/s$) | Small Pump (12 HP) | Small Pump (12 HP) | Pumps (2 Nos.) | Headworks |
| Scheme Area (ha) | 3,000 ha (Plan) | 5 ha | 5 ha | 69 ha | 100 ha |
| Actual Irrigation Area (ha) | 300 ha | 5 ha | 5 ha | - | 86 ha |
| Main crops | Maize | Vegetable | Vegetable | Vegetable | Maize, Vegetable |

Source: Dugda Bora OIDA Wareda Office

### 3.4.2 Meki-Ziway Irrigation Scheme

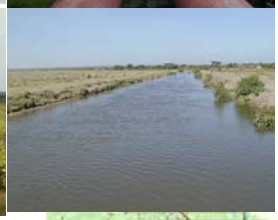
(1) Outline of Scheme

The Meki-Ziway Irrigation Scheme is located 5 km west of the Meki town. The scheme was established in 1989 under a technical assistance arranged with the previous government. It was envisaged to develop 3,000 ha, out of which 1,500 ha was to be a state farm, while the balance was to be allocated to local farmers. So far, 930 ha of land on the right bank of the lower Meki river has been developed, including intake channel from the Ziway lake, pump station, delivery pipeline, main, secondary and tertiary canals, and related structures. The pump station has nine (9) pumps, of which two (2) were reserved as stand-by. Each pump unit has capacity of 764 liter/sec. with a head of 16.3 m.

## Five (5) Selected Irrigation Schemes for the Study

Meki-Ziway



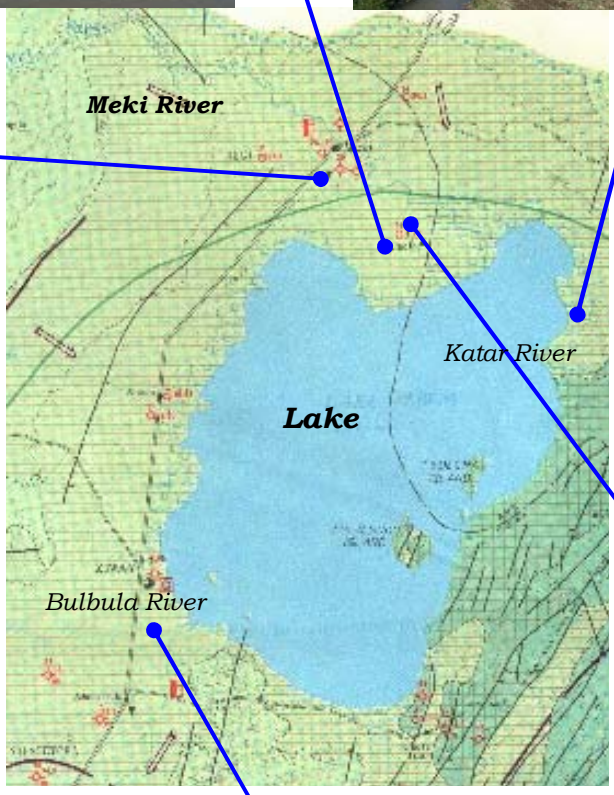



Areta Chufa




Oda Bogota




Melka Aba Godana




Dodicha


z



(2) Operation and Maintenance

From 1989 to 1991, the scheme provided free water to farmers under full control of the government. Since the governmental reform, however, the responsibility of the government has been limited only to security control. Currently, the facilities are under the responsibility of OIDA. Without government subsidy, farmers are obliged to pay electricity supply charges against operation hours. Except for some 300 ha, the irrigable farmland and facilities have been lying idle since then.

(3) Major Findings

1) Needs for Rehabilitation of the pumps and irrigation canal system

Two (2) sets of pumps out of nine (9) are currently functioning, while seven (7) pumps need repairs. In order to activate the scheme to some extent, the rehabilitation work is necessary. It is suggested that an inventory survey to be conducted to clarify the defect of the scheme and to estimate cost for the rehabilitation and also availability of spare parts. It is noted that spare parts are not to international standard.

2) Operation cost for the pump

Only 300 ha are activated out of 3,000 ha. Increase of farmers, who will commence cultivation in the remaining area, could relieve the burden for the farmers to pay the pump operation charge. It is worth, therefore, while considering the farmland re-allocated to farmers, who are residing outside of the scheme.

### 3.4.3 Small Irrigation Schemes by Farmers

(1) Outline of Scheme

There are two types of individual farmers who run irrigated farming along the Meki river and the Ziway lakeshore. One group includes those who do not have any piece of land. They buy motor pumps and make an arrangement with those people who possess land, bringing their resources together to start a farm. The benefit from the farm is shared among the two parties in accordance with their specific agreement. As of November 2000, there are 160 motor pumps in the Dugda Bora Wareda, and 75 motor pumps along the Meki river, most of which are of 12 – 20 horsepower. More pumps tend to be introduced to the Wareda. According to the inventory survey made by OIDA in 2001, the total number of the pumps increased to 180.

Another group is the individual local farmers who get organised and seek assistance from NGOs to start an irrigated farm. They operate on their plots on an individual basis but share the common service given by the motor pumps, which are usually provided by NGOs. Some of the groups establish farmers groups (water users association) assisted by the Department of Agriculture and the Department of Cooperative under the Wareda Administration Office. The farmers groups are listed below.

**Water Users Association in Dugda Bora Warada**

| No. | Name of WUA | PA | Members | | | Irrigation Area (ha) | Source of Water | Year of Establish-ment |
|---|---|---|---|---|---|---|---|---|
| | | | Male | Female | Total | | | |
| 1 | Lega Meki-1 | Gemu Sbubi | 10 | - | 10 | 32.5 | Meki river | 1997 |
| 2 | Lega Meki-2 | Bekere Girrisa | 19 | 5 | 24 | 6.0 | Meki river | 1998 |
| 3 | Bekere Girrisa | Bekere Girrisa | 130 | 5 | 135 | 218.0 | Ziway lake | 1997 |
| 4 | Melka Cherecha | Welda Mekdela | 34 | - | 34 | 14.1 | Ziway lake | 1998 |
| 5 | Meika Korma | Welda Kelina | 28 | 9 | 37 | 16.6 | Ziway lake | 1998 |
| 6 | Melka Aba Godana | Welda Kelina | 18 | 1 | 19 | 7.8 | Meki river | 1998 |
| 7 | Oda Bokota | Oda Bokota | - | 23 | 23 | 5.0 | Meki river | 1999 |
| 8 | Teppo-140 | Teppo Chareke | 40 | - | 40 | 13.0 | Ziway lake | 1997 |
| 9 | Cheleleka Denbel | Dodola Denber | 34 | 1 | 35 | 10.9 | Ziway lake | 1998 |
| 10 | Dodoata Denbel | Dodola Denber | 15 | - | 15 | 18.1 | Ziway lake | 1997 |
| 11 | Wayyo Gabrier | Wayyo Gabrier | 19 | 5 | 24 | 13.8 | Ziway lake | 1996 |
| 12 | Wedia Kelina | Wedia Kelina | 30 | 1 | 31 | 8.6 | Ziway lake | 1998 |
| 13 | Wayyo Serrit | Wayyo Gabrier | 28 | 4 | 32 | 17.0 | Ziway lake | 1999 |
| 14 | Tuchi Denbel | Tuchi Denbel | 16 | - | 16 | 15.3 | Ziway lake | 1996 |
| 15 | Jara Wayu | Elen | 20 | 5 | 25 | 8.0 | Elen lake | 1998 |
| | **Total** | - | 441 | 59 | 500 | 404.6 | - | - |

Except for Bekere Girrisa located in the command area of the Meki-Ziway irrigation project, they have been developed using surface water resources of the Meki river and the Ziway lake by use of small pumps.

(2) Operation and Maintenance

Water abstracted by pumps is discharged to the raised earth canals, which convey the water to distribution canals. Irrigation is applied through furrows. The schemes are run in accordance with discussion and consensus by all members. All members participate in operation and maintenance works of the scheme. Further, decision of the group is made by members meetings when problems arise.

In some schemes, pump operation and water distribution are entrusted to water masters employed by the group, with an allowance of Birr 50 per month. The water master attends to the water distribution work, forming canal bunds and furrows per each farm lot. Irrigation benefits are shared between the members and the water master according to their agreement. This system contributes to proper water distribution, even without concrete water diversion structures in these schemes.

(3) Major Findings

At present, success of the small-scale pump irrigation schemes leads to motivate more farmers, who are anxious to embark on irrigation farming. However, it should be

noted that increase of schemes might result in disordered water use along the Meki river. The government agencies including OIDA are expected, therefore, to be involved in the schemes positively, restricting and monitoring the existing and new schemes in terms of water resources development

### 3.4.4 Dodicha Irrigation Scheme

(1) Outline of scheme

Dodicha is a drought-prone area and has suffered from frequent crop failures. The PA has applied to ESRDF in order to irrigate agriculture to eliminate or reduce food shortage in 1997 with the service area of 100 ha. Against the PA's application, ESRDF reduced the irrigation area from 100 ha to 69 ha due to fund limitation. The project was implemented by the Central Branch Office of OIDA. According to the agreement with OIDA, all the members directly participated in the canal excavation works and carrying construction materials.

The scheme is located on the east of Addis Ababa – Awasa main road at 3 km branched off at Adamitulu town. Water for the scheme is abstracted from the Bulbula river at the end of the level of the Ziway lake. The scheme covers a net irrigable area of 69 ha and is cultivated mainly with vegetables and cereal crops, such as maize. The scheme beneficiaries are 160 family heads or 3,628 persons.

The project area is divided into 31 tertiary units with maximum and minimum sizes of 4.2 ha and 0.70 ha, respectively. Continuous flow is applied to the canals serving tertiary units and within the tertiary unit the water supply is rotated among the individual fields. The discharge in the canal system is adjusted to the daily irrigation requirement. The type of irrigation is surface irrigation and the method of supply is by furrows. The water is supplied to the furrows either by siphon tube from tertiary canal or by a simple off-take that feeds the feeder ditch to the furrows.

(2) Operation and Maintenance

The WUA was established under the assistance of both the Wareda administration office and the agricultural office. The members of the sub-committee, including secretary, financial head, cashier and auditors, as well as water users' team, were already appointed. The WUA has set up the by-law and operation rule for the irrigation facilities. Although the operation of the scheme is not commenced yet, responsibilities of operation and maintenance of the facilities are understood by the farmers as follows:

| | | |
|---|---|---|
| Pumps | : | Four pump operators who will be trained by OIDA |
| Gate on the canals | : | Seven team leaders for each water users' team |
| Canal | : | WUA members |

(3) Major Findings

1) Communication gap between WUA and Government

As mentioned above, due to probably fund limitation, the PA was forced to reduce the project beneficiaries. Although the government officials were supposed to have enough discussion with the farmers, farmers appear to be still not convinced well of this issue. In addition, it is revealed that OIDA are expected to bear the initial running cost for the pump station in spite of the fact that all O&M cost shall be borne by the WUA. This fact suggests that strengthening of communication between farmers and the government as well as awareness creation to farmers are needed during the planning stage of the irrigation scheme.

2) Hand over of the scheme

In the scheme, although the WUA members are satisfied with the quality of the project facilities, they stated that some concrete structures already have been damaged. Further, the hand over ceremony, which was due to be held in November 2000, was suspended because the gates attached to diversion structures on the canal have not been installed. The scheme was taken over at completion of outstanding works in middle of 2001.

3) Operation cost for the pump

In accordance with the agreement between OIDA and WUA, all running cost shall be borne by the WUA. However, the WUA members stated that lack of initial running cost for the pump might result in failure of scheme operation. As present funding sources such as ESDRF do not cover the initial running cost, some attempt to seek financial assistance during the period are needed so as to run the scheme successfully.

### 3.4.5 Areta Chufa Irrigation Scheme

(1) Outline of Scheme

The Areta Chufa scheme is located in Areta Chufa PA in Ziway Dugda Wareda of Arsi Zone. With the financial assistance of IFAD, the Project was embarked on in 1995/96 under the agreement between WMERDB and the Areta Chufa PA. The community development was promoted by Cooperation & Promotion Department of Oromia, MoA. Currently, the government responsibility is transferred to OIDA. The WUA is organised by 317 members. Gravity water is available nearly throughout year from the Chufa river, i.e. stable perennial flow to the Katar river. The total scheme area (86 ha) is allocated to all the members at 0.25 ha per member. Two Development Agents (DAs) from OIDA and the Bureau of Agriculture are assigned to the scheme.

(2) Operation and Maintenance

The committee members are elected by the WUA members and appointed by the

OCPB and OADB. The Committee represents the beneficiaries with respect to all the matters concerning the WUA and the scheme. According to the annual plan of the WUA, the Committee follows, guides and accomplishes all the aspects of the WUA's activities regarding irrigation O&M with different external bodies.

The Chairman, Financial Head and Cashier are responsible for the financial management. OCPB carries out external auditing once a year. So far there is no problem arising from the financial management by the WUA committee.

The WUA set up the by-law and the operation rules of the irrigation facilities. Most of the WUA members understand these by-law and rules. Apart from the by-laws and rules, the Committee occasionally prepares proposals when problems are arising from project management.

The irrigation plan and schedule are agreed upon at the WUA meeting. The rotational irrigation by block is applied in the scheme. The main canal is operated under the responsibilities of the chairman, while other structures including the division boxes and the pond are operated by group leaders and members. The intake gate is operated by a water master employed by the WUA.

The headworks maintenance is done by communal works. Major work items include cleaning, desilting, and weeding. Every three months, the maintenance work on the main canal is carried out also by communal work. Major work items are cleaning, desilting, weeding, and repair of embankment. The maintenance of secondary canals and field canals are done when required under the responsibility of individual farmers. The communal maintenance work is carried out by every member. It is agreed by all WUA members that any member who is absent from the work is obliged to pay 5 Birr per day to the WUA.

(3) Major Findings

Although the Areta Chufa scheme is recognised as one of successful irrigation projects in the service coverage of the Central Branch Office of OIDA, some constraints and problem were identified through the RRA session as described below.

1) Water shortage

Irregular water shortage in the dry season is pointed out as a problem. The leakage problem is the central issue among the members. They believe that diverting water from the spring in the upstream area will be the best solution for water shortage. They accessed the government to solve the problems on water shortage, but so far no action has been taken.

2) Uneven water distribution

The members are not fully satisfied with the water distribution, i.e. unfair gap between the upstream area and the downstream area. They point out that the problem is caused by illicit water distribution by members and leakage from the canals. The members need keys for turnout gates to avoid illicit operations. This problem

could be solved to some extents through strengthening the capacity of conflict management of the WUA supported by DA of OIDA.

3) Maintenance Costs borne by WUA

In terms of the maintenance of the scheme facilities, the members requested; (i) construction materials such as cement; (ii) keys for turnout gates to avoid illicit operation; and (iii) machine to excavate siltation in the pond. Some members raised these issues to the government. But no assistance has yet been extended.

No firm idea about water charge is established among the WUA members. The WUA has solved most of the troubles in the past by contribution of labour. However, the WUA Committee is now preparing for introduction of water charge on the scheme operation, i.e. 5 Birr per year per member. Against this proposal, all the informants were not willing and replied in a very reluctant manner. The situation implies that in-depth discussions among the WUA are urgently required with technical advice from OIDA.

4) For Further Sustainable Operation and Maintenance (O&M)

The successful O&M of the Areta Chufa scheme suggests an advantage of gravity irrigation scheme in terms of less maintenance costs than that of pump irrigation schemes. The maintenance works have succeeded due to members' labour contribution to some extents. In future, considering affordability of farmers, simple structures that would eliminate maintenance cost should be considered.

Division boxes should be provided at the head of each irrigation block to facilitate equal water distribution by rotational irrigation method. The tail-first rotation method would have effect for even distribution of water.

To ensure an advanced level of O&M and management of WUA, further support for operation and maintenance and community management would be needed by the government staff, such as settlement of uneven water distribution, operation and maintenance collection system. Thus, a capacity building programme for OIDA staff will be highly needed in order to support the WUA properly and efficiently.

### 3.4.6 Lesson Learned

Present condition of existing irrigation scheme discussed in the previous section show the following constraints:

- Lack of an O&M fund
- Improper design of facilities
- Insufficient awareness of farmers on operation and maintenance

To solve the above-mentioned constraints, the following measures have to be taken into consideration:

- To minimise the Operation and Maintenance cost
- To design user-friendly irrigation facilities

- Strengthen O&M training for WUA
- Further Government support for WUA management

It is also remarked that capacity building for engineering staff is needed to enhance participatory planning approach.

## 3.5 Animal Husbandry

### 3.5.1 Breeds and Population

Cattle prevailing in Ethiopia are mostly unimproved indigenous Zebu, Sanga or Intermediate Sanga/Zebu types. Recognized breeds include Boran, Fogera, Horro, Sheko, Abigar and Danakil. Boran is renowned as a beef breed well beyond the boundaries of Ethiopia.

The animal population of the Dugda Bora Wareda is summarized below.

| Livestock species | Number |
|---|---|
| Oxen | 70,930 |
| Female cattle | 135,370 |
| Goats | 60,772 |
| Sheep | 28,473 |
| Horses | 525 |
| Donkeys | 12,164 |
| Poultry | 240,178 |

In Oromia, the most common breed is Arsi, which is small and unproductive for milk. Males weigh around 360 kg and females, 280 kg. European breeds, especially Friesian and Jersey have been imported for many years and crossed with indigenous cattle in attempts to improve the productivity of the latter. The improved breeds are limited in number in the Region.

Almost all sheep are indigenous types although several breeds have been identified. In Oromia, the fat tailed Menz and Arsi types predominate. They have generally evolved under harsh conditions of health, nutrition and climate and their output is low. They weigh 35 kg for male and 25 kg for female on average. However, when crossed with Corriedale, output in the F1 generation is improved considerably. This does not appear to have been taken up by the small holder sector.

Several types of goats have been identified, of which the Worre, Afar and Abergelle predominate in the Northern Rift Valley area of Oromia. They are generally small, with the male weighing between 30 and 40 kg and the female between 25 and 30 kg.

The national poultry flock comprises about 99% indigenous birds that are mostly managed under a scavenging system with the remaining 1% being imported exotic breeds that are usually managed intensively.

### 3.5.2 Feed Sources

(1) Grazing capacity and stocking rate

Grazing condition was a subjective assessment given by the wareda livestock experts and the veterinary assistants. Figure 3.5.1 shows the grazing capacity estimated by the local experts. This does not relate to the rainfall distribution within the Wareda. This appeared to be related less to natural grazing capacity of the area than to the level of grazing management in each PA. It appears that in those PAs where grazing is designated well, the community keeps natural pastureland from uncontrolled grazing so those oxen can be put there to gain condition before ploughing commences. In view of the highly over-grazed conditions of the natural pasture it is probably the only means by which grazing capacity can be assessed.

Grazing land does not include what is designated as bush and woodland, although it must be remembered that this (albeit severely deforested) provides browse to goats. When it is considered that this type of vegetation, in a semi-arid agro-ecological region, should be stocked at a rate of 8 ha per TLU (tropical livestock unit: 270 kg of live-weight), i.e. 0.13 TLU/ha, the whole area is severely overgrazed. Livestock pressure is as high as 0.25 TLU/ha.

In the rainy season, some farmers supplement their cattle on grazing such as rapeseed cake, bean seed cake, wheat bran and brewers waste from local breweries. Presumably the remainder of crop residues from the previous harvest and the partition between grazing only or grazing with supplement appears to be variable within and between groups. The grazing pattern showed that, in most of these PAs, grazing was divided between “home” grazing in the PA and grazing by the lakes or rivers.

In the dry season, PAs existing far from the lake depend more heavily on crop residues and hay than those near the lakes do. The PAs near the lakes appear to depend almost exclusively on grazing at the lakes, where the river is also used, while those PAs far from the lakes depend more heavily on grazing at the river.

(2) Crop residues

The quantity of crop residue is estimated to be produced from an average sized cropping land in the Wareda. Ratio of residue yield to grain yield was taken from figures provided by ILCA, 1993. Planted area and yield of each crop were taken from a report provided by the District Agricultural Office. This is variable between farmers and PAs but provides an average estimate over the whole Wareda.

A total of 2.6 tons of crop residue is produced per annum by an average farmer with 1.5 ha of farmland in the Wareda. The district livestock expert reports that there are no farmers who cut and store their crop residues immediately after harvesting but allow uncontrolled grazing of crop residues after stacking teff hay. After grazing the rest of crop residues, the remainder-maize stalks, mostly, are cut and stacked in the

back yard but no treatment with urea or molasses is applied. However, some farmers feed their oxen the maize stalks treated with brewers grain, i.e. residue from home brewed beer.

Most farmers store teff hay but the remainder of the crop residues are left standing for uncontrolled grazing by the livestock, which takes up to one month on average. The rest of the ungrazed residue (maize and sorghum stalks) are cut and stacked on the ground. There is no treatment of crop residue.

(3) Forage production

There were no farmers growing herbaceous forages except for a few farmers producing cowpeas in their backyard and leucaena trees. Average farmers feed one branch a day to their oxen. The district livestock expert also reported being aware of possibly 10 farmers in the wareda who also grew Sesbania trees. Overall, the number of farmers growing forage or tree forage appears to be insignificant in terms of supplementing their livestock with good quality feed in the dry season.

### 3.5.3 Veterinary Services

There is one veterinary clinic in Meki town and one health post with 10 veterinary crushes distributed around the Wareda. This is grossly inadequate and according to the veterinary office, at least 10 more health posts should be established around the Wareda. Table 3.5.1 shows the planned and actual activities of the veterinary wareda office over three years, where in virtually all activities, the actual number achieved was well below the targeted number.

In particular, vaccination and dosing levels are totally inadequate. According to the veterinary office, prophylactic drugs and chemicals have become unreliable and costly. Recently, a cost recovery exercise commenced to allow better consistency in supplies.

The most prevalent disease outbreaks in the Wareda appear to be Anthrax, Black Leg (Quarter Evil), Pasteurellosis and Lumpy Skin Disease in cattle; sheep and goat pox in sheep and goats and African Horse Sickness in horses. Table 3.5.2 shows the number of outbreaks, the locations where they occurred and number of locations where vaccinations were carried out. Clearly, vaccinations are only carried out in reaction to outbreaks and not as herd prophylaxis. Tick borne disease occurs only infrequently probably due to the enzootic stability achieved in the indigenous population of livestock. Spraying or applying acaricide with a soft cloth is carried out when tick burdens are heaviest, in the late rains, mainly to prevent damage to hides or severe loss of body condition. Internal parasites are a major cause of mortality in this area because of the large population of animals that congregate around bodies of water during the dry season. Dosing is an essential activity, especially at the beginning and end of the dry season and especially in sheep and cattle. In poultry, Newcastle disease occurs sporadically but the most important cause of mortality in poultry is coccidiosis in young pullets or cockerels.

The survey shows that mortality in all groups is low, with a mean of 0.5 (range 0 to 6) per annum. Most deaths appear to occur at the end of the rains, which is the normal time in the tropics and are partly attributed to "disease" and partly to nutritional causes.

Clearly farmers far from the lake use prophylaxis significantly more than those near the lake but even within this group, tick control is not considered an important measure, when most farmers only apply tick acaricide once, when the tick burden is at its heaviest, i.e. January. Surprisingly, dosing for internal parasites, which should be a greater challenge for those animals near the lake, where fluke is an important cause of weakening condition, is carried out more in animals far from the lake. It appears that herd prophylaxis is not adequate, probably for reasons given under the general information on the Wareda and could be improved through an increase in animal health posts.

### 3.5.4 Animal Products

(1) Cattle- beef

Oxen are fed after plowing and threshing season for sale on the open market. The feeding strategy for fattening them appears to vary considerably with PA and does not appear to bear any relation to grazing status or proximity to the lake. The majority of farmers appear to depend on both grazing and crop residues for fattening their oxen, but there are some that depend only on grazing and some only on crop residues. Of note, however is that farmer's perception of whether their fattened oxen are "very fat" or "little fat" show that in general, where grazing is good, the farmers consider their oxen to be very fat. Crop residues alone, in view of their poor quality, are not likely to produce a well-finished animal. Oxen are normally sold after three months of feeding from December to February. The average price for an ox sold on the open market is 780 Birr (range 650 to 1,700). This provides the farmer with the money to buy seed and fertilizer and in some cases, more oxen for ploughing for the next season. However, the cost of an ox, which are mostly thin and weak when bought, is an average of 588 Birr (range 450 to 900) for those who have to buy more draught oxen.

(2) Milk

Mean number of cows is proportional to mean size of the herd but actual numbers of cows are surprisingly low. This suggests that aside from the oxen, there are large numbers of young cattle in the large herds. Oxen take priority under present management conditions. In fact, cows are reported to be second in importance to oxen. Farmers never use cows for draught purposes but are kept only for breeding and milk.

According to the farm interview of 258 HHs under the Study, most farmers (74%) depend on a "village" bull to serve their cows, some (36%) have their own bulls and a

very small percentage (5%) use artificial insemination (AI) in order to produce crossbred cows. It is difficult to estimate the true number of crossbred cows in the Wareda according to the livestock expert. The livestock extension expert of the OADB reports a total number of 340 in the Wareda. Among the farmers interviewed, only three farmers reported owning one crossbred cow each.

Cows tend to calve at the end of the rains, i.e. September to December, when grazing and crop residues are in reasonable supply, and there is milk for the calf, but calving times appear quite widely distributed nevertheless. If cows calve in the wet season or towards the end of the dry season, the calf is more susceptible to disease and malnutrition. This therefore is likely to be the reason for high calf mortality.

Cows lactate for an average of 6.5 months with a range of 4 to 8 months, giving an average of 1.5 liters a day with a range of 0.5 to 3. This yield appears to be consistent throughout lactation. Per week, the average amount of fresh milk kept for family use (children) is only 0.75 litres (about 0.1 litres a day) ranging from 0 to 4 litres. An average of 2.5 litres (range 0 to 10 litres) are kept for making butter for sale (yoghurt, or soured milk, is made from the skimmed milk and fed to the children, or made into "*Ibe*" or "*Ayeeb*" cheese. An average of 2.4 litres are made into "*Ibe*" cheese for sale per week. The average price of butter is 17.5 Birr/kg (range 0 to 45) and cheese is 5.2 Birr/kg (range 0 to 30). It is notable that butter and cheese sold through the dairy development program milk units (marketing cooperatives) sell for 28 and 35 Birr/kg, respectively.

All farmers interviewed expressed a wish to sell more cheese and butter through the use of cross bred cows but were apparently unaware of the need to produce high quality forage for sustained milk yield and optimum fertility.

(3) Sheep and Goats.

The average number of sheep over all PAs in the farm survey is 4.6 (range 0 to 40), while that of goats over all PAs in the farm survey is 5.4 (range 0 to 35). Distribution of sheep and goats appears to be similar throughout all PAs. The reasons for keeping sheep and goats are in order of importance:

1) Cash for household requirements
2) Fear of death through disease or drought of livestock (insurance)
3) To buy other animals

Sheep and goats are not milked, nor does the household eat them, even on holiday occasions. An average number of two sheep are sold annually (range 0 to 20) for an average price of 101 Birr per sheep (range 11 to 200). An average number of 2.5 goats are sold annually (range 0 to 35). The average price for goats is 85 Birr (range 45 to 100). While sheep and goats are not managed well, particularly on nutrition, they are dosed for internal parasites twice a year by 67% of farmers in all PAs. However, kid and lamb mortality is high in all PAs (average 55%).

(4) Donkeys and horses.

No farmers were reported to own horses or mules. The average number of donkeys per farm is 1.2 (range 0 to 6). An average of 0.3 donkeys is sold per farm annually (range 0 to 6) at an average price of 254 Birr (range 180 to 445). Donkeys are kept for pack transport but some are sold every year.

(5) Poultry-eggs

An average number of 8.9 hens (range 0 to 50) are owned by each household in all PAs. From these hens, an average of 3.5 eggs per day is produced (range 0 to 35). This provides a laying average of less than 50%, which is low. The average number of eggs given to the family for consumption per day is 1.7 (range 0 to 40), while the number of eggs sold every week averages 7 (range 0 to 49) at an average price of 0.25 Birr/egg (4 eggs per Birr). Chickens are not eaten by the family except at very special occasions like weddings and are normally eaten with "*Injira*" as "*Doro wat*".

No supplement is given to poultry; they are left to scavenge. All farmers expressed an interest in increasing the number of eggs to sell but were not able to say how they could feed crossbred poultry, as they were themselves short of grain

## 3.6 Agricultural Support Services

### 3.6.1 General

The agricultural support services include research, extension, credit, farm input supply, marketing, and famine relief. Ministry of Agriculture (MoA) takes a sole responsibility of all these institutional support services in Ethiopia. According to the long-term strategies and targets agreed with MoA, Ethiopian Agricultural Research Organization (EARO) takes substantial parts of the research activities. As for agricultural extension, MoA acts as a policy maker and provides technical supports to the regional governments as executive organs. The institutional farm credits in Ethiopia are represented by Extension Package Program (EPP). MoA controls the operation of EPP in collaboration with donors at the national level, while OADB undertakes its full responsibilities from distribution of packages to collection of repayment. OCPB is another organ, which promotes the rural credits to the registered cooperative members. Although the government envisages to penetrate the financial supports to peasants through cooperatives' channels, the performance is still low. There are institutional organizations to promote import and distribution of domestic markets of farm inputs such as seed and fertilizer. Disaster Prevention and Preparedness Committee (DPPC) is an institutional organization against the natural disasters and social disorders especially for famine relief by keeping close relationship with World Food Program (WFP) and NGOs.

### 3.6.2 Research

Ethiopian Science and Technology Commission (ESTC) is an advisory body for prime minister, which concerns policy planning in science and technology. EARO

manages all the agricultural research centers. In East Shewa zone, which includes Dugda Bora, there are three (3) research centers: Melkassa and Debre Zeit national research centers, and Adami Tulu regional research center. Melkassa RC in Nazareth has contributed to the rural development particularly in the central rift valley. It substantially contributes to crop research on fruits, maize, haricot bean, etc. Debre Zeit RC near Addis Ababa is a national center for teff research. Adami Tulu RC, south of Dugda Bora, is a livestock research center. Technological transfer is coordinated by Research-Extension-Farmers Linkage Advisory Councils organized at federal, regional, and zonal levels, respectively. The feedback from farmers is also planned in the zonal level council as schematically presented in Figure 3.6.1. Remarkable research achievements are published by EARO.

### 3.6.3 Extension Service

The extension services in Dugda Bora Wareda are executed under the control of the wareda office of OADB by deploying Subject Matter Specialists (SMS) and DAs. The total number of DAs of the Wareda is 27. Every DA covers two PAs where 800 farm households with 2,500 ha of farmland are distributed on average. The numbers of DA have rapidly increased with EPP development since 1995. About 80% of DA were appointed after 1996 in order to meet the additional duties for EPP.

The DA activities are broadly categorized into two parts, namely EPP and the regular extension activity (REA) although only a little time is available for DA to work for REA since EPP was introduced. In principle, REA is carried out by applying the improved Training and Visit (T&V) system, in which DAs visit selected leading farmers instead of groups. Each DA divides his/her extension block into eight (8) sub-blocks and selects six (6) contact farmers for each sub-block. This means that 48 contact farmers are selected under each DA. According to the instructions from the OADB wareda office, DAs transfer the extension messages to 48 contact farmers during two (2) weeks.

On the other hand, DAs concentrate training of "Graduate Farmers", who have experienced two (2) crop seasons with EPP and completed credit repayment. The details of EPP are mentioned in Section 3.6.4 on Credit Operation.

The monthly and seasonal (every four months) training programs are envisaged to be provided to DAs. However, few programs are held when donors' supports are available. It was identified that the DAs suffer from insufficient agronomic knowledge and tools.

### 3.6.4 Credit Operation

(1) Extension Package Program (EPP)

The EPP was introduced to Ethiopia in 1994 and applied for 40,000 plots of 0.5 ha/plot with technical assistance of SG2000 in 1995. Since 1996, the number of EPP

has sharply increased, especially after 1998 as presented in Table 3.6.1. EPP in Dugda Bora has also developed since 1998, and covered over 10,000 plots in 2000. EPP plots per DA count up to more than 400, which seems to be over the limit of the DA service capacity. The OADB wareda office has an idea to improve the EPP system to hand over the monetary part of EPP to co-operatives so that DAs have more time to work on daily activities of REA.

The financial source of EPP is budgeted by Ministry of Finance. OADB are responsible for tenders in selection of input suppliers. Down payment or advanced payment in EPP loan is directed to be 25% by OADB, however, actual rate of the down payment in East Shewa zone has been raised up to 35-50% in 2000. The recovery rate of EPP loans is as high as 97% in Oromia Region and 78% at Dugda Bora in 1999/2000.

(2) Crop credits by cooperatives

There are two types of co-operatives in Dugda Bora Wareda, namely Meki Union Co-operatives organized by irrigation water users and Cooperative Association. The Meki Union co-operative is composed of 15 WUAs and sells fertilizer, vegetable seeds, and agro-chemicals with 40% down payment. Co-operative Associations exist in two administrative blocks and are composed of 10 PAs. They sold 15 ton of DAP last crop year (2000/01).

(3) Crop credits by NGOs

The crop credit schemes operated by NGOs are also available in Dugda Bora Wareda in order to assist peasants for farm input procurement for such crops as maize, wheat, teff, and tomato. The major NGOs include Meki Catholic Secretariat (MCS) and Christian Children's Fund (CCF ).

(4) Others

National Commercial Bank (NCB ) at Meki town operates short-term loans for entrepreneur farmers. Farmer-to-farmer seed lending and/or exchange in neighborhoods can constantly be seen in general. Seed growers or producers of new crop varieties lend around 15% of the produce as seeds to other farmers (see Tables 3.6.2 and 3.6.3).

### 3.6.5 NGOs Activities in Dugda Bora

According to the NGO list given by Oromia DPPB, there are 37 NGO projects in East Shewa zone. Meki Development Project by Self-help International had been executed with an integrated approach including eight (8) components, i.e. crop production, livestock, soil conservation, health, rural water supply, women association, education and farmers' training for eight (8) years in 1992 to 1999. MCS started relief activities in the drought year of 1984. On the basis the assessment in 1992, their activities have concentrated on three programs since 1997 till today: (i)

Tuchi Sumeyan project (1997- 2000); (ii) Micro-finance, women saving and credit bank (1998- ); and (iii) Mother & child health/food assisted child survival program (1998- ). CCF has given financial support to children with the parents of those children organized into a saving & credit association with agricultural support and consumers' credit, health education, latrine construction, capacity building, etc.

### 3.6.6 Cooperatives Promotion

There were 150 co-operatives before the beginning of 1970's. Under the socialist system in 1974-1991, thousands of various co-operative societies had flourished across the country in line with the Soviet Union & Eastern Europe style, but all had failed. The actual co-operative activities have been restructured and strengthened by four regulations in 1994, 1997, 1998 and 1999. There are 351 co-operative associations that were restructured. Union co-operatives are also organized at six places, one having a saving and credit co-operative. Major activities in co-operatives are: (1) Farm input supply; (2) Production credit; (3) Marketing of farm produce;, (4) Mill factory; (5) Rental service of tractor or combine; (6) Consumer credit; (7) Promotion of irrigation farming; etc. In Dugda Bora, a co-operative office was already completed, however, another co-operative room is still in the agricultural office. Out of a total of 440 PAs in East Shewa zone, 310 PA are already organized into co-operative associations, that is, 132 PAs are not organized (44 PA in Dugda Bora). Union co-operatives are organized at three places. Oromia RCB is now making a second five-year plan for 2000-2004.

### 3.6.7 Marketing of Farm Input

National Seed Industry Agency (NSIA) has started a five-year plan, i.e. Farmers Based Seed Production and Marketing Scheme (FBSPMS) with help of World Bank in accordance with EPP since 1997 (see Tables 3.6.4 and 3.6.5). Improved seed production by FBSPMS is dominated by two crops: wheat and maize. However, improved seeds of both crops introduced in Dugda Bora account for only 30% of the total EPP seeds. The coverage of improved wheat and maize seeds was limited only to 1,349 ha or 2.25% of total food crop area in 2000. There were no improved seeds of teff and haricot bean, which are important cash crops for farmers. Thus shortage of improved seed is the crucial constraint of EPP. NFIA reported that crop yield would not be improved as long as local seeds were used. The average yield when local seed are used decreases by 50% for maize, 40% for wheat, and 10% for teff in comparison with those with improved seed packages as presented in Table 3.6.6.

The fertilizer consumption in Oromia from 1995 to 2000 is presented in Table 3.6.7. The national average of fertilizer consumption by small farmers is 34 kg/ha in 2000, while the regional average is 37kg/ha. In East Shewa, the fertilizer consumption has gradually decreased in the said period although the package numbers released under EPP has sharply increased. The retail prices of fertilizer have increased since 1998

although the import prices are going down as presented in Table 3.6.8.

Around 90% of agro-chemicals are consumed by state farms and entrepreneur farms. The use of agro-chemical by small farmers is limited; fungicide and pesticide by vegetable farmers, and herbicide by grain crop farmers.

## 3.7 Rural Infrastructure

### 3.7.1 Roads

The roads in Dugda Bora Wareda are categorized into three (3) classes, national roads under the responsibility of Ethiopia Road Authority (ERA), district roads and rural roads under Oromia Rural Road Authority (ORRA), and footpaths under rural community, respectively.

There are six (6) major roads in Dugda Bora Wareda, which are categorized into 3 classes in accordance with its pavement, such as asphalt-paved road, gravel-paved road and un-paved road. In the Wareda, paved roads with a length of 97 km have been provided as shown below.

**Road Network in Dugda Bora Wareda**

| No. | Name of Road | Pavement | Length in the wareda | Responsible Organization | Remarks |
|---|---|---|---|---|---|
| 1 | Addis Ababa – Awassa Road | Asphalt Paved | 59 km | ERA | Trunk road to link national capital to Southern Region under assistance of EU |
| 2 | Meki – Koshe – Butajera Road | Gravel Paved | 24 km | ORRA | |
| 3 | Meki - Habra Road | Gravel Paved | 14 km | ORRA | This road is constructed by Ethio-Italian grant aid. |
| 4 | Meki – Ejersa Lele Road | Unpaved | 20 km | - | |
| 5 | Alan Tena – Ombole Road | Unpaved | 21 km | - | In the 5-years development plan, ORRA has plan to upgrade the road. |
| 6 | Alan Tena – Habra Road | Unpaved | 17 km | - | |

Source: JICA Study Team

In order to grasp the transportation methods and condition of the roads in the Wareda, an Origin–Destination survey was carried out by the study team at Meki and Alem Tena market on each market day. Transportation methods and average time in hours to access to markets in dry season and rainy season are shown in the following table.

**Transportation Methods and Average Hour to Access to Markets**

| Transportation | Meki Market | | | Alam Tena Market | | |
|---|---|---|---|---|---|---|
| | Nos. of interviewee | Average hour to access market | | Nos. of interviewee | Average hour to access market | |
| | | Dry Season | Rainy Season | | Dry Season | Rainy Season |
| Donkey | 3 | 1.8 h | 2.5 h | 17 | 1.6 h | 2.5 h |
| Donkey cart | 12 | 1.6 h | 2.3 h | 1 | 2.0 h | 2.5 h |
| House cart | 5 | 1.0 h | 1.8 h | 2 | 1.0 h | 1.5 h |
| On foot | 37 | 1.9 h | 2.5 h | 35 | 1.7 h | 2.6 h |
| Bus[1)] | 5 | 2.4 h | 2.6 h | 11 | 1.3 h | 1.3 h |
| Car | 1 | 0.3 h | 0.3 h | 1 | 2.5 h | 3.5 h |
| Others[2)] | 5 | - | - | 3 | - | - |
| **Sub-total** | 68 | - | - | 70 | - | - |
| From outside | 7 | - | - | 21 | - | - |
| **Total** | 75 | - | - | 91 | - | - |

1) : The bus is not regular route bus but hired by business basis.
2) : Others consisted by bicycle and mule
Source: JICA Study Team

Layout map of the major roads and accessibility to the two markets are shown in Figure 3.7.1. Contour lines in the map show times taken from houses of the interviewee to the markets on foot. Some 40% of inhabitants living in the area the Wareda seldom access the two big towns, which can be reached within 3 hours on foot. The result shows that main transportation method in the Wareda is donkey, donkey cart and on foot while motorized transport is not yet widely available in the area.

There is a difference of 45 minutes on average for transportation on foot in the dry and rainy seasons. Asked if the road conditions differ in rainy and dry seasons, some 22% of the interviewee answered that they took the major road in the rainy season instead of the rural roads and the footpath, which they usually take in dry season. It suggests that transportation within the Wareda in the rainy season is constrained by a relatively bad condition of the rural roads and the footpaths as indicated in the following table.

**Constraints of the Roads in Rainy Season in Dugda Bora Wareda**

| Constraints | Meki | Alam Tena | Total |
|---|---|---|---|
| Muddy Road Condition | 52 | 57 | 109 |
| River/Gully Crossing | 7 | 31 | 38 |
| Water Logging on Road | 2 | 16 | 18 |
| No problem | 10 | 9 | 19 |

Multiple answers
Source: JICA Study Team

Road extension per population and its coverage area are presented in the following table.

**Road Extension per population and Covered Area**

| | Road Extension per 1,000 persons | Road Extension per 1,000 $km^2$ |
|---|---|---|
| Dugda Bora Wareda | 0.62km | 66km |
| Oromia Region | 0.50km | 27km |
| Ethiopia | 0.43km | 21km |
| Africa | 0.61km | 50km |

Source: The Economy of Oromia,1999

The above table shows that the wareda has a better road networks compared with that of the Oromia Region and the Ethiopia average in terms of road densities. Although there are some constraints in the rural roads, and the road network in the Wareda, it can be considered satisfactory in terms of quantitative levels.

### 3.7.2 Domestic Water Supply

The main source for drinking water in Dugda Bora Wareda is groundwater. The groundwater table is around EL.1,620 m throughout the Wareda. The water supply to Meki town is under the responsibility of the OWMERDB wareda office. There are four (4) deep wells, out of which only one is currently functional. The design works for rehabilitation and expansion of the existing facilities was completed in 1997, while financial arrangement is required for its implementation.

The coverage of rural water supply in East Shewa Zone and Oromia Region are as low as 23% and 16%. The OWMEERDB conducted an inventory survey in1999 to clarify the present condition of the rural water supply in Dugda Bora Wareda. In the rural area, there are 66 water supply facilities managed by communities, i.e. 45 boreholes, 16 shallow wells and 2 hand dug wells as illustrated in Figure 3.7.2. Their total installation capacity is to meet the domestic water demand for 117,000. However, out of 66 wells, 26 wells are not functional. Besides, 19 wells are deteriorated and need maintenance works. Therefore, actual coverage of rural water supply in Dugda Bora Wareda is much lower than the installation capacity.

**Condition of the Rural Water Supply Scheme in Dugda Bora Wareda**

| Water Source | | | Engine Type | | |
|---|---|---|---|---|---|
| | Status* | nos. | | Status* | nos. |
| Borehole | • | 11 | Diesel or Electrical Engine | • | 8 |
| | • | 17 | | • | 14 |
| | × | 17 | | × | 10 |
| | Sub-Total | 45 | | Sub-Total | 32 |
| Shallow Well | • | 7 | Wind Mill | • | 5 |
| | • | 2 | | • | 5 |
| | × | 7 | | × | 13 |
| | Sub-Total | 16 | | Sub-Total | 23 |
| Hand Dug Well | • | 0 | Hand Pump | • | 5 |
| | • | 0 | | • | 0 |
| | × | 2 | | × | 3 |
| | Sub-Total | 2 | | Sub-Total | 8 |
| No Data | | 3 | No Data | | 3 |
| Total | | 66 | Total | | 66 |

Status • : Functioning with no problem, • : Functioning with some problems
× : Not functioning
Source: Oromia Water, Mining, Energy Development Bureau

Windmills are also prevailing in the Wareda. Most of them were installed with assistance from NGOs. It should be noted that more than 50% of the existing windmills are not functional. Lack of spare parts is one of the most critical problems for windmills.

In order to operate and maintain the wells, Water Committees are organized with assistance from OWMERDB. The committee is responsible for operation and maintenance of motor engines, overhead tanks, water points and cattle troughs, and the collection of water charges. In addition, special attention is paid to keep animals away from the water points to prevent them from pollution by animals' excreta. Water master collects water charges, that is 5 to 15 cents per 25 liters from beneficiaries. The committees deposit collected money in their bank accounts to cover O&M cost including salary of water master. OWMERDB has made much effort to assist the committee by dispatching a maintenance team upon the request of the committee.

It was also observed that some of the wells were abandoned due to water quality problems such as a high concentration of fluoride and salinity as widely recognized in the existing wells within the Rift Valley. High fluoride contents could cause dental and skeletal fluorosis. To eliminate constraints, it is recommended to study more use of surface water in the Wareda.

### 3.7.3 Health Care Service

Although the Oromia Health Bureau promotes the primary health care in the rural area of the Region, insufficient facilities and health personnel are still crucial issues. Majority of rural population does not have immediate access to safe water and sanitation facilities. Therefore, they suffer from water-borne diseases. The major causes of morbidity are respiratory infection, malaria, skin infections, diarrheal diseases and intestinal parasitic infections. Prevailing diseases in Dugda Bora Wareda are presented below.

**Prevailing Diseases in Dugda Bora Wareda in 1999**

| Rank | Diagnosis | No. of patients * | % |
|---|---|---|---|
| 1 | Urticaria | 4,973 | 16.6 |
| 2 | Malaria | 3,035 | 10.1 |
| 3 | Intestinal Parasites | 2,842 | 9.5 |
| 4 | Skin Disease | 2,362 | 7.9 |
| 5 | Eye Disease | 1,851 | 6.2 |
| 6 | Diarrhea | 1,245 | 4.2 |
| 7 | Anaemia | 1,025 | 3.4 |
| 8 | Gastritis | 894 | 3.0 |
| 9 | Injury | 821 | 2.7 |
| 10 | Tonsilitis | 750 | 2.5 |
| | Others | 10,110 | 33.8 |
| | Total | 29,908 | 100.0 |

Source : Meki Health Center

The table below shows mortality rates from the 1994 population and housing census. In terms of infant mortality, under-five mortality and expectation of life at birth, Meki town shows lower values that those in East Shewa Zone and Oromia Region.

**Mortality in the Study Area**

| Area | Sex | Infant mortality | Under-five mortality | Lif expect. at birth |
|---|---|---|---|---|
| Oromia Region | M + F | 118 | 173 | 50.4 |
| | M | 128 | 182 | 49.2 |
| | F | 108 | 164 | 51.7 |
| East Shewa Zone | M + F | 128 | 190 | 48.6 |
| | M | 139 | 198 | 47.3 |
| | F | 117 | 181 | 49.9 |
| Meki Town | M + F | 154 | 229 | 44.4 |
| | M | 179 | 260 | 41.1 |
| | F | 127 | 195 | 48.4 |
| Ziway Town | M + F | 96 | 137 | 54.8 |
| | M | 110 | 154 | 52.7 |
| | F | 82 | 120 | 57.0 |

Source : 1994 Population and Housing Census

Remarks:

Infant Mortality: the probability of dying between birth and the first birthday per 1000 live births

Under-five mortality: the probability of dying between birth and the fifth birthday per 1000 live births

Expectation of life at birth:the average number of years a new born baby is expected to live if he/she is exposed throughout its life to the prevailing pattern of age specific death rates

The responsibility for front line service for health care is under the health department of wareda. The health care facilities are categorized into 1) health center (1 in number), 2) district clinic (5), 3) private clinic (7), 4) health post (2) 4) drug store (10). The health center located in Meki town, and clinics located in Alam Tena and major PA, are providing curative and preventive health care services including general consultation, prenatal and baby clinic, examination, treatment, family planning, immunization, health education and promotion of national health campaign (eradication of malaria and polio). A doctor and nurses are assigned at the health center while health assistants mainly run clinics. A community health worker with basic training in health and midwifery manages each health post. But the facility faces budgetary and manpower problems in terms of the number of staff and lack of training. In addition to the government service, in Alam Tena, the Catholic Church established a clinic in 1995. The number of patients that visited the facilities in 1999 was reported to be 29,900 first visits, and 31,900 repeat visits.

The number of medical facilities, personnel and ratios of facilities/medical personnel to population in the wareda, zone and region are shown below, and the location of the medical facilities are shown in Figure 3.7.3.

**Medical facilities and Personnel in Dugda Bora Wareda**

| Facilities / Medical Personnel | Number of Facilities / Personnel | Ratio of Facilities, Medical Personnel to population | | |
|---|---|---|---|---|
| | | Dugda Bora Wareda | East Shewa Zone | Oromia Region |
| Health Center | 1 | 156,358 | 361,979 | 272,069 |
| Clinic | 13 | 12,027 | 54,845 | 23,826 |
| Government | 5 | - | - | - |
| Private | 7 | - | - | - |
| NGO | 1 | - | - | - |
| Health Post | 2 | 156,358 | 361,979 | 272,069 |
| Drug Stores | 10 | 15,636 | Not available | Not available |
| Doctors | 1 | 156,358 | 30,676 | 68,714 |
| Nurses | 5 | 31,272 | 10,969 | 22,149 |
| Health Assistants | 15 | 10,424 | 5,954 | 6,288 |
| Health Worker | 6 | 26,060 | Not available | Not available |
| Saniterian | 1 | 156,358 | Not available | Not available |
| Pharmacy Technicians | 4 | 39,090 | Not available | Not available |

Source : Wareda Health Department, Meki, 1999 and Zonal Level Health Department in 1996

The above table shows that the wareda has the facilities above the zonal and the regional average while the personnel in the wareda does not reach those average. The availability of health institution and staff does not ensure coverage of health care. However, as far as the facilities and personnel of health care are concerned, it can be

seen that the Dugda Bora wareda is not very inferior to the regional level.

A preventive health care service is being carried out by the staff in the department in spite of shortage of staff and equipment. It includes construction of latrine and refuse disposal, inspection of pit latrine, refuse disposal, water source, small-scale industries, food & drink establishment, prison & school health service, vaccination service, and malaria control campaign. Especially, in 1999, the department had malaria control programme in 20 PAs, spraying DDT in houses and mosquito breeding sites and distributing chloroqine and fansidar to the inhabitants. However, those activities were constrained by poor community participation.

The present condition of the health care service in the wareda suggest that it is important to strengthen the health post, with a front-line health care institution and awareness of the communities, for preventive health care.

### 3.7.4 Education

Education plays a crucial role in the process of social and economic development. In this context, while the focus is on expanding primary education, the structure of education is diversified into technical and vocational education, the expansion of which takes place in parallel with the expansion of primary education. An enrollment ratio and the total literacy rate evaluate level of education. The net enrollment ratio is defined as the ratio of the number of pupils of eligible age at a particular level to the total population of the corresponding age group. Ratios of pupils to total number of school-aged children for each grade compared to those of East Shewa Zone and Oromia region are shown below.

**Ratios of Pupil to Total Number of School-aged Children and Literacy (%)**

| | | Primary School | Junior Secondary School | Senior Secondary School | Total Literacy |
|---|---|---|---|---|---|
| Dugda Bora Wareda | Male | 9.65 | 3.09 | 2.02 | 28.74 |
| | Female | 9.36 | 2.87 | 1.90 | 15.05 |
| | Total | 9.51 | 2.98 | 1.96 | 21.99 |
| East Shewa Zone | Male | 18.98 | 8.79 | 10.17 | 42.40 |
| | Female | 18.42 | 10.31 | 10.75 | 29.64 |
| | Total | 18.70 | 9.55 | 10.46 | 36.04 |
| Oromia Region | Male | 11.86 | 4.32 | 4.23 | 29.29 |
| | Female | 9.62 | 4.41 | 4.07 | 15.56 |
| | Total | 10.76 | 4.37 | 4.15 | 22.40 |

Source: The 1994 Population and Housing Census of Ethiopia Result for Oromia Region

In terms of all indicators, East Shewa Zone has ratios roughly twice as high as those of the regional average, while Dugda Bora District, which is within the East Shewa Zone, has the same values as the region.

There are 27 primary schools and 3 junior high schools in the district for 17,232 pupils administrated by the wareda education department (location of the schools are shown in Figure 3.7.4). There is only one senior secondary school, which belongs to

the Catholic Church. The pupil population in the primary, junior and high schools is indicated below.

**Pupil in Dugda Bora Wareda (1992/93 – 1999/2000)**

| Year | 1992/93 | 1993/94 | 1994/95 | 1995/96 | 1996/97 | 1997/98 | 1998/99 | 1999/00 |
|---|---|---|---|---|---|---|---|---|
| Primary & junior high school population | 2,751 | 3,196 | 2,894 | 5,272 | 7,501 | 10,094 | 14,814 | 17,232 |
| Senior secondary school population | 287 | 338 | 399 | 264 | 278 | 278 | 313 | 359 |

Source: Wareda Education Department , Meki 1999

Although the population of the senior secondary school shows slight variations during the period, the population of primary and junior high schools has drastically increased, requiring a commensurate increase in schools and school facilities. The shortage of schools and teachers can be seen in the following table.

**Status of Primary School, Students and Teachers**

| | No. of Schools | No. of Students | No. of Teachers | Students / school | Students / teacher |
|---|---|---|---|---|---|
| Dugda Bora Wareda | 27 | 17,232 | 248 | 638 | 69 |
| E. Shewa Zone | 301 | 115,504 | 3,557 | 384 | 32 |
| Oromia Region | 4,108 | 1,401,508 | 35,585 | 341 | 39 |

Source: Wareda Education Department, Meki 2000 and Zonal Level Education Department in 1996

In response to high needs of school facilities, 2 primary schools are under construction while one junior high school is being upgraded. In the wareda, other than government activities, UNICEF and NGOs play an important role in the education sector. UNICEF is conducting a capacity building programme for communities as well as schools, such as awareness programme to community, gender issues and children's rights. An NGO, the Christian Children's Fund, builds and manages kindergartens and constructs primary schools and employs teachers. After construction these are eventually transferred to the government. It is reported that the dropout ratio of 27% in 1998/99 has drastically declined to 18% in 1999/2000. This is because of the awareness activities, expansion of the number of classes and employment of additional teachers.

The Alam Tena vocational training center conducts training courses for tailoring, carpentry, spinning and weaving, and blacksmith.

Although there are still a lot of constraints in the sector, such as a shortage of teachers, schools, classrooms, and insufficient training of teachers, the educational administration with external support by UNICEF and NGOs has been established.

# CHAPTER 4 DEVELOPMENT CONSTRAINTS AND NEEDS

## 4.1 Analytical Methods

Chapter 4 aims at identification of region-specific constraints against and needs for the agricultural and rural development in the Meki area by means of the following analytical approaches.

1) Review of the existing literature, reports and other documents
2) Field observation with stakeholders
3) Project Cycle Management (PCM) workshop with OIDA focusing on institutional and organizational constraints in the existing irrigation schemes
4) A series of subject workshops with OIDA and other agencies concerned
5) Interviews with and questionnaires to local administrators and officers at the zonal and wareda levels
6) Interviews with and questionnaires to farmers
7) Rapid Rural Appraisal (RRA) at several community levels in association with local consultant
8) Interview survey of traders and venders at public markets focusing on rural road conditions
9) Questionnaire surveys of institutions concerned with primary health care and education
10) Interview survey of major NGOs

The Study carried out direct interviews to the district officers and other stakeholders including PA chairpersons, development agents (DAs), NGOs, community leaders, middlemen, street vendors, and retailers at the public markets at Meki and Alem Tena. The farmers' attitude and intention for agricultural and rural development were studied at representative communities through the RRA and the intensive field inspections. These activities verified social and cultural characteristics of the Meki area including roles of traditional groups, way of decision making in a rural community and gender imbalance. The field study has also focused on local experiences and indigenous knowledge to cope with unfavorable natural conditions.

A series of workshops were held with collaboration of OIDA by inviting cadres, officers and researchers from other organizations. In response to the presentation by each expert of the JICA Study Team, development constraints, needs and possible countermeasures were discussed more specifically from the professional point of view. The subjects included improved farming techniques, modernized animal husbandry with dairy cattle, irrigation development, agricultural support systems, environmental conservation, etc. The development constraints and needs through the Study are mentioned below.

## 4.2 Constraints and Needs in Irrigation Development

(1) Lack of development strategy in the Meki area

The irrigation development in the Meki area is encouraged by the government agencies, NGOs and private investors. It is urgently required to establish an optimum development plan with a long-term strategy. However, several constraints are identified against the irrigation development in the Meki area as follows.

1) Fragile environmental conditions of the Rift Valley

The Meki-Ziway basin forms a closed hydrological system on the bottomland of the Rift Valley. Surface water in the Meki river basin finally drains into the Ziway lake and finally into the Abijata lake. Therefore, the water levels of both lakes are subject to water abstraction from the Meki river. In view of such fragile environmental conditions of the Rift Valley, hydrological observation and impact assessment are required before further irrigation development is undertaken in the Meki river basin.

Some 180 small pumps are currently installed by investors for profit-oriented horticultural farming. These on-going irrigation activities give local farmers strong incentive to embark on further irrigation development. However, irresponsible expansion of irrigation area will accelerate water use of the Meki river basin. In order to avoid environmental impact and optimize irrigation water use in the Meki river basin, a well-balanced development plan has to be formulated with a long-term strategy. In parallel, it is also required to continue a monitoring survey of irrigation water use in the Meki river basin so as to minimize environment adverse impact at the earliest stages.

2) Topographic constraints against introduction of a gravity irrigation system

The regional state government has faced the financial difficulties of the Meki-Ziway scheme during last decade. In order to reduce the financial burden for O&M of its pumping facilities, OIDA envisages converting the existing pump system to the cost-saving gravity system. With this background, the Study aimed firstly at justifying technical and financial viability of a gravity irrigation development including a dam construction on the upstream of the Meki river.

The Meki river incises a v-shaped valley of 40-50 m deep in the upstream reaches and forms steep narrow gorges of 10-20 m deep on flat alluvial deposits extending over the downstream. Due to such morphological conditions of the Meki river, a scale of either dam or diversion structure tends to be large with few alternatives. The required dam is not lower than 30m, while the proposed diversion structure is to be designed not lower than 10 m. The geological foundation of the riverbanks and riverbeds of the Meki river is generally friable with high permeability and needs additional subsurface and protection works. In order to recover an initial investment for such large-scale civil works, an irrigation area has to be enlarged to the maximum level, e.g. 8,000 ha, so as to ensure reasonable economic scale.

3) Management capability of large-scale scheme

More attention should be paid to institutional and organizational arrangements necessary for a large-scale irrigation scheme. As mentioned in Chapter 2, the irrigated area under the control of OIDA is limited to less than 100 ha per scheme. This means that both OIDA and water users need more established management system far beyond their past experience in the existing schemes.

In-depth study is required to confirm a viability of the proposed scheme not only from environmental, technical and economic viewpoints but also from institutional and organizational viewpoints. In this regard, the capability building of OIDA and water users is crucial.

(2) Inadequate operation and management (O&M)

1) Vague demarcation of responsibility between OIDA and WUAs

At completion of the construction of irrigation schemes, most of responsibilities for O&M are officially taken over from OIDA to WUAs. However, the handing-over agreements do not mention clear demarcation of responsibilities between OIDA and WUAs at the O&M stage. As a result, confusions are raised from day-to-day operation especially when the project faces unforeseeable troubles, for which countermeasures are beyond technical and financial capacity of WUAs.

2) Farmers' ignorance to financial management for O&M

NGOs have provided local farmers free pumps together with farm inputs for the first crop season. With such supports, the farmers obtain successful harvest from the first crop season. In most cases, however, farmers faced financial difficulties in and after second crop season when NGOs faded out due to lack of fund for procurement of fuel. Moreover, most of WUAs have failed to replace the pumps after their depreciation.

It is believed that irrigation farmers in the Meki area do not have sufficient capacity to pay the water charge and can not sustain the scheme operation without financial supports. To improve the profitability of the irrigation farming at farmer level, further detailed financial analyses will be required. In addition, awareness creation will be required for sustainable financial management for O&M. The Study preliminarily identified farmers' ignorance to necessity of financial sustainability for O&M. In fact, water charge is not collected in most community-based irrigation schemes even though farmers are capable to pay water charge after good harvest.

3) Lack of technical knowledge for O&M

Water Management and Extension Department of OIDA is responsible for extension of the O&M techniques to WUAs at official hand-over of a scheme. After the hand-over of the project, farmers are to take most responsibilities for O&M with little assistance of OIDA staffs. However, some project facilities are not functioning due

to lack of annual or seasonal maintenance as a result of insufficient knowledge among the WUA members. Weed control and desilting of canals are rarely operated due to negligence of WUAs. Uneven water distribution and illicit water tapping due to ignorance among the WUA members are also reported in many existing schemes. In this regard, the DAs assigned by OIDA are expected to be catalyst to train the WUA members. The Study recognized urgent needs for provision of training programs for both the DAs of OIDA and the WUA members especially on efficient use of limited water resources.

(3) Insufficient support by OIDA

1) Insufficient capacity for planning and design

The OIDA engineers need more technical training especially for planning and design of irrigation development. The Study identified urgent needs of intensive training especially for hydrological analysis essential for design of diversion weirs. The analytical methods are required to assess the water development potentials in the basin, in particular, where discharge records are very limited. It is noted that low irrigation performance of the existing schemes, i.e. 58%, could not be improved without proper hydrological analysis and countermeasures.

Some structures do not function as designed due to technical negligence to soil and geological conditions. In this regard, lack of planning and design criteria is one of constraints.

2) Lack of criteria for implementation of new projects and rehabilitation works

The OIDA branch offices receive and assess farmers' proposals for new irrigation projects, while the OIDA head office makes final decision for project selection and provides approval for its budgetary arrangement. Similarly, the maintenance work, which is beyond the WUA's capacity, will be conducted by OIDA upon their request. The application for the maintenance work is evaluated in the branch office and approved by the head of the extension and water management department in the head office for budgetary arrangement. Due to lack of guidelines and criteria for project selection and prioritization, these services are not systematically operated.

3) Insufficient administration capacity to manage external resources

Some facilities are not properly constructed in accordance with design and technical specification. Soil compaction is not satisfactorily carried out resulting in water leakage from embankments of canal and night ponds. A total review is required to optimize quality control by OIDA especially for site inspection and measurement.

In recent years, some of planning and design works were performed with aid of foreign consultants. In future, the project construction will be carried out by more participation of private contractors instead of on OIDA's force account. This will reduce the workloads of the OIDA engineers. Instead of direct management, however, OIDA's responsibility for progress and quality control of construction

works including preparation of terms of reference (TOR) for the engineering services, construction management, contract administration, preparation and interpretation of general and technical specifications and monitoring of physical and financial progress.

4) Insufficient project monitoring and evaluation

The project monitoring and evaluation system is not fully functioned in OIDA. To ensure the development activities in each scheme, a regular reporting system between the head office and the branch offices are required.

5) Insufficient experiences for participatory development approach

The community mobilization is one of the most important steps of the project implementation. OIDA dispatches the community mobilization teams to the candidate communities for WUAs and encourages awareness creation followed by participatory plan formulation. At this initial stage of the project, the communities need a wide range of information concerning the irrigation farming to make proper judgement. However, due to lack of information necessary for plan formulation, the communities can not realize the actual difficulties of the community-based irrigation management. One of the reasons is the staff structure of a community mobilization team of OIDA, which is organized only by social workers. The OIDA social workers do not have sufficient engineering knowledge and working experiences. It is crucial for community members to be aware not of management difficulties of the irrigation project but also of the engineering problems during the PRA. The WUA members need to be motivated by appropriate facilitation by both socialists and engineers.

(4) Low crop productivity due to poor farming techniques

1) Lack of research for irrigation farming

The agricultural research in Ethiopia is currently carried out in line with the research-extension linkage program under the responsibility of EARO. In view of large impact to majority of farmers, EARO has attached the priority to improvement of rainfed farming and animal husbandry, which contributes to substantial portions of the national economy and livelihood. In contrast, the irrigation research is carried out to the limited scale by EARO. Modern irrigation techniques are not sufficiently studied under local climatic and soil conditions of Ethiopia.

2) Weak extension activities

OADB is responsible for the agricultural extension services by deploying DAs. Most DAs have educational background of high school with agricultural diploma for 2 years. In general, their practical experiences are not sufficient to meet the requirement among local farmers. Moreover, DAs are not capable to provide extension advises to farmers since DAs are not provided skill training for irrigation farming, which are under the responsibility of OIDA. It is important to train the DAs not only in rainfed crop production but also in the technical field of irrigation farming.

Although OIDA dispatches DAs to the selected waredas where irrigation schemes are operated, their technical knowledge and experiences are not sufficient.

## 4.3 Constraints and Needs in Rain-fed Agriculture

(1) Improper farming practices

1) Lack of research for rainfed farming techniques suited to ASAL

With regard to the linkage between research centers and extension offices, there is no direct communications between research centers and district office. As mentioned above, the research-extension linkage program is the main stream of the agricultural research activities in Ethiopia. Some 300 recommendable agricultural techniques are already selected and in process for extension. However, most of them are selected under relatively favorable agro-climatic conditions and, therefore, not appropriate to introduce directly to the ASAL zones including the Meki area. The agricultural research in situ is required to modify the selected techniques to more suitable for the local conditions of Meki.

2) Weak extension

As mentioned above, the technical knowledge of DAs is not sufficient to provide a wide range of appropriate advises to local farmers. The DAs need more training programs to elaborate their technical skills and knowledge. Lack of extension tools (materials) is also one of constraints facing DAs. Besides, lack of transportation means hinders regular visits to contact farmers according to the schedule of T&V system. Heavy workloads of EPP are another constraint against the regular visits of DAs. On an average a DA visits a farmer one to four times per month according to the farmers interview by the JICA Study Team. The most of interviewees need more frequent visits by DAs to meet their demands.

(2) Delayed inputs supply

1) Poor agro-inputs supply system

Grain yield can be increased when improved seeds and chemical fertilizers are applied together. One of the agronomic constraints in Ethiopia is lack of improved seeds. Especially improved seeds of teff and haricot beans are in short supply. Only fertilizers are often available in EPP. Instead of improved varieties, farmers are forced to use local varieties, which are available through local middlemen. The productivity of local varieties is basically low even though chemical fertilizers are sufficiently applied. Grain yield can be increased only by 20-30% at maximum when local varieties are used. This yield increase can not meet to repayment of EPP credit. Recovery rate of EPP credit in the entire Oromia Region is as high as 97%, while 78% in the Meki area where EPP improved seeds are in short. This gap may be cased by incomplete EPP without improved seeds. Incomplete EPP without improved seeds is not recommendable to farmers unless farmers have their own good

seeds to use.

2) Weak financial status of farmers

Most of the farmers in the Meki area are at subsistence level. Their farming system cannot be profit-oriented due to lack of capital. Opportunities for access to credit schemes such as EPP and NGO are limited.

(3) Low post-harvest efficiency

1) Post-harvest loss

Post-harvest losses of grains are substantial especially during traditional threshing by oxen. Legs of oxen penetrate threshing plot and easily mix grains with soils and sands. As a result, grain quality is significantly degraded. Furthermore waste and urine directly thrown on grain decrease their quality.

2) Insufficient flour milling places

As mentioned in Chapter 3, there are only nine (9) flourmills registered in addition to a few more non-registered mills in the 54 PAs. Some villagers have to spend a long time to go to Meki town for milling.

(4) Low bargaining power against middlemen

About 70 % of grains produced in the Meki area are traded through middlemen, who make tacit agreement in price setting. Farmers have no financial margin to build up bargaining power and are forced to sell their farm products at asking prices.

(5) Frequent Drought Disaster

1) Limited and erratic rainfalls

Drought hazard is the most uncontrollable cause of crop damages, especially when recurrent dry spells occur during the reproductive stage of grain crops. Especially the western to northern lakeshore of Ziway is a chronically drought prone area. In this zone, crop failures have continuously occurred during the last 5 - 6 years.

2) Poor soils with low water holding capacity

Soils in the study area are originated from lacustrine deposits with medium to coarse texture, which are basically poor in plant nutrients and of low water holding capacity. Crop residues are rarely incorporated into soils and are often utilized as animal feed.

## 4.4 Constraints and Needs in Animal Husbandry

(1) Prevailing local breeds of low productivity

Cattle in the study area are not controlled and are mostly unimproved indigenous. Recognized breeds include Boran, which is renowned as a beef breed well beyond the boundaries of Ethiopia. In Oromia, the most common breed is Arsi, which is small and unproductive for milk. European breeds, especially Friesian and Jersey, have

been imported for many years and crossed with indigenous cattle in attempts to improve the productivity of the latter. However, the improved breeds are limited in number in the Region.

Almost all sheep and goat are indigenous types although several breeds have been identified. They have generally evolved under harsh conditions of health, nutrition and climate and their output is low. The national poultry flock comprises some about 99% indigenous birds that are mostly managed under a scavenging system with the remaining 1% being imported exotic breeds that are usually managed intensively.

(2) Shortage of forage crops

1) Low carrying capacity of natural grasslands

The problem of nutrition is exacerbated in the Meki area particularly due to overstocking although this may be mitigated to some extent by the access to grazing by the lakes and rivers in the dry season. Mortality of adult animals is low, despite poor herd health management, but mortality among young stock is high, calving rate in cows is poor, and growth in cattle is poor. At a stocking rate of an average of 0.25 TLU per ha against the carrying capacity of 0.13 TLU/ha, severe environmental degradation through, erosion, bush encroachment and loss of topsoil is inevitable, particularly in a fragile environment.

2) Shortage of managed pasture for intensified animal husbandry

Livestock raising can be intensified partially by zero-grazing system of production. This is only possible through a year-round supply of farm-grown forages, fed as green chop in the rains and as conserved forage through the year. The supply of high quality forage is possible only in this area through irrigation. However, the use of this system, together with the use of livestock which have been crossbred with exotic breeds, provides an opportunity for profit-oriented production. This can be achieved through dairy production. When profits are high enough, farmers would be less concerned with keeping unproductive livestock as insurance and would sell them to buy crossbred heifers. This reduces the number of cattle per herd even further.

Planting of improved pasture species in contours and suitable species in wetlands would involve community participation in preventing uncontrolled grazing on these areas until the grass is well established. Irrigation provides the potential for ruminant livestock development. Through irrigation, high yielding, good quality forages can be produced for year-round feeding. However, one should be careful in selecting the system of production that would likely to be successful in terms of profit, adoption by farmers, and sustainability.

(3) Frequent outbreak of animal diseases

The most prevalent disease outbreaks in Dugda Bora appear to be Anthrax, Black

Leg (Quarter Evil), Pasteurellosis and Lumpy Skin Disease in cattle; sheep and goat pox in sheep and goats and African Horse Sickness in horses. Tick borne disease only occurs infrequently probably due to the enzootic stability achieved in the indigenous population of livestock. Internal parasites are a major cause of mortality in this area because of the large population of animals that congregate around bodies of water during the dry season. Dosing is an essential activity, especially at the beginning and end of the dry season and especially in sheep and cattle. In poultry, Newcastle disease occurs sporadically but the most important cause of mortality in poultry is coccidiosis in young pullets or cockerels.

There is one veterinary clinic at wareda level and one health post, with ten veterinary crushes distributed around the wareda. This is grossly inadequate and according to the veterinary office, at least ten more health posts should be established around the wareda.

In particular, vaccination and dosing levels are totally inadequate. According to the veterinary office, prophylactic drugs and chemicals have become unreliable and costly. Recently, a cost recovery exercise commenced to allow better consistency in supplies. Spraying or applying acaricide with a soft cloth is carried out when tick burdens are heaviest, in the late rains, mainly to prevent damage to hides or severe loss in body condition.

(4) Lack of animal husbandry techniques suited to the Meki area

The research station of Adami Tulu undertake the livestock experiment focusing on feeds and nutrition, breeding for selection of suitable cross-bred, i.e. Boran and Jersey, and animal health under the local climatic conditions. In view of income generation by women, the study for the dairy farming techniques suited to women are commenced. In addition, selection of forage species is envisaged. Promising forage crops selected *are Lablab purpureus* and *Chloris Guyana*. Due to lack of extension staff and budgetary arrangement, these techniques are not fully transferred to local farmers.

(5) Farmer's low capacity

1) Farmer knowledge and interest

It is important to promote adoption and commitment of a production system which farmers are familiar with. In the Meki area, cattle feedlot with young steers is not a mode of production familiar to them, nor is goat milk, nor is lamb or mutton production. Modes of production that are in use are milk and egg production from cattle and hens, allowing a foundation of development on which to build.

2) Adopting new technologies

Farmers can be encouraged when it can be shown that a production system is very profitable and will not only bring significantly increased income to the farmer but at low risk and high sustainability. The main lessons to be learnt from previous projects,

i.e. SDDP, are that heavy imposed structures do not serve the best needs of the nation and are unable to continue after project financing is terminated, and incremental recurrent costs should be kept to a minimum. Although farmers can quickly adopt technologies that provide rapid and clearly perceived increased in production and profitability, the demonstration activities are very limited.

3) Irregular income

A production system can be more easily adopted when returns are by short term. Income from milk and eggs is regular and returns are regular and frequent (usually weekly). This is important when financial reserves are low and the farmer depends on a regular cash flow. Beef on the other hand is long term. It would take two years from birth of a calf before income can be realized from commercial production and if animal dies, there has been no return on the animal before that event.

4) Unstable marketing

There must be a ready and accessible market. In the Wareda, eggs, butter, cheese and milk are sold easily and the markets, namely Meki, Ziway, Ela, Ombole, and Alem Tena, are reachable within a morning by most farmers on market day. There is no market for goats' milk as this is not popular in this area, nor is there any market for young beef or lamb (lack of formal beef marketing in this area).

## 4.5 Environmental Degradation

(1) Increase of sediment loads in river water

The soils in the Meki area are extensive in the eroded, hilly and sloping areas. In the uppermost catchment area, over 90% of which lies in the Southern Region, erosion is observed to be serious as characterized by deep and wide gullies. The effect of erosion and the resultant sedimentation can reduce the efficiency of irrigation structures, increasing maintenance and operating efficiency and costs. Since erosion rates in the catchment area are unavailable, it is difficult to quantitatively assess sedimentation in the backwater flow at the proposed intake.

(2) Low water retention capacity of catchment

Oromia has about 3 million ha of forestry and it is estimated that about 50,000 ha to 100,000 ha of natural forests are lost annually due to shifting and commercial agriculture, fuelwood collection, forest fires etc. Virtually no extensive areas of undisturbed forest and wildlife habitat remain in the Meki area except for remnants of the original forests, i.e. "Podocarpus mixed forests". Only 11.3% of the Meki area are covered by bushlands. The annual incremental yields are only 1.2 $m^3$/ha for woodlands and 0.2 $m^3$/ha for bushlands. Due to the open access system, their harvest has exceeded their annual growth.

Few experiences exist in watershed management in the Meki area except in the 4 PAs,

where WFP has initiated soil and water conservation and gully stabilization project by organizing a watershed management team in each PA. It is estimated that the Meki area with a population of about 162,750 need to plant at least 9,765 ha to meet the current total demand of 146,475 – 195,300 $m^3$/year. The current afforestation activities are still far below its requirement.

(3) Deterioration of farm land

1) Difficulties in environmental conservation

Re-forestation of lands that have been severely denuded of browse trees by goats and sheep. Goats in particular are browsers and if trees were planted to prevent erosion in degraded areas and de-forested areas, goats would decrease grazing activity in preference for browse. This would reduce grazing pressure.

2) Decrease of arable and grazing lands caused by land degradation

Slope lands especially edges of terraces are severely eroded and incised by large gullies as a result of deforestation, over-grazing and irresponsible cultivation without awareness of soil conservation.

3) Soil salinity

Soil salinity is partially observed in the farmlands adjacent to the Ziway lake and causes physiological desiccation of plant growth and further detailed survey is required. Incorporation of organic manure is recommendable not only for improvement of soil fertility and but also for mitigation of salinity problems. However, crop residues are vital for feeding. Recycled residues are apt to reduce demand, which increases due to increase of livestock population under fragile environment in the central Rift Valley.

(4) Prevalence of water-born diseases

Due to lack of sanitary facilities and poor public concerns related to hygiene and nutritional availability, health conditions of the local people are under serious threat causing relatively high morbidity rates of diarrhea infections. As for vector borne parasitic diseases, malaria is the most prevailing disease in and around the Meki area. Bilharzia is also known to be present in the Meki area.

## 4.6 Low Development Incentives and Capabilities among Rural Communities

(1) Lack of awareness creation by the local government agencies

Awareness creation aims at advocacy for quality of life among community members. The government is responsible to tackle poverty alleviation by uniting the efforts in evaluating the past efforts among the communities and in planning new initiatives to solve common social problems. In order to promote solidarity, community would make attempt to identify their rules and traditional customs to accommodate each other. In the process, they would be aware of democracy in both form and content. There are no systematic approaches in the Meki area to finally envisage strengthening

solidarity and equity in their community. Insufficient participatory experts among the local government staff would be one of the most crucial constraints.

(2) Farmer's difficulty to access to public services

The system of decision making at community level is democratic. Each peasant is in a position to discuss the social and physical problems in and around their community. PA chairmen take responsibility to submit official request upward. Since the community meeting is not regularly held and attendants are limited, opinions of poverty groups including women and youth are hardly reflected to the meeting resulting in lower accessibility to public services for them.

(3) Discouraged farmers

In the Meki area, some of communities have been involved in the development projects, which were initiated by either donors or NGOs. The Meki-Ziway irrigation project is the most typical case. After the donor's assistance faded out, the responsibilities of project operation were transferred to the communities without sufficient skill training. As a result, the project performance currently remains far below the expectation of the donor. The Study identified that some of communities were discouraged by these negative experiences.

(4) Conventional society of rural community

Traditional societies in the Meki area are sometimes too conservative to embark on new development activities.

(5) Low participation caused by financial constraints

Due to low financial capability, peasants are often not able to participate in the community-based development, which forces each member to share group finance.

## 4.7 Insufficient Fulfillment of Basic Human Needs (BHN)

(1) Shortage of safe drinking water

In the district, main source for drinking water is underground water, level of which is almost the same around EL.1,620 m through the district. Thus in the mountain area, it is very difficult to fetch the water, while that is easier in lakeside. The number of water supply schemes managed by communities is 66, consisting of 45 boreholes, 16 shallow wells and 2 hand dug wells. Planned beneficiaries for the schemes amount to some 117,000. However, out of 66 schemes, 26 schemes are not functioning and 19 schemes need maintenance works. Over half of the windmill schemes are not functional, most of which were constructed under assistance of NGOs. The beneficiaries in the schemes pointed out that it was caused by lack of spare parts, and the bureau has taken no action for the repair.

It was also observed that some of schemes were abandoned due to water quality problems, such as a high concentration of fluoride and salinity. Such high fluoride

contents could cause dental and skeletal fluorosis. To eliminate the constraint, which is widely discussed in Rift Valley, it is suggested that surface water as alternative water source for domestic water could be sought in the study area.

(2) Stagnation of inter and inner transportation

There are six (6) major roads in the Wareda, which are categorized into 3 classes in accordance with its pavement, such as asphalt-paved road, gravel-paved road and unpaved road. In the Wareda, the total length of the paved roads is 97km. Some 40% of inhabitants living in the rural area seldom access to Meki and Alam Tena, which can be reached within 3 hours on foot. Their main transportation means include donkey, donkey cart and on foot. Footpaths are deteriorated in the rainy seasons resulting in not only time loss during transport but also serious damage of agro-products and other commodities.

(3) Insufficient health care service

Although the region has been putting emphasis on ensuring the primary health care, there are a limited number of health care facilities and health personnel. A large portion of the population neither has access to safe water nor sanitation facilities, which is afflicted by water-borne diseases. The major causes of morbidity are respiratory infection, malaria, skin infections, diarrhea diseases and intestinal parasitic infections.

The responsible of front line service for health care is under health department of wareda. There are i) health center (1), ii) district clinic (5), iii) private clinic (7), iv) health post (2) and v) drug store (10). A doctor and nurses are assigned to the health center, while health assistants mainly run clinics. A health post is managed by a community health worker with basic training in health and mid-wives. But the facility faces to budgetary and manpower problems in terms of number of staff and lack of training. In addition to the government service, in Alam Tena, the Catholic Church established a clinic in 1995. The number of patients visited the facilities in 1999 was reported to be 29,900 for first visit, and 31,900 for the repeated. The present condition of the health care service in the wareda suggest that of importance is to strengthen the health post, where is a front-line health care institution and awareness of the communities for preventive health care.

(4) Insufficient schools

Education plays a crucial role in the process of social and economic development. There are 27 primary schools and 3 junior high schools in the district for 17,232 pupils administrated by the wareda education department. There is only one senior secondary school that belongs to the Catholic Church.

In the wareda, other than government activities, UNICEF and NGOs are acting an important role in the education sector. UNICEF is conducting a capacity building programs to communities as well as school including awareness program to community, gender issue and children's right. NGOs manage a kinder garden,

construct a primary school and employ teachers, which are finally to be transferred to the government. With these efforts, drop out ratio of 27% in 1998/99 was drastically reduced to 18% in 1999/2000. On the other hand, enrollment of the primary and junior high schools are drastically increased, thus, requiring a commensurate increase in schools and school facilities. To make up the school facilities, 2 primary schools are under construction while one junior high school is being upgraded. Shortage of school facilities is still crucial.

## 4.8 Institutional Constraints

OIDA has directed every effort towards improvement and reinforcement of its institutional and organizational set-up since the official recognition in July 1999. OIDA is now entrusted with full responsibility for development of the irrigation sector in the Region. In view of project sustainability and appropriate resource use, the Study focuses on the institutional development of OIDA to meet the supporting requirements arising from the project implementation. The initial study identified the following constraints, which will be crucial for future adequate institutional and organizational operation of OIDA as well as the irrigation sector of the Region.

(1) Financial loads to be expanded by staff recruitment

The staff structure of OIDA is not yet fully developed but has expanded to meet urgent requirements at the zonal and district levels. Currently, OIDA has 720 staff including 211 at 69 districts level. There is a proposal to increase the district staff to 621 in accordance with the five-year irrigation development plan. Staff salary is the largest expenditure of the recurrent cost of OIDA and will be expanded further in the years to come. In-depth study and intensive monitoring will be required for optimum use of human resources to adjust staff salary and related cost implication within an acceptable range.

(2) Weak quality control in the direct force account project

Currently, OIDA carries out construction work of irrigation projects by applying two (2) modes, namely OIDA's direct force account and sublet work. IFAD provides the heavy equipment and vehicles together with the training program for OIDA to implement construction works. Construction Management Team is fully responsible for OIDA's direct construction works executed under the supervision of a Construction Supervision Team. The tasks of both teams are summarized below.

1) Construction Management Team (Construction Department) : To supervise construction work in general and occasionally take responsibilities for direct force account work

2) Construction Supervision Team (Study and Design Department) : To supervise progress, quality, cost, etc. and to issue approval for the completion of project works

This internal arrangement sometimes tends to make the responsibility on quality control of the construction vague at the field level. In addition, direct construction needs frequent supervision by construction teams of both the head and branch offices. This results in increasing the heavy burden on supervisory staff. In terms of strict quality and financial control, extended use of sublet method may be considered. Urgent review of this aspect will be required for OIDA, which is in a position to supervise the construction works as a client and owner of the projects. To rationalize the OIDA's scope of responsibilities, the study of the international rules, e.g. FIDIC, will be useful.

(3) Unnecessary gap between community development and agricultural extension

Two (2) departments of OIDA are responsible for soft components of irrigation development on frontline. They are as follows.

1) Community Participation Department : Coordinate community mobilization and organize WUAs
2) Irrigation Extension and Water Management Department : Implement extension works on irrigation farming including water management

The cadre and staff of Community Participation Department are mainly sociologists, while those of Irrigation Extension and Water Management Department are graduates from agricultural fields. There is an unnecessary gap between two activities of OIDA, namely community mobilization by Community Participation Department and extension of irrigation farming techniques by Irrigation Extension and Water Management Department. Although the immediate roles and specialties of two parties are different, their ultimate target is to contribute to "rural community". Coordination between two parties is urgently required for smooth flow of the project cycle.

(4) Needs for capacity building for watershed management works

Watershed Management Team under the Irrigation Extension and Water Management Department was organized at the OIDA HQs, while no staff is posted to branch offices and no activities are carried out. Participatory afforestation and other conservation measures are required for protecting watersheds from soil erosion.

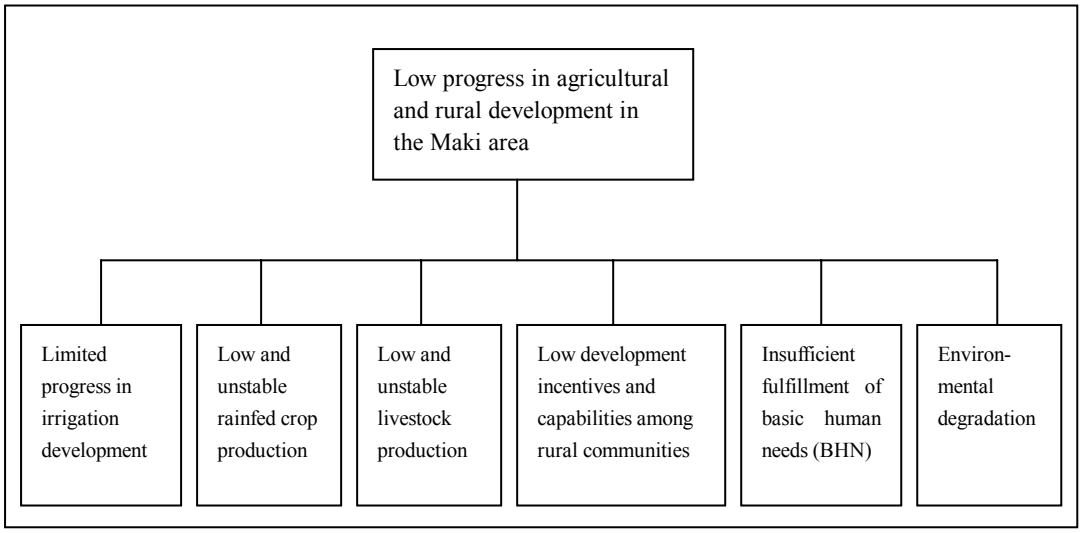
(5) Needs for communication facilities between head office and local offices

The communication between the head office and local offices is limited. Further consideration is required for closing this communication gap. The Study identified

urgent needs for regular visits and reporting system between the head office and local offices to exchange and share their information with each other. Shortage of communication facilities including vehicles is chronic constraints experienced by both head office and local offices.

## 4.9 Problem Tree

The Study Team prepared the problem tree taking all the information and lessons learnt through the above-mentioned studies into consideration. The problem tree is illustrated in Figure 4.9.1. All the constraints in the agricultural and rural development in the Meki area are categorized into six (6) direct causes as illustrated below.




The direct causes comprise (i) limited progress in irrigation development, (ii) low and unstable rainfed crop production, (iii) low and unstable livestock production, (iv) low development incentives and capabilities among rural communities, (v) insufficient fulfillment of basic human needs (BHN) and (vi) accelerated environmental degradation. Although the magnitude of the impact on the core problem can not be quantified, the problem tree shows nearly all the problems.

As seen, some of problems are derived from underlying sociological causes including non-organized community activities and institutional weakness rather than physical factors. Therefore, particular attention has been paid to both physical causes and the background to those causes so as to identify proper solutions.

# CHAPTER 5 WATER RESOURCES POTENTIAL AND CONSTRAINTS

## 5.1 Basic Approach for Water Source Development

The agriculture activities in the study area have been constrained by erratic rainfall, resulting in low and unstable productivity. In order to relieve the areas from the above circumstances, it is crucial to aim at a new water source development so that the land can be fed with water extensively.

There are two types of irrigation scheme; one is a pump irrigation scheme, and another is a gravity type irrigation scheme, in which water is abstracted by a diversion weir or a dam. As past lessons learnt from existing medium- and large-scale pump schemes it has been proved, that farmers' in these schemes could not afford the operation and maintenance cost, which have led to unsatisfactory performance of the schemes. It is obvious that a gravity type irrigation scheme has more advantage than a pump irrigation scheme in terms of scheme sustainability.

The basic approach for formulation of the water source development plan is as follows:

a) New irrigated area shall be fed by the gravity irrigation scheme, for which water source is the Meki river,
b) The possibility to construct a diversion weir or a dam on the Meki river shall be studied,
c) A water balance model in the river basin shall be set, taking present water demand and existing hydrological data into account, and
d) A water balance study shall be conducted so as to estimate an irrigable area, setting some development alternatives.

## 5.2 Candidate for New Water Sources

As discussed in the previous chapter, the Meki river is considered a candidate for new water sources. Hydrological analysis was made for the river as shown in section 3.1.4. The Meki river has an annual runoff as much as 290 million $m^3$ year. The river also is featured by a considerable annual variation in runoff, reflecting rainfall pattern in its upstream reach. At the gauging station at Meki town, its mean monthly discharge is 9.2 $m^3/s$, with a minimum monthly discharge of 0.90 $m^3/s$ in December, whereas it is 30 $m^3/s$ in August. It suggests that the Meki river could be expected as a new water source with double cropping irrigated cultivation if a dam with a regulatory capacity is constructed. In other words, construction of a diversion weir may contribute mainly for supplemental

irrigation in the rainy season.

The Study Team conducted the field investigation to seek locations of the water source facility, such as the diversion weir and the dam. The identified locations of the water resources are presented in Figure 5.2.1.

### 5.2.1 Proposed Diversion Weir Sites

Through the field investigation, two candidate sites for the diversion weir are identified on the Meki river. The alternatives for diversion weir sites are called "upstream plan" and a "downstream plan".

One candidate site as the upstream plan is located approximately 2 km upstream of the confluence point of the Meki river and Deke Neki river. The site is composed of tuff. The river cut a steep sided valley 30 to 40 m deep, forming a v-shaped valley with almost vertical or 1: 0.1 to 1: 0.2 side slopes. The average gradients of the Meki river is 1/60, and the riverbed elevation is El. 1,710.0 m. Height of the weir would be 20 to 30 m from the river bed for the diversion of water. Further, since the site is located upstream, a head reach canal to convey water to the commanding area would be long, and deep-cut rock excavation works will be needed. The plan with the diversion weir ensures to irrigation of high-elevated lands in the study area.

The another site the downstream plan is located approximately 2.5 km upstream of Meki town. The river has cut a steep sided narrow gorge of 10 to 20 m deep. The average gradients of the Meki river is 1/500, and the riverbed elevation is El. 1655.0 m. Height of the weir would be 10 m from the riverbed. As the site is composed of lacustrine deposits, special attention would be paid for its foundation treatment and upstream river training to ensure stability of the river course. This plan will make sure to irrigate land mainly below Meki town.

### 5.2.2 Proposed Dam Site

The proposed dam site is located 48 km upstream of the Ziway Lake. The Meki river flows down on the plateau, forming a 30-40 m deep v-shaped valley with a width of about 1,000 m. The average gradient of the river is 1/600, and the riverbed elevation is El. 1,760.0 m. The abutments at the site is characterized by a steep slope with almost vertical or 1: 0.1 to 1: 10. Taking the topographic condition into consideration, it is possible to construct a dam with a height of 40m at the maximum.

The proposed dam site is covered by quaternary deposits specially pyroclastic deposits, such as welded tuffs, welded lapilli tuffs with a less percentage of unwelded tuff and scoriaceous basalts, overlain by lacustrine deposits.

Results of the standard penetration test data depicted that majority of the subsurface soils are in dense or hard state, ranging from 50 to 100. It can be said that the bearing capacity of the foundation is satisfactory for construction of the dam. The water pressure tests are carried out in the sound rock layer of the boreholes to assess water tightness of the foundation. Results of the tests indicated that the permeability coefficients are found at the range of $10^{-4}$. Series of an impermeable rock were not observed on the abutments up to the depth of 20m. A clue based on the obtained tests results the need for large-scale foundation treatment, which could result in a rise in the construction cost of the dam.

## 5.3 Water Balance Study

The study area in rift valley is prone to drought because of erratic nature of rainfall. The supplemental irrigation is one the means to minimize drought risk and sustain small holders agricultural production. The construction of the dam and the diversion weir on the Meki river are alternatives for irrigation of the study area. The diversion weir or dam will regulate the river water and supply water to the project area. The Meki-Ziway-Abijata sub-basin is important in the rift valley in terms of potentials for water resources exploitation. However, the lakes and rivers have an interconnected system and the constraints for water resources are complex. Therefore, the diversion of water from the Meki river will affect the water recharge of Ziway lake, which can lead to change in outflow to Bulbula river and will ultimately affect water level of the Abijata lake. Therefore, the water resources development of the basin requires a judicious planning for protection of the fragile eco-system.

The objectives of the preliminary water balance study are to determine the optimum development scale for the irrigation area under the project and to maximize the irrigation benefits without significantly affecting the environment of the lakes system.

The water balance study linked with the Meki-Ziway-Abijata system was carried out under alternative cases (i) proposed dam and (ii) diversion dam on the Meki river. Based on the results of the water balance study, the evaluation of the potential irrigation area in the Meki Irrigation Project is made under the alternative conditions. The water balance model is formulated from the conceptual diagram (Figure 5.3.1) of the water resources system that includes the Meki river, Ziway, Abijata lake and a dam to supply the water to the new area, the procedure of the study and results are described in the following sections.

### 5.3.1 Irrigation Requirement

(1) Cropping Pattern

Two alternative cropping patterns are considered for water balance study. Cropping pattern 1 with 105% cropping intensity is taken for diversion weir scheme, while 195% is taken for dam irrigation scheme due to introduction of 5% perennial fruit crop. The commencement date for main rainy season crops is taken as 11 June for maize and haricot bean and 1 July for wheat and fruit. The staggered period of planting is taken as 30 days for rainy and dry seasons. In addition, non-irrigation periods before harvesting were set up to be 20 days. The cropping area is presented in the following table.

**Cropping Pattern**

| Cropping Pattern | Cropping Intensity | Cropping Area (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Wet Season Crops | | | | Dry Season Crops | | | |
| | | Maize | Haricot B. | Wheat | Fruit | Wheat | Maize | Vegetables | Pulse |
| 1. | 105 | 33 | 30 | 35 | 2 | 2.5 | - | 2.5 | - |
| 2. | 195 | 30 | 30 | 35 | 5 | 28.5 | 28.5 | 9.5 | 28.5 |

(2) Diversion Water Requirements

The Diversion water requirements are calculated for 10-day intervals using the methodology described in FAO Irrigation Drainage Paper 24, 25 and 46. The overall irrigation efficiency is taken as 44.2%. The monthly diversion requirements per 1000 ha for cropping intensity of 105% and 195% are presented in the following table.

**Diversion Water Requirements**

| Cropping Intensity | Diversion Water Requirement (MCM/1000 ha) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
| 105% | 0.15 | 0.12 | 0.19 | 0.17 | 0.12 | 0.67 | 0.93 | 1.28 | 2.22 | 1.13 | 0.08 | 0.05 | 7.11 |
| 195% | 1.93 | 1.74 | 3.03 | 2.37 | 0.55 | 0.74 | 0.94 | 1.24 | 2.17 | 1.15 | 0.14 | 0.12 | 16.12 |

The peak diversion requirement for 195% cropping intensity is 1.32 l/s/ha during the month of February.

### 5.3.2 Elevation-Storage Capacity

The elevation-storage and elevation-area curves of lakes are based on the curves used in previous reconnaissance study carried out by Halcrow & Partners Ltd. The bathymetric survey data is available only on the Ziway lake. The elevation-storage-area curves of the Ziway lake and Abijata lakes are presented in Figure 5.3.2. The elevation-storage and elevation-area curve of the proposed dam is determined, based on the available topographical map and shown in Figure 5.3.2.

### 5.3.3 Water Balance Model

The water balance model is formulated based on the conceptual diagram of the water resources system that includes one storage/diversion dam, 3 lakes, and 5 rivers to supply water to the irrigation areas and Abijata Soda-Ash Enterprise. The computation of the water balance is performed on a monthly basis for a period of 21 years from 1979-1999. The operation of the combined Meki, Ziway and Abijata system is simulated using a water balance model whereby the change in reservoir storage is equal to inflow minus outflow equals change in storage.

### 5.3.4 Data Used

The monthly data of rivers' discharge and lakes' water levels related to this study are available from 1979 to 1999. Therefore, this period of 21 years from 1979 to 1999 is selected for the simulation study. The monthly data of river discharge, monthly lake water level, monthly rainfall, monthly diversion requirements, storage characteristics of lake and dam are used in the water balance study.

### 5.3.5 Case Study

Simulation study was carried out for the following four cases:

Case 1 : Diversion Weir constructed on the Meki river
Case 2 : Dam of 30 m height is constructed on the Meki river
Case 3 : Dam of 35 m height is constructed on the Meki river
Case 4 : Dam of 40 m height is constructed on the Meki river

The details of cases are summarized in the following table.

**Case Study**

| Case | Condition | Cropping Intensity (%) | Storage Capacity of Dam (MCM) | Dead Storage of Dam (MCM) |
|---|---|---|---|---|
| 1. | Diversion Weir | 105% | - | |
| 2. | Dam (30 m height) | 195% | 78 | 25 |
| 3. | Dam (35 m height) | 195% | 125 | 25 |
| 4. | Dam (40 m height) | 195% | 170 | 25 |

## 5.4 Results of the Study

(1) Cropping Intensity

The river discharge as well as rainfall is significantly low during December and January, therefore with diversion scheme reliable water flow is not available for the irrigation area during the period. Therefore, only 5% of the area for second cropping period could be irrigated from January, which is the start period of the Belg season (short rain season). The cropping intensity of 105% or 2,300 ha could be irrigated with the diversion scheme. However, the 195% cropping intensity is also possible with the dam scheme due to regulation of the river flow.

(2) Potential Service Area of the Meki Irrigation Project

The viability of the results of the water balance study is measured by the reliability, and effect on the downstream lakes and rivers. The definition of reliability is the number of times the dam/weir is able to supply the reservoir demand over the total period of operation. In the case of an irrigation system, a failure to supply for a one month period will mean loss of crop or reduction in yield. Reliability of 80% is adopted for determination of the potential irrigation area. The potential irrigation area is determined at 80% reliability under four alternative cases and presented in the following table.

**Potential Irrigation Area**

| Case | Condition | Cropping Intensity (%) | Potential Area (ha) | Total Irrigation Area (ha) | Reduction in Meki Flow to Ziway Lake (%) |
|---|---|---|---|---|---|
| 1 | Diversion Weir | 105 | 2,300 | 2,415 | 5.4 |
| 2 | Dam H=30m | 195 | 4,700 | 9,165 | 29.7 |
| 3 | Dam H=35m | 195 | 8,000 | 15,600 | 48.4 |
| 4 | Dam H=40m | 195 | 9,400 | 18,330 | 57.1 |

The results of alternatives study show that 2,300 ha of area can be irrigated with 105% cropping intensity with a diversion scheme. Dam scheme can irrigate larger area with 195% cropping intensity, from 4,700 ha for 30 m dam height to 9,400 ha for 40 m dam height. However, dam scheme will cause substantial reduction in Meki river flow to the Ziway lake, from 29.7% for 4,700 ha to 57.1% for 9,400 ha. The reduction in inflow to Ziway lake will result in reduction in water level of the lake and that will lead to a reduction in Bulbula river outflow and the Abijata lake's water level. The effect on downstream water resources system is discussed in the following sections.

(3) Effect on Ziway Lake Storage

The effects of the Meki river water diversion on the downstream water resources system under different alternatives are presented in the following table.

**Effect of Meki River Water Intake on Downstream Lakes and Bulbula River**

| Case | Condition | Reduction in Ziway Lake Storage (%) | Reduction in Outflow to Bulbula River (%) | Reduction in Abijata Lake Storage (%) | Reduction in Abijata Lake Area (%) |
|---|---|---|---|---|---|
| 1. | Diversion Weir | 1.6 | 8.0 | 5.1 | 2.0 |
| 2. | Dam H=30m | 10.3 | 42.5 | 25.9 | 10.6 |
| 3. | Dam H=35m | 19.6 | 66.4 | 37.5 | 17.1 |
| 4. | Dam H=40m | 24.2 | 76.3 | 41.3 | 20.1 |

The results show that Ziway lake storage will reduce by 1.6% with diversion scheme. However, it will reduce by 10.3% with a dam of 30 m height and by 24.2% with a dam of 40 m height. The increase in dam height causes more reduction in storage of the lake due to increase in water for irrigation and also increase in storage capacity of dam. A large reduction in storage of the lake with the dam scheme can cause increase in salinity of the lake and will have some impact on existing pumping schemes on the Ziway lake. Moreover, reduction in the Ziway lake storage also has a significant impact on the outflow to the Bulbula river.

(4) Effect on Outflow to Bulbula River

The reduction in the Bulbula river flow under different alternatives is shown in the previous table. The results show that diversion weir will cause 11.3% reduction in the Bulbula flow, however, the dam scheme will cause much reduction in flow; from 42% to 76% under various dam heights. It can be seen from results that the effect of dam schemes on the Bulbula outflow is significant compared to that of Ziway lake storage reduction. The seasonal reduction in the Bulbula outflow is shown in Fig 5.4.1. It shows the Bulbula river flow with dam scheme will decrease to nearly zero during the period from April to July. There are several irrigation schemes on the Bulbula river, they may also face some problems with decreased discharge. Moreover, the Bulbula river is also used for domestic water supplies along its length from the Adami Tulu to Abijata lake, they may face water problems during dry period. The Bulbula river recharges the Abijata lake and it provides more than half of total inflow into the Abijata lake. Therefore, the decrease in the Bulbula river discharge will also affect the fresh water flow to Abijata lake. Therefore, the effect on the outflow to the Bulbula river is critical in the determination of the potential irrigation area as it has direct effect on the decrease of the water level of the Abijata lake.

(5) Abijata Lake

The reduction in the Abijata lake storage and area is shown in the previous table. The results show a reduction of 5.1% in storage with diversion scheme and from 26% to 41% with dam schemes. The results also show that dam scheme can have

significantly impacts on the water level of the Abijata lake. The reduction in water level can cause increase in the alkalinity of the lake, which may affect the birds such as Pelican and Flamingo. These are rough estimate to show the possible environmental impacts on the Abijata lake as the storage characteristics of the Abijata lake is assumed based on the previous study. However, for more precise estimate a bathymetric survey of the lake is essential to determine the water level, area and storage's relationship of the lake.

Moreover, larger dam heights significantly reduce the outflow to the Bulbula river and thereby, it will have significant affect on the water level of the Abijata lake. The reduction in fresh water will increase the alkalinity of the Abijata lake. The Abijata lake provides a feeding ground for Pelican, Flamingo and other birds, so that bird life is also influenced by the reduction in water storage

## 5.5 Conclusions and Recommendations

The following conclusions are made based on the water balance study results:

1. Any new irrigation development or expansion of the existing system on the Bulbula river could have serious environmental impacts on the Abijata lake as well as the downstream reach of the river.
2. Irrigation development with diversion weir scheme mainly for wet season on the Meki river will have less adverse environmental impacts.
3. There is a possibility of development of 2,300 ha area with gravity irrigation for 105% cropping intensity on the Meki river.
4. The expansion of the Abijata Soda Ash Enterprise can cause reduction in water level of the lake, therefore its impacts should be carefully studied before any expansion.

The result of the water balance study revealed that irrigation development plan with the dam will have significant environmental impacts on the river basin.

Further, as indicated in section 4.2.2, it is predicted that construction of the dam needs the large-scale foundation treatment resulting in raising the cost.

It is, therefore, concluded that the plan with the diversion weir is adopted aiming at supplementary irrigation in the study area. The expected irrigable area is shown in Figures 5.5.1 and 5.5.2.

Recommendations on the future water resources development are as follows.

1. There is a need to monitor the Bulbula river discharge downstream of the Adami Tulu station and to set the maintenance flow to the Abijata lake based on the ecological requirements.
2. There is also a need to monitor the water use of various irrigation projects

located on the Ziway lake and Bulbula river and to develop water rights for each scheme.

3. A comparative study is recommended to decide where to locate the diversion weir. The study includes geological investigation of the site, river morphology study on the Meki river, route survey for the headreach, and so on. Based on the results an optimum option is to be adopted taking into consideration technical and economic viewpoints.

# CHAPTER 6 THE MASTER PLAN

## 6.1 Basic Concepts

### 6.1.1 General

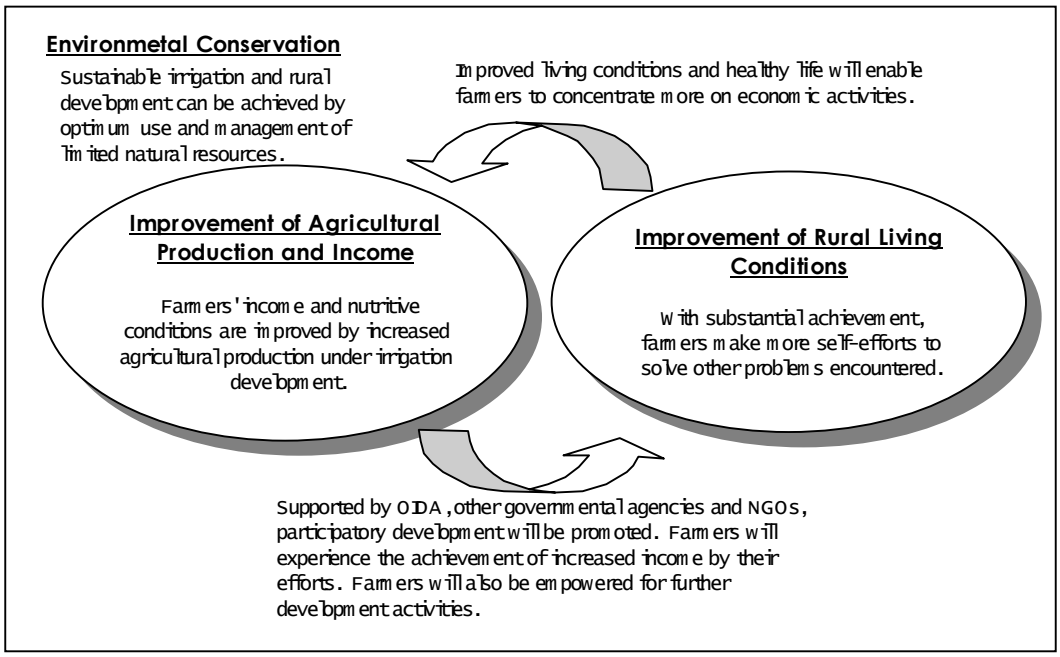
The Study aims at formulation of a master plan for the Meki Irrigation and Rural Development Project. The plan formulation has been directed around the following three basic concepts.

1) Integrated development
2) Sustainable development
3) Model development

The background of each of three concepts is spelled out below.

### 6.1.2 Integrated Development

Poverty problems widely range with the complex structure of cause-effect relationships. In other words, several approaches will be required for solving even a single problem. For instance, overload of domestic work such as fetching water and pounding maize grains, tends to reduce working hours for farm works. This causes insufficient crop maintenance and results in low crop yield and consequently low farm income. This implies needs of "holistic approach", in which a crop yield improvement project and a rural water supply project should be simultaneously implemented under one programme. The concept of an integrated development is thus derived.




Integrated Development Concept

Due to limited financial resources, however, it is crucial for both the government and a community to select the most effective project, which can quickly contribute to poverty alleviation. In the Study, the priority is attached more to profit-oriented agricultural development and income generating projects. Farmers can be more empowered by increased income through the development. Empowerment of farmers thus initiated will direct them to further initiatives for more development. Increased income will enable farmers to make more efforts for improvement of "quality of life" and the cycle illustrated above.

In addition, the environmental conservation is a prerequisite for sustainable development especially within the fragile environmental conditions of the Rift Valley system. The Meki area falls in the semi-arid zone of which ecology is susceptible to environmental changes and would be often irreversible by drastic changes. For instance, intensive irrigation farming with saline water will accelerate accumulation of soluble salts in soils resulting in crop damages. It is crucial to avoid such degradation processes by knowing soil conditions and water quality.

The Study firstly concentrated on in-depth analyses of the natural conditions of the Meki area. Secondly, constraints and potentials were carefully assessed from the viewpoint of optimum use of land and water resources. Finally, all the information and analytical results were incorporated into the master plan for sustainable development in the Meki area.

The watershed management is another important aspect of sustainable development. Over-grazing and deforestation in the upstream areas of the Meki riverbasin are major causes of high content of sediment loads in the river water, which is adversely affecting the ecology of the Ziway lake. Irresponsible land use including deforestation has to be controlled so as to reduce river sedimentation in the downstream areas and prolong a project lifetime when irrigation projects will be implemented. The watershed conservation program is also prepared within the framework of the Study.

### 6.1.3 Sustainable Development

Project performance is often minimized after donors and NGOs are phased out at the completion of project implementation. The project sustainability is one of the important aspects to be discussed when a project is formulated.

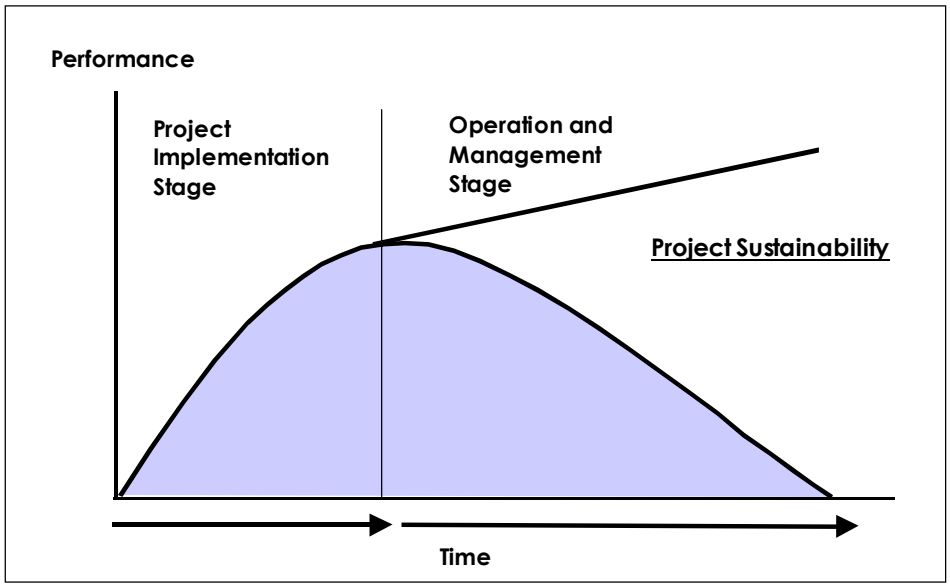
For instance, inadequate technical plan and design of irrigation facilities will finally result in rapid deterioration of facilities and technical difficulties in O&M. This directly increases the O&M cost and occasionally the necessity for rehabilitation within a few years. This means that the farmers are loaded with the heavy burden of O&M when the project scheme is handed over to them by from the government.

Apart from technical and financial issues, the project sustainability is often highly

dependent upon sociological aspects including maturity of consensus among the community. Farmers have different interests and problems depending on their natural and social conditions. Even within a community, farmers have different problems and conflicting interests. It is highly important to verify the interests of farmers so as to formulate a more beneficial and sustainable project for them. This is why "bottom up approach" is undertaken for community based development.

In principle, the Project is planned and to be implemented by initiatives and self-efforts of farmers. The government is to support such farmers' efforts by infrastructure development, which is too costly to realize only by farmers' financial sources. The project sustainability is dependent not only upon farmers' empowerment (capability to solve the problems facing them) but also upon the logistic supports. Capacity building for both the government and community is another essential input to enhance project sustainability. To enhance project sustainability, two approaches should be emphasized; (i) capacity building of the government staff directly and indirectly involved in the project management and (ii) community awareness and empowerment with training. The well-balanced combination of these inputs will help in achieving the project objectives.

Necessary actions for all these aspects should be considered during the project implementation stage. The concept of sustainable development is illustrated below.

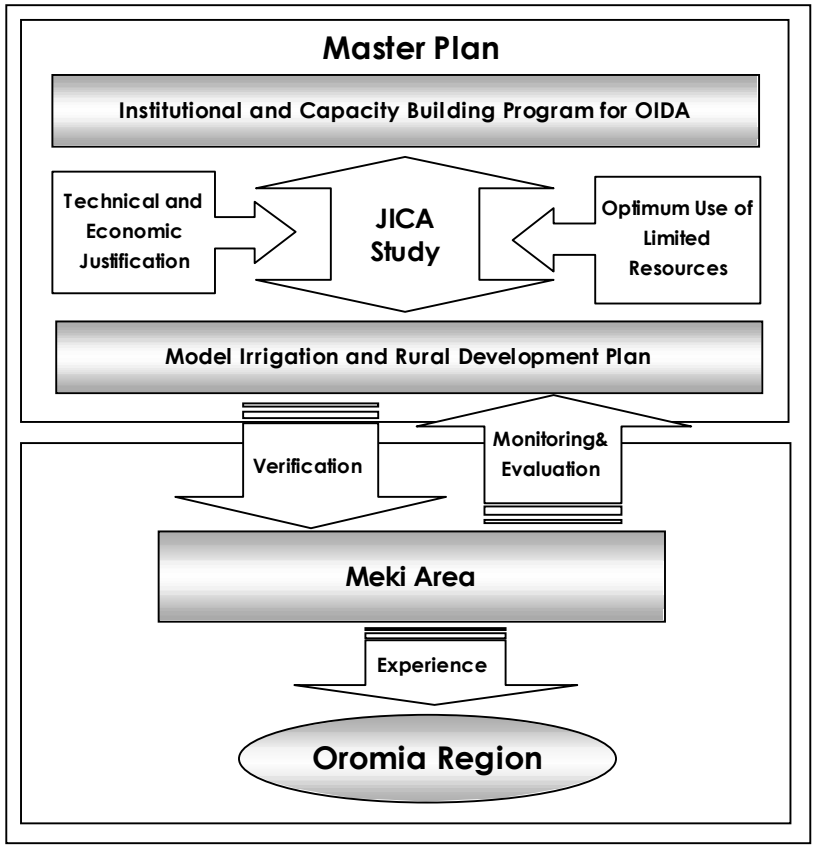



Sustainable Development Concept

To learn from local experiences and identify needs among communities more precisely, all the possible tools have been fully applied throughout the Study.

### 6.1.4 Model Development

Since the Meki area is located at 130 km south of Addis Ababa with easy access, the Project is envisaged as a model scheme to demonstrate the performance of the development activities. Experiences in the Meki area are expected to be applied to other zones and waredas in the Oromia Region as illustrated below.




Model Development Concept

In order to achieve such an important objective, all the steps of the Study have been carefully executed by selecting standardized study procedures and methodologies. In this regard, the verification study in the Phase 2 of the Study is an extremely important step to confirm viability of the master plan and to verify unforeseeable conditions. At the final stage, all the results of the verification study will be incorporated into the master plan for its modification and elaboration.

## 6.2 Development Approaches

The attempts have been made for identification of development approaches on the problem tree in Figure 4.9.1. The followings are selected development approaches.

**a. Irrigation Farming Promotion Approach**

a.1 Irrigation planning and monitoring capacity building sub-approach

a.2 Operation and maintenance reinforcement sub-approach

a.3 Participatory small-scale irrigation development sub-approach

a.4 Irrigation farming techniques improvement sub-approach

**b. Rain-fed Agriculture Improvement Approach**

b.1 Farming techniques optimization sub-approach

b.2 Optimized farming techniques extension sub-approach

b.3 Farm inputs supply sub-approach

b.4 Post-harvest techniques optimization sub-approach

b.5 Price-setting improvement sub-approach

b.6 Supplemental irrigation water supply sub-approach

**c. Animal Husbandry Modernization Approach**

c.1 Improved breed introduction sub-approach

c.2 Forage production promotion sub-approach

c.3 Veterinary services supporting sub-approach

c.4 Animal husbandry techniques optimization sub-approach

c.5 Optimized animal husbandry techniques extension sub-approach

**d. Environmental Conservation Approach**

d.1 Watershed management sub-approach

d.2 Farmland conservation sub-approach

d.3 Environmental education promotion sub-approach

**e. Capacity Building Approach**

e.1 Local government staff training sub-approach

e.2 Community leaders training sub-approach

e.3 Community awareness creation sub-approach

e.4 Off-farm income generation for women and landless farmers sub-approach

**f. Rural Infrastructure Development Approach**

f.1 Rural drinking water supply sub-approach

f.2 Rural roads development sub-approach

f.3 Rural primary health care promotion sub-approach

f.4 School construction sub-approach

The primary target group of the Project is “small farmers in the Meki area”, who are below the poverty line. All approaches mentioned above are expected to provide solutions to the problems stipulated on the problem tree and contribute towards poverty alleviation directly or indirectly.

## 6.3 The Master Plan

### 6.3.1 Plan Period

The master plan aims at directing all the development efforts to the ultimate objectives, i.e. food security and poverty alleviation, along the long-term strategy. With realistic sense, the Study defined a plan period to be the next decade of 2001-2010.

The master plan will be implemented within the macro-framework of the Five Years Development Programmes of the Oromia State Government. The development investment and recurrent budgetary arrangement are to be optimized within the Programmes. In order to facilitate the project implementation and its budgetary arrangement, the master plan period is tentatively split into two (2) phases, which are coincident with two (2) five-year programmes, i.e. Phase-I for 2001-2005 and Phase-II for 2006-2010. The project selection was made for the entire period of 2001-2010, while the action plan is to be prepared only for the Phase-I period of 2001-2005.

It is noted that the Meki area is rather in better conditions in terms of existing rural infrastructure. It is envisaged to optimize the government investment and avoid expansion of socio-economic gaps between the Meki area and other rural areas of the Region by intensive investment in the Meki area. It seems that infrastructure development in Meki area cannot be prioritized at least for the coming 10 years of the master plan in comparison with that of other areas of the Region.

### 6.3.2 Project Selection

The 21 projects were preliminarily formulated as presented in Table 6.3.1 to meet the requirement verified through the analysis of the development approaches. As aforementioned, the rural infrastructure development is excluded from the master plan. The selected 21 projects selected are listed below and their outlines are summarized in Table 6.3.2. The details of the projects are stipulated in Attachment 2.

1. **Irrigation Development Programme**
   - 1-1 WUA Support Programme
   - 1-2 Meki Irrigation and Rural Water Supply Project
2. **Rain-fed Agriculture Improvement Programme**
   - 2-1 Semi-Arid Farming Improvement Project
   - 2-2 Community Seed Bank Project
   - 2-3 Post-Harvesting Techniques Improvement Project
   - 2-4 Community Pond Project
3. **Animal Husbandry Modernization Programme**
   - 3-1 Demonstration Unit Project
   - 3-2 Forage Production Project
   - 3-3 Improved Breed Promotion Project

**4. Environmental Conservation Programme**

4-1 Environmental Monitoring Programme

4-2 Seedling Center Project

4-3 Watershed Management Programme

**5. Capacity Building Programme for OIDA and Wareda Staff**

5-1 OIDA Engineers Training Programme

5-2 OIDA Community Development Experts Training Programme

5-3 Wareda Staff Training Programme

5-4 Community Resource Mapping Project

**6. Community Development and Cooperative Promotion Programme**

6-1 Community Leader Training Programme

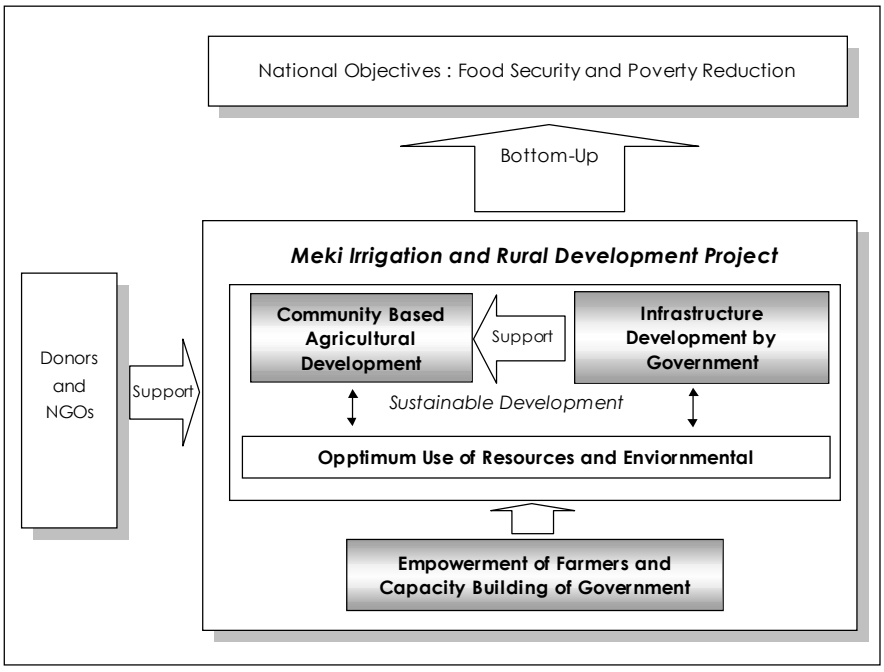
6-2 Visioning Workshop Programme

6-3 Drinking Water and Nutritional Improvement Programme

6-4 Community Center Project

6-5 Grain Bank Promotion Programme

The master plan will be carried out by either single project or combination of the projects among the 21 projects. The basic structure of the project implementation is illustrated below.




Basic Structure of Implementation of Master Plan

The 21 projects can be categorized into three (3) components. The community-based agricultural development is the main component supported by infrastructure development by the government. Both activities are sustainable by human factors,

namely empowerment of farmers and capacity building of the government staff. Donors and NGOs are supporters for implementation of the master plan.

## 6.4 Preliminary Assessment of Project Priority

The project priority is assessed on a preliminary basis in order to set up the tentative implementation schedule. The selected 21 projects were qualitatively evaluated in terms of the following factors.

1) Contribution to project objectives, namely food security and poverty alleviation.
2) Urgency among rural communities
3) Technical adaptability of OIDA
4) Technical adaptability of Bureau of Agriculture
5) Technical adaptability of farmers
6) Fund requirement
7) Time requirement
8) Duplication with on-going projects
9) Social risk
10) Environmental impact

The results of the analysis are presented in Table 6.4.1. According to the preliminary analysis, the priority was given to such projects as the semi-arid farming technical improvement project, the WUA support programme, the environmental monitoring programme, the seedling center project, the community leader training programme, the visioning workshop programme for farmers empowerment, and the drinking water and nutritional improvement programme.

The quantitative project evaluation will be made from technical, economic, financial, environmental and sociological points of view. The results will be presented in the Draft Final Report.

## 6.5 Implementation Schedule

Taking into consideration the preliminary analysis on the project priority, the implementation schedule of the master plan is tentatively prepared as presented in Figure 6.5.1.

## 6.6 Preliminary Consideration of Financial Arrangement

### 6.6.1 Ethiopian Social Rehabilitation and Development Fund (ESRDF)

The master plan consists of 21 projects mentioned above. Suitable fund sources for the implementation of the master plan should be a flexible multi-sector development

fund. In this regard, the existing nationwide development fund, namely ESRDF, is the ideal source.

In parallel to the SDPs, the ESRDF was established in February 1996 under the initiatives of IDA. This fund aims at financing multi-sector poverty reduction projects and programs. As of December 2000, the ESRDF has disbursed US$ 88 million, out of US$ 153 million earmarked from donors, for 1,740 projects consisting of 891 water supply and sanitation, 386 education, 340 health, 25 small-scale irrigation and capacity building and training since its establishment. So far about 5 million poor people were covered by the ESRDF projects. Other activities including agriculture, environment protection and income generation are also to be covered by support of the fund in future.

The major beneficiaries of the fund are rural communities, which are expected to participate not only in labour and material contribution but also in decision making, cost sharing and overall ownership of the projects. With a concept of decentralization, the fund management is entrusted to the national board and the regional steering committees.

### 6.6.2 Oromia Rural Development Fund (ORDF) for Community-Based Agricultural and Rural Development Projects

(1) Objectives

The ESRDF has contributed largely to the development of such components as drinking water supply, education, primary health care and roads. In contrast, the irrigation sector is less promoted with financial assistance from ESRDF due to its funding conditions.

Successful irrigation projects are highly dependent upon: (i) rigid ownership of a project by community (WUA); (ii) financial arrangement for O&M at initial stage; and (iii) skillfulness of irrigation farming by water users. The community mobilization is utmost important for the above-mentioned. In addition, the irrigation projects in Ethiopia should be integrated with environmental conservation activities. Capacity building of OIDA and Bureau of Agriculture is urgently required at national, zonal and wareda levels, respectively. Integrated approach will be required under one scheme consisting of technical and financial assistance.

The Oromia Rural Development Fund is proposed to implement the following five (5) projects selected under the M/P.

1. Irrigation Development Program
   1-1 WUA Support Program
2. Rain-fed Agriculture Improvement Program
   2-3 Post-Harvesting Techniques Improvement Project
   2-4 Community Pond Project
3. Animal Husbandry Modernization Program

3-1 Demonstration Unit Project

4. Environmental Conservation Program

4-3 Watershed Management Program

(2) Basic Concepts

In order to promote community-based development, especially for irrigation development [1-1], the funding conditions should be carefully studied. A development fund more suited to agricultural and rural development should have the following conditions.

1) Fund should be more accessible for poverty groups including womens' groups

2) Revolving fund formation in a saving bank account during the construction period – the initial O&M cost will be allocated from the fund.

3) Participation in environmental conservation activities is a preconditions.

4) Training and capacity building should be linked with facility development.

5) Frequent monitoring by the Fund should be carried out to identify any problems arising from a project.

Fund will also be suitable for community (cooperative) activities including pond construction, mini-flourmills procurement and dairy farming.