No.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

OROMIA IRRIGATION DEVELOPMENT AUTHORITY (OIDA)

THE STUDY
ON
MEKI IRRIGATION AND RURAL DEVELOPMENT PROJECT
IN
OROMIA REGION, ETHIOPIA

VOLUME III : APPENDIX X
VERIFICATION STUDY

MARCH 2002

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LIST OF REPORTS

Volume I	**Main Report**
Volume II	**Sector Studies**
Appendix I	Socio-Economy and Institutions
Appendix II	Meteorology and Hydrology
Appendix III	Agriculture
Appendix IV	Animal Husbandry
Appendix V	Agricultural Support System
Appendix VI	Irrigation Development
Appendix VII	Rural Infrastructure
Appendix VIII	Environmental Assessment and Watershed Management
Appendix IX	Project Evaluation
Volume III	**Verification Study**
Appendix X	Verification Study

CURRENCY EQUIVALENTS

US$ 1.00 = Ethiopian Bir 8.577 = ￥121 as of 23rd November 2001

The Study
on
Meki Irrigation and Rural Development Project
Oromia Region, Ethiopia

Appendix X

Verification Study

Table of Contents

List of Tables

List of Figures

List of Attachments

* * *

Chapter 1

General

CHAPTER 1 GENERAL

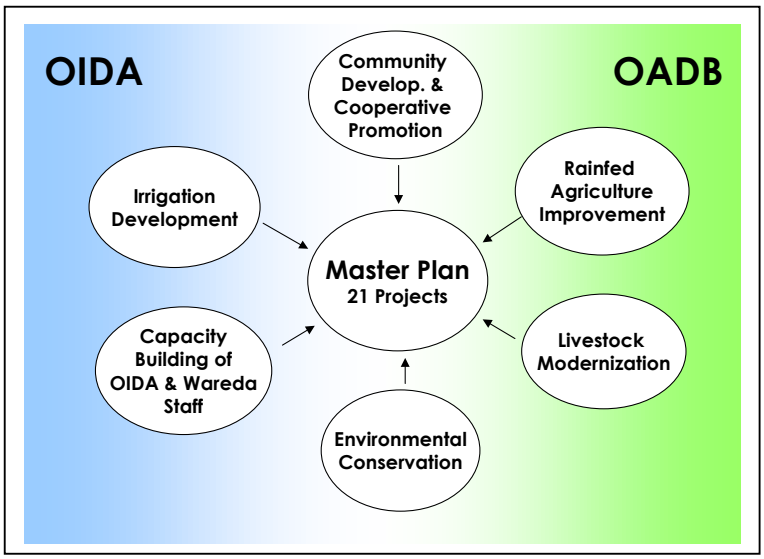
1.1 Authority

The Study on the Meki Irrigation and Rural Development Project (hereinafter referred to as "the Study") is currently undertaken pursuant to Clause VI of the Scope of Work (the S/W) agreed upon between Oromia Irrigation Development Authority (OIDA) and the Japan International Cooperation Agency (JICA) on 28th March, 2000.

Within the framework of the Study, the Verification Study (the V/S) was carried out through the Phase-II Study from May to November 2001 according to the S/W. The JICA Study Team proposed six (6) programs for the V/S. The objectives and activities for each of the six (6) programs were discussed and agreed in the Steering Committee meeting held on 8th March 2001.

1.2 Objectives

The Master Plan is composed of six (6) components as illustrated below.

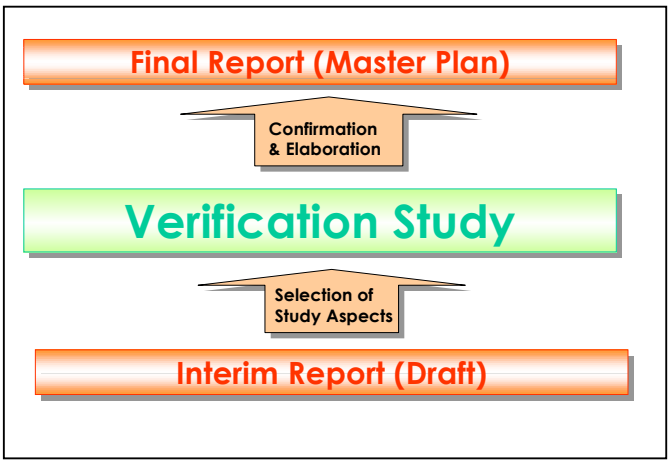


Mater Plan Components

Under six (6) components, 21 projects were preliminarily formulated as stipulated in the Interim Report submitted in March 2001. The anticipated implementation agencies of the proposed 21 projects are to be not only Oromia Irrigation Development Authority (OIDA) but also Oromia Agricultural development Bureau

(OADB). Especially for improvement of rain-fed agriculture and livestock sectors, OADB will play a key role. Moreover, community development and environmental conservation are to be promoted by both OIDA and OADB.

The S/W directed the Study to examine technical and financial viability of the draft Master Plan and to select pilot activities (study aspects) for the V/S as mentioned in Clause V of the S/W. All the results of the V/S will be incorporated into the final Master Plan in Draft Final Report to be submitted in March 2002. The objectives of the V/S can be summarized as illustrated below.



Objectives of Verification Study

The V/S is expected to provide a lot of valuable information for confirmation and elaboration of the Mater Plan. In addition, the V/S is envisaged to contribute to the capacity building for the government staff, who will play key roles in the implementation of the Mater Plan in future and the direct benefits to target groups through the implementation of the V/S.

1.3 Verification Study Programs

1.3.1 Selection Criteria of Verification Study Programs

The V/S programs were selected under the following conditions.

(1) Pilot projects to confirm viability of the priority projects among 21 projects and identify unforeseeable constraints for their elaboration

(2) Pilot projects to contribute effectively to the capacity building of OIDA and OADB for future smooth implementation of the Master Plan

(3) Pilot projects to be completed within definitive time period, i.e. six (6) months from May to November 2001, for earlier commencement of the actual Master Plan

1.3.2 Selected Programs

The following six (6) programs were selected for the V/S.

Selected Verification Study Programs

No.	Verification Study Program	Agency
1.	Training of analytical methodology for water resources development	OIDA
2.	Establishment of management information system of the OIDA irrigation schemes	OIDA
3.	Environmental monitoring – irrigation water use in the Meki area	OIDA
4.	Preparation of guideline for formation and operation of water users associations (WUA)	OIDA
5.	Community resource mapping	OADB
6.	Preparation of extension tools and research program for the Meki area	OADB

1.4 Organization Set-up

1.4.1 Executing Agencies

The six (6) programs were carried out under the responsibilities of OIDA and OADB as presented in the above-mentioned table. OIDA wss responsible for Programs 1 to 4, while OADB undertook Programs 5 and 6.

All the study activities were performed by both agencies in collaboration of the JICA Study Team. The assignment schedules of the JICA experts are illustrated in Figure X.1.1.

1.4.2 Program Coordinators

OIDA organized the counterpart team consisting of one (1) Leader and four (4) Program Coordinators. The organizational set-up for execution of the V/S is illustrated in Figure X.1.2. The profiles of the counterpart team members are presented in Table X.1.1. All four (4) programs were carried out under the control of both Team Leaders of the JICA Study Team and the OIDA counterpart team. Under

them, four (4) Program Coordinators took direct responsibility for day-to-day operation of four (4) programs in parallel.

OADB organized the counterpart team consisting of one (1) Team Leader and two (2) Program Coordinators. The organizational set-up for execution of the V/S is illustrated in Figure X.1.3. The profiles of the counterpart team members are presented in Table X.1.2. Both programs will be carried out under the control of both Leaders of the JICA Study Team and the OADB counterpart team. Under them, two (2) Program Coordinators took direct responsibility for two (2) programs individually.

1.4.3 Participants and Target Group for Capacity Building

The participants of the V/S amounted to 96 persons from OIDA and OADB. Apart from the government staff, the rural communities were also involved in Participatory Rural Appraisal (PRA) and other related meetings. The total numbers amounted to 63 households of Shubi Gamo PA and some 100 households of three (3) PAs, namely Tuchi Sumeyan, Korke Adi and Sori Dolesa.

(1) OIDA

Program 1 : 12 hydrologists consisting of 4 from head office and 2 from each of four (4) branch offices (Table X.1.3)

Program 2 : 12 irrigation engineers consisting of 4 from head office and 2 from each of four (4) branch offices (Table X.1.4)

Program 3 : 7 irrigation engineers consisting of 2 from head office, 2 from central branch office and 3 from the wareda office (Table X.1.5)

Program 4 : 12 community development experts and social workers consisting of 4 from head office and 2 from each of four (4) branch offices (Table X.1.6)

(2) OADB

Program 5 : 31 OADB staff consisting of one (1) community development expert of OADB HQ, three (3) wareda staff and 27 Development Agents (DA) (Table X.1.7). The 27 DAs were fully involved in the V/S.

Program 6 : 31 OADB staff consisting of one (1) extension training officer of OADB HQ, three (3) wareda staff and 27 Development Agents (DA) (Table X.1.8)

1.5 Study Activities and Major Events

The V/S was commenced on 30th May 2001. The study activities for each of six programs were carried out in parallel by the joint operation of the JICA Study Team and the Counterpart Teams. Apart from day-to-day study activities including ad-hoc meetings and field surveys, the V/S organized the following workshops, intensive training and educational tour.

Major Events of Verification Study

Date	Program	Activity	Participants (No.)
June 21 - 22	1	Workshop on Hydrological Analysis	10 OIDA engineers
June 21 - 22	1	Workshop on Hydrological Analysis	10 OIDA engineers
June 25 - July 5	1	Intensive Training on Hydrological Analysis	5 OIDA engineers
June 26	5	Community Resource Map Workshop	40 SMSs and DAs
July 5 - 6	4	Workshop on Community Development	9 OIDA Social Workers
July 6	5	Community Resource Map Workshop	40 SMSs and DAs
August 9 - 10	4	Illust Meeting at Shubi-Sombo	74 villagers
August 16	1～4	PDM Workshop (OIDA)	10 OIDA staff
August 17	1～4	Interim Appraisal Workshop (OIDA)	34 OIDA staff
August 22	5 & 6	Interim Appraisal Workshop (OADB)	40 OADB staff and DAs
August 27 -29	5 & 6	Educational Tour to Research Centers	30 OADB staff and DAs
August 28 -30	2	Visit to Eastern Branch Office (Harar)	5 OIDA staff
September 5 - 6	2	Visit to Western Branch Office (Nakamte)	8 OIDA staff
September 12 - 13	2	Visit to Southern Branch Office (Robe)	4 OIDA staff
September 24	6	Extension Materials Workshop	30 DAs
October 10	4	Site Visit of the Minister of Embassy of Japan	10 OIDA staff
October 15	4	Commencement of construction (Shubi & Sombo)	10 OIDA staff
November 8	4	Site Visit of H.E. Japanese Ambassador	20 OIDA staff
November 21	1～6	Steering Committee Meeting on Progress Report (2)	

Table X.1.1 Appointment of Program Coordinators for Verification Study Programs 1 - 4 (OIDA)

No.	Proposed Position for V/S	Office	Name	Current Position	Educational Background	Work Experience with OIDA (years)
1.	Chief Counterpart	HQ	Mr. Teshome Atnafie	Deputy General Manager & Head Planning and Design Departmrent	MSc. Soil&Water	13.90
2.	Program Coordinator - 1	HQ	Mr. Abera Shiferaw	Team Leader Survey and Design Departmrent	MSc. Hydology	6.30
3.	Program Coordinator - 2	HQ	Mr. Teshome Lemma	Design Engineer Survey and Design Departmrent	BSc. Irrig. Eng.	9.25
4.	Program Coordinator - 3	HQ	Mr. Sileshi Getahun Hailu	Head, Irrig. Extension & Water Management Department	MSc. Agr. Eng.	10.00
5.	Program Coordinator - 4	HQ	Mr. Berhanu Hirpo	Team Leader Coomunity Mobilization	MSc. Economics	14.00

Table X.1.2 Appointment of Program Coordinators for Verification Study Programs 5 & 6 (OADB)

No.	Proposed Position for V/S	Office	Name	Current Position	Educational Background	Work Experience with OADB (years)
1.	Chief Counterpart	HQ	Kebede Woldegiyorgis			
2.	Program Coordinator - 5	HQ	Benti Shomina	Oromia Soil Laboratory Center Coordinator	BSc.	15 years
3.	Program Coordinator - 6	HQ	Mohamed Yeqin	Acting Team Leader of Extension Team	BSc. + 6 months	17 years

Table X.1.3 OIDA Hydrologists/Engineers to be Trained under Program 1

No.	Office	Name	Current Position	Educational Background	Work Experience with OIDA (years)
1.	HQ	Abera Shiferaw	Hydrologist	MSc.Degree	6.3
2.	HQ	Haile Moya	Hydrologist	MSc.Degree	7.7
3.	HQ	Tesfaye Deribe	Irrigation Engineer	MSc.Degree	10.0
4.	HQ	W/Mariam Shewa	Hydraulic Engineer	MSc.Degree	15.4
5.	Cenral Branch	Tesfaye Abebe	Irrigation Engineer	BSc.Degree	6.0
6.	Cenral Branch	Girma Nigussie	Irrigation Engineer	BSc.Degree	6.0
7.	Eastern Branch	Habtamu Emiru	Agricultural Engineer	BSc.Degree	5.0
8.	Eastern Branch	Asnake Teshome	Hydrologist	Diploma	9.0
9.	Western Branch	Tulu Nemera	Irrigation Engineer	BSc.Degree	5.3
10.	Western Branch	Chali Edessa	Agricultural Engineer	BSc.Degree	6.3
11.	Southern Branch	Feleke Gerbi	Agricultural Engineer	BSc.Degree	6.0
12.	Southern Branch	Mekonnen Zekarias	Irrigation Engineer	MSc.Degree	7.0

Table X.1.4 OIDA Engineers Participating in Program 2

No.	Office	Name	Current Position	Educational Background	Work Experience with OIDA (years)
1.	HQ	Girma Asfaw	Irrigation Engineer	BSc.Degree	7.0
2.	HQ	Dagnachew Alemu	Irrigation Engineer	MSc.Degree	8.2
3.	HQ	Teshome Lemma	Irrigation Engineer	BSc.Degree	9.3
4.	HQ	Bifa Bedhadha	Agricultural Engineer	BSc.Degree	17.0
5.	Cenral Branch	Debebe Mekuria	Irrigation Engineer	BSc.Degree	5.0
6.	Cenral Branch	SisayFekadu	Irrigation Engineer	BSc.Degree	6.0
7.	Eastern Branch	Zewdu Tafese	Agricultural Engineer	BSc.Degree	12.0
8.	Eastern Branch	Belete Akele	Agricultural Engineer	BSc.Degree	8.0
9.	Western Branch	Takele Wakjira	Agricultural Engineer	BSc.Degree	13.0
10.	Western Branch	Dereje Adeba	Agricultural Engineer	BSc.Degree	10.5
11.	Southern Branch	Kedir Lole	Agricultural Engineer	BSc.Degree	5.0
12.	Southern Branch	Abomsa Kebede	Agricultural Engineer	BSc.Degree	4.0

Table X.1.5 OIDA Engineers and Experts Participating in Program 3

No.	Office	Name	Current Position	Educational Background	Work Experience with OIDA (years)
1.	HQ	Seyoum Gatachew Tesfa	Irrigation Water Manegement Engineer	M.E. Irrigation Water Manage.	8
2.	HQ	Sileshi Getahun Hailu	Head, Irrigation Extension & Water Management Department	MSc. Agr. Eng.	10
3.	Cenral Branch	Kebede Mingistu Feleke	Irrigation Expert	BSc. Agr. Eng.	15
4.	Cenral Branch	Kefiyalew Bekele Tola	Irrigation Extension	BSc. Agr. Eng.	12
5.	Dugda Bora Wareda	Mengistu Bose Jiru	Head, Wareda Office	BSc. Agr. Eng.	5
6.	Dugda Bora Wareda	Sisay Abdisa Merga	Irrigation Water Manegement Expert	BSc. Agr. Eng.	2
7.	Dugda Bora Wareda	Ahimad Abdulahi	Extension Expert	BSc. Agr. Extesi.	6
8.	Dugda Bora Wareda	Dejane Bekele	DA OIDA	Diploma	4

Table X.1.6 OIDA Sociologists and Social Workers Participating in Program 4

No.	Office	Name	Current Position	Educational Background	Work Experience with OIDA (years)
1.	HQ	Birhanu Hirpo	Community Mobilization Team Leader	MSc. Economics	14
2.	HQ	Abdulahi Ahmed	Training Team Leader	BA Management	26
3.	HQ	Motuma Hayile	Expert	BA Sociology	14
4.	HQ	Mamitu Tolera	Expert	BA Economics	7.8
5.	Cenral Branch	Admasu Debele	Community Mobilization Team Leader	BSc. PSIR	20
6.	Cenral Branch	Mahamed Abda	Expert	Diploma in Plant Sciences	9
7.	Eastern Branch	Abdul Hamid Mohamed	Expert	Diploma in Accounting	20
8.	Eastern Branch				
9.	Western Branch	Daniel Gudata	Community Mobilization Team Leader	Diploma RESD	15
10.	Western Branch	Bekelech Gobbu	Expert	12+6 Months	15
11.	Southern Branch	Tuna Usman	Expert	12 Class	7
12.	Southern Branch	Yahiya Aman	Expert	BA Sociology	8

Table X.1.7 OADB Experts Participating in Program 5

No.	Office	Name	Current Position	Educational Background	Work Experience with OADB (years)
1.	HQ	Benti Shomina	Community Development Expert	BSc.	15
2.	HQ				
3.	HQ				
4.	Dugda Bora Wareda	Tamirat Tefera	Head of Bureau - Dugda Bora Wareda	12+2	13
5.	Dugda Bora Wareda	Worku Nigeta	Soil & Water Conservation Exper	12+2	15
6.	Dugda Bora Wareda	Shumi Negesu	Soil & Water Conservation Co-co Forestry Expert	12+2	8
7.	Dugda Bora Wareda	Sharafadin Hasen	Planning & Program	12+2	16

Note : List of 27 DAs in Dugda Bora Wareda is attached hereto.

Table X.1.8 OADB Experts Participating in Program 6

No.	Office	Name	Current Position	Educational Background	Work Experience with OADB (years)
1.	HQ	Mohamed Yeqin	Extension Training Officer	BSc. + 6 months	17
2.	HQ				
3.	HQ				
4.	Dugda Bora Wareda	Tamirat Tefera	Head of Bureau - Dugda Bora Wareda	12+2	13
5.	Dugda Bora Wareda	Birhane Glutedin	Agronomy Expert	12+6 months	20
6.	Dugda Bora Wareda	Akililllu Bogale	Horticulture Expert	12+2	5

Note : List of 27 DAs in Dugda Bora Wareda is attached hereto.

The Study for
Meki Irrigation and Rural Development Project
in Oromia Region, Ethiopia

Japan International Cooperation Agency

Figure X.1.1
Assignment Schedule of the Team in Phase II Study

Expertise	Name	Phase II Study											
		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Team Leader / Organization & Institution	Masayuki KOYAMA		29						23		(15)		
Irrigation and Rural Infrastructure	Takuya IGAWA		29			23		11	23		(15)		
Agriculture and Soils	Zetsugaku KURITA				14				23				
Hydrology and Water Use	Brijesh K. MEHTA			14	10								
Agricultural Support System	Masayoshi SHIBATA			14			6						
Project Evaluation	J. Kakinuma JIN				31	18		30	15				
Coordination	Yoshikazu ANDO			5		23							

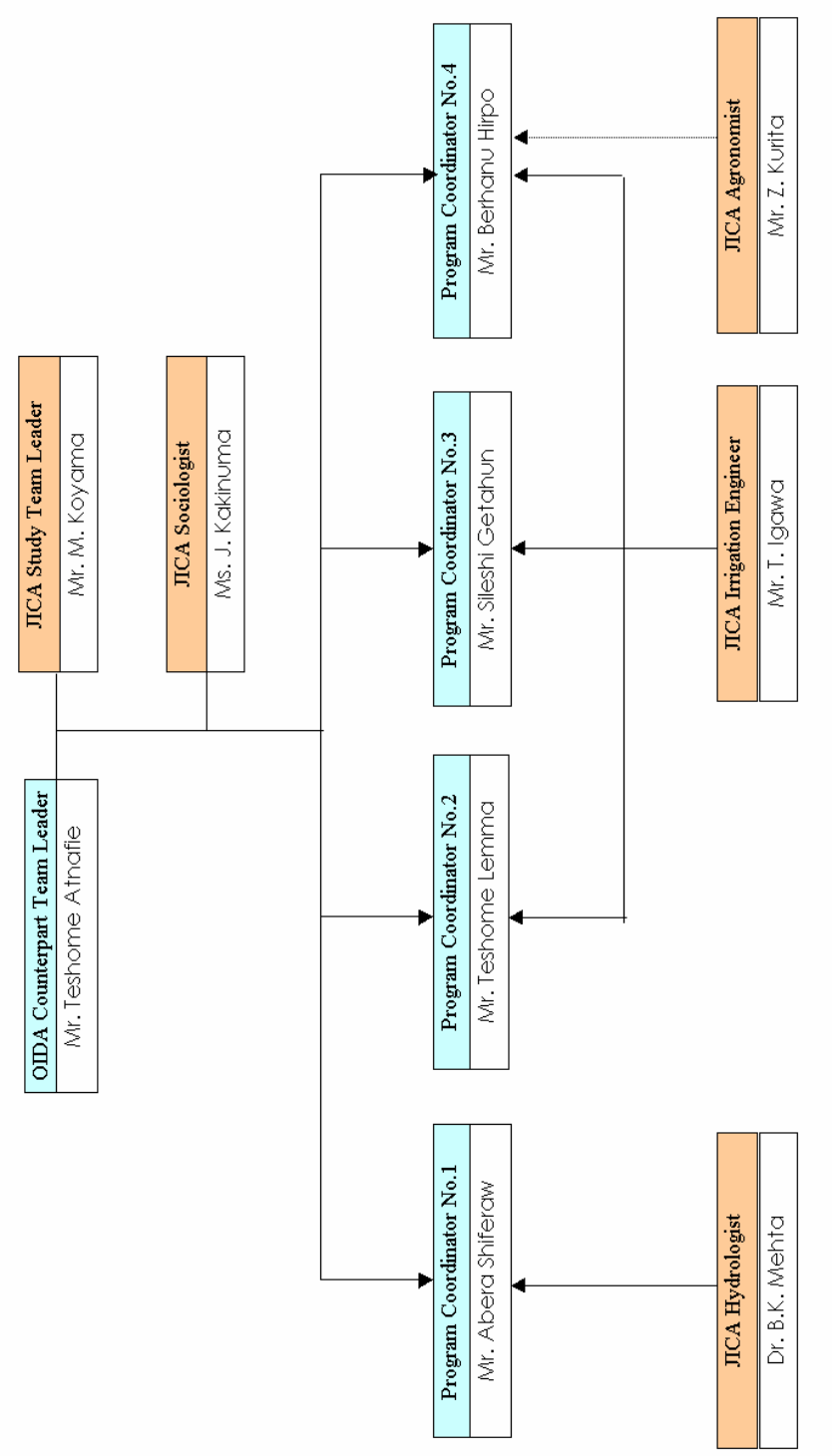


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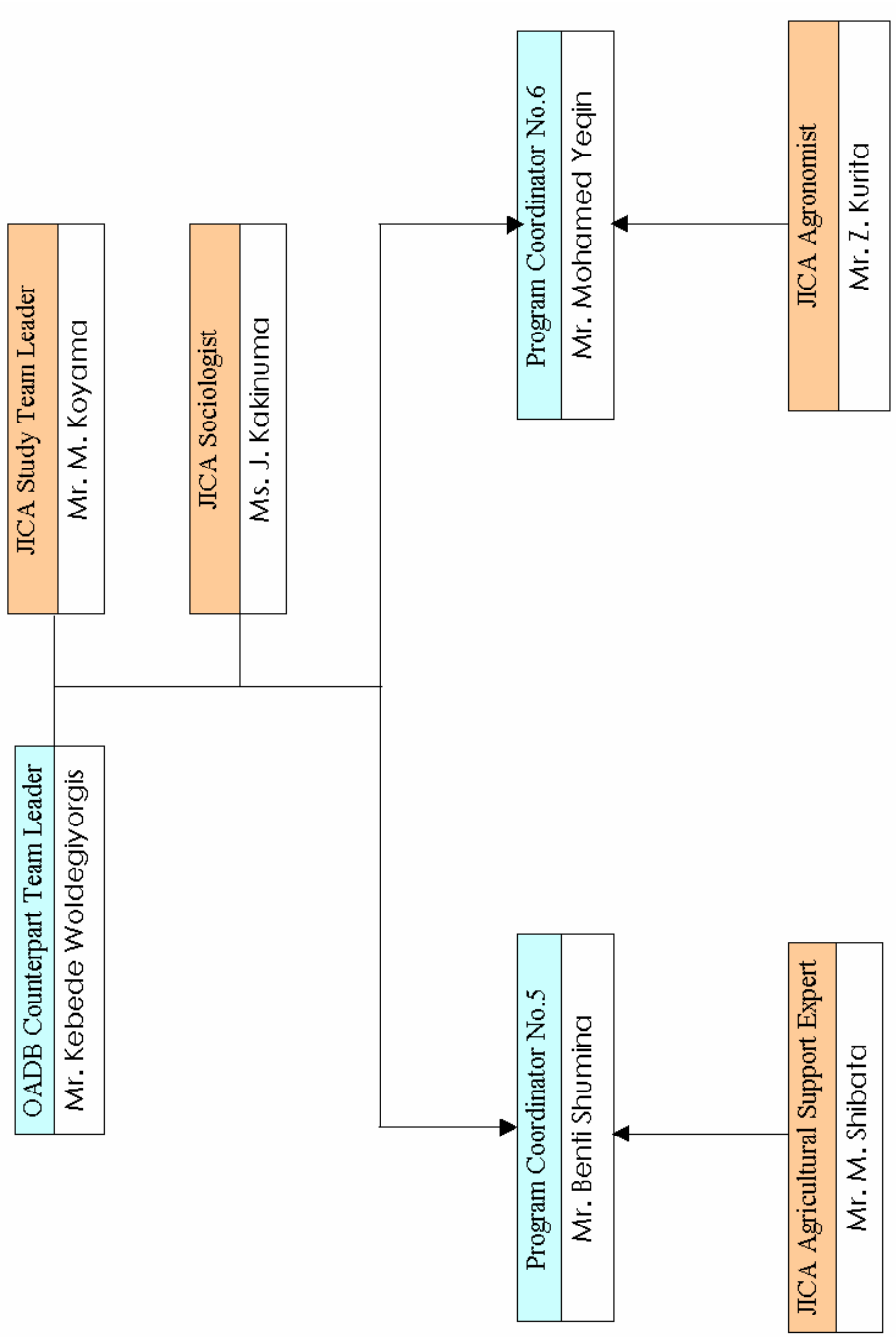
Figure X.1.2

Organisation Chart for Verification Study - Programs 1 to 4



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in Oromia Region, Ethiopia

Japan International Cooperation Agency

Figure X.1.3

Organisation Chart for Verification Study - Programs 5 and 6

Chapter 2

Program 1 of Verification Study

Training of Analytical Methodology for Water Resources Development

CHAPTER 2 TRAINING OF ANALYTICAL METHODOLOGY FOR WATER RESOURCES DEVELOPMENT

2.1 Introduction

2.1.1 General

Program 1 aimed at execution of training of analytical methodology for water resources development. The training program consisted of the two (2) days workshop for the hydrologists and engineers of OIDA head office and branch offices and two (2) weeks intensive training program for selected engineers and hydrologists.

The data collected through the Phase I of the Study in September to December 2000 were used for explaining various methodologies of hydrology analysis such as regression, correlation and probability analysis, crop water requirement calculation and other methods. The technical training included both theory and practical exercise. Technical notes on methodology were distributed to trainees. Microsoft Excel and other software were used for demonstration of various hydrological calculation procedures as well as data management methodologies.

2.1.2 Objectives

The objectives of Program 1 are:

(1) To determine the baseline, namely the present capability and knowledge of the existing OIDA engineers on analytical hydrology for irrigation development,

(2) To optimize realistic targets to meet the tasks of OIDA,

(3) To select effective training programs necessary to fulfil the gap between (1) and (2) mentioned above, and

(4) To finalize [5-1] OIDA Engineers Training Program proposed under the Draft Mater Plan.

2.1.3 Plan of Operation

The training program for capacity building on analytical hydrology was included (i) general workshop for all engineers and hydrologists and (ii) intensive training program on analytical methodology of hydrological analysis for selected engineers/hydrologists.

(1) Workshop on Analytical Hydrology

The workshop on Analytical Hydrology was conducted for two days and this was

attended by 10 engineers/hydrologist of OIDA of which seven engineers were from branch offices. The basin model developed in the JICA Study phase I for water balance study and results of the study were explained. The data needed for various calculations were discussed and methodology of the model was also explained. The questionnaire survey was carried out to determine the present knowledge and their requirements for the training. The use of computer for data analysis was demonstrated and practiced by trainees. Computer aided probability analysis, crop water requirement analysis and water balance analysis were explained and practiced by engineers.

(2) Intensive Training Program on Analytical Hydrology

The Intensive Training Program was conducted for the selected four (4) engineers from the head office and one engineer from the branch office. In this training program, hydrological analysis procedures were explained in detail, therefore, engineers who are really carrying out hydrological analysis for planning or other purposes and stationed at the head office or who had master degree were selected. The technical training consists of (i) theory lectures on analytical methodology, (ii) data management and analysis methods, and (iii) use of computer software for data management and hydrological analysis.

2.2 Workshop on Analytical Hydrology

2.2.1 Participants

The workshop on Analytical Hydrology was conducted for two days and this was attended by 10 engineers/hydrologist of OIDA. Total 10 persons had participated in the workshop of which 7 persons were from the branch offices and the rest were from the head office of OIDA. The basin model developed in the JICA Study phase I for water balance study and results of the study were explained. The use of computer for data analysis was demonstrated and practiced by trainees. Computer aided hydrology methods were explained and practiced by engineers. Four computers were used for the exercise, 2 to 3 participants shared each computer. The baseline survey was carried out to determine the present status of analytical hydrology knowledge and their immediate requirements for the training. The list of participants and their background is presented in Table X.2.1.

Table X.2.1 Participants of Workshop

No.	Name	Position	Office	Technical Qualification	Experience (Years)
1	Abera Shiferaw	Hydrologist	HQ	MSc	6
2	Tesfaye Deribe	Irrigation Engineer	HQ	MSc	15
3	W/Mariam Shoa	Hydraulic Engineer	HQ	MSc	10
4	Tesfaye Abebe	Irrigation Engineer	Central Branch	BSc	6
5	Girma Nigussie	Irrigation Engineer	Central Branch	BSc	6
6	Habtamu Emiru	Agricultural Engineer	Eastern Branch	BSc	5
7	Tulu Nemera	Irrigation Engineer	Western Branch	BSc	5
8	Chali Edessa	Agricultural Engineer	Western Branch	BSc	5
9	Feleke Gerbi	Agricultural Engineer	Southern Branch	BSc	5
10	Mekonnen Zekarias	Irrigation Engineer	Southern Branch	MSc	7

2.2.2 Presentation of Meki-Ziway System Water Balance Study

The basin model of Meki-Ziway-Abijata system and its methodology was explained in the workshop. The water balance study, which was carried out during the last year by JICA Study Team, was presented. The whole process of the study from data collection to the results was explained to understand each step of the study. The data needed for various calculations were discussed and methodology of the model was also explained. The presentation helped the participants to understand the process of the water resources assessment and the results of the water balance study to understand present conditions of the water resources in the Rift Valley lakes. The discussion on the presentation was also carried out to clarify the queries or doubts of the participants. The participant raised several questions and discussion was fruitful.

2.2.3 Questionnaire Survey

The baseline survey was carried out to determine the present knowledge and their requirements for the training. The participants required to fill questionnaire on the participants' present hydrological analysis knowledge, technical experience, computer knowledge, problems in hydrological analysis and their needs for technical training. The questionnaire survey helped in evaluating the present status of the OIDA engineers and hydrologist and planning the training according to their present qualifications and requirements. The questionnaire from used for the survey is presented in Attachment X-1.

2.2.4 Results of Questionnaire Survey

The ten persons attended the workshop and answered the questionnaire. Four (4) of them had master degree while others had bachelor degree in engineering. The average technical experience of trainees was 7.2 years. Only few of them had earlier experience in using computer. The technical background of the participants is summarized in Table X.2.2.

Table X.2.2 Technical Background of Trainees

Description	No. of Trainees
Technical degree	Master degree = 4 persons Bachelor degree = 6 persons
Technical Experience	Average experience = 7 years
Computer Knowledge/Experience	Some experience = 4 persons No experience = 6 person
Technical Position	Hydrologist = 2 persons Irrigation Engineers = 8 persons

The analytical hydrological experience of the participants varies from person to person according to their technical background and present position. The design engineers of branch offices had some experience in analysis of crop water requirements, while they had not experience in rainfall analysis and flood analysis. The participants had not experienced in estimating missing data or correlation and regression analysis. Participants were interested in data management, estimating of missing data, crop water requirements and flood analysis. The hydrological analysis experience of OIDA engineers is summarized in Table X.2.3.

Table X.2.3 Hydrological Analysis Experience

Hydrological Method	Some Experience	No Experience
Rainfall Analysis	2	8
Regression and Correlation Analysis	0	0
Frequency/ Probability Analysis	6	3
Flow Analysis	8	2
Crop Water Requirements	9	1
Flood Analysis	2	8

2.2.5 Technical Topics for Workshop

The technical training topics for the workshop were decided taking into consideration the engineers' background and their priority. The most of the engineers/hydrologist have no knowledge and experience in using computer and interested to have training in data management and analysis and crop water requirements analysis. Therefore, on first day it was decided to provide basic knowledge of computer and computer use for data analysis. The technical topics of training program were as follows:

Day 1: Introduction to Computer System
Basic Operation of Windows System and Practical Exercise
Use of Microsoft Excel for Data Analysis and Practical Exercise

Day 2: Calculation of Potential Evapotranspiration (Eto) using FAO's CropWat
Calculation of Crop Water Requirements using FAO's CropWat
Probability Analysis
Simple Water Balance Calculation using Microsoft Excel

2.2.6 Introduction of Basic Computer Use

The component of computer system and its use were explained. The basic operation of the computer system was explained and demonstrated. Microsoft Windows 98 system's general features, useful commands, keyboard shortcuts, and useful Windows procedure were explained and demonstrated. The maintaining computer system was also explained. Participants carried out exercises on the basic operation of the computer system and useful windows procedures such creating folders, copy and paste, dragging, deleting, empty trash, moving files and folders, shut down computer, starting program, saving file, opening file and others.

2.2.7 Microsoft Excel for Data Analysis

The basics of the Microsoft Excel was explained and demonstrated. The data entry and formatting cells and columns were explained and demonstrated. The use of formula for calculation was explained and its use for data analysis was demonstrated. The use of formula for calculation of sum, standard deviation, average, multiplication of column, calculation of mass curve and residual mass curve was demonstrated. The preparation of various kind of graph such as X-Y, Bar, Line and Pie graphs were explained and demonstrated. Participants carried out exercises on the calculation of sum, average, standard deviation of the data and multiplication of columns. They prepared various kinds of graphs.

2.2.8 Water Resources Assessment

The procedure of assessment of available water resources for the design of irrigation system was explained. The assessment of flood was also explained which is important for the design of structures such as dams, drainage canals and weirs.

2.2.9 Crop Water Requirements Analysis using CropWat

The FAO procedure for the calculation of the potential evapotranspiration and crop water requirements was explained and demonstrated using FAO CropWat program. Participants carried out the exercises on the calculation of the potential evapotranspiration from sample climatic data and later practiced crop water requirements calculation from the sample cropping pattern, climatic data and project data.

2.2.10 Probability Analysis

The probability distribution functions such as Normal, Log-normal, Log Pearson III and Gumbel were explained. SMADA software was used to fit the distribution and determine the probable rainfall at different return periods. Participants carried out the exercise to fit distribution and determine the probability of rainfall at different return periods.

2.2.11 Simple Water Balance Calculation

The use of Microsoft Excel for the simple water balance of the storage structure was explained and demonstrated using sample data. The participants carried the exercise of the water balance calculation and plotted the variation of storage with time.

2.2.12 Feedback of Workshop

The comments on the Workshop were provided by the participants in the Comments Sheet. The Comments Sheet used is presented in Attachment 2-2. The comments of participants are summarized below.

(1) Participants felt that the duration of the workshop was short and they wanted to have intensive training to cover the analytical hydrology topics in detail.

(2) Participants got the basic knowledge of the computer system for data analysis but they were interested to participate in intensive training to practice more so that they can use computer for design.

(3) Some of participants suggested to cover flood analysis, rainfall-runoff analysis, regression and correlation analysis in detail during the intensive training program.

(4) Some of participants wrote that the handouts provided during the workshop are useful but they require additional reference materials such as FAO papers and other technical reference materials or books.

(5) Some participants complained that they have no access to computer in their office.

2.3 Intensive Training Program

2.3.1 Topics and Schedule of the Intensive Training

The Intensive Training Program was conducted for the selected 5 hydrologists/engineers of OIDA of which 4 engineers were from OIDA head office and 1 engineer from branch office. The participants for intensive training were listed in Table X.2.4.

Table X.2.4 Participants of Intensive Training

Name	Position	Location	Technical Qualifications
1. Abera Shiferaw	Hydrologist	Head Office	M.Sc. (Engg Hydrology)
2. Haile Moya	Hydrologist	Head Office	M.Sc. (Engg. Hydrology)
3. W/Mariam Shoa	Irrigation Man. Expert	Head Office	M.Sc. (Hydraulic Engg)
4. Tesfaye Deriba	Irrigation Man. Expert	Head Office	M.Sc. (Irrigation Engg)
5. Mekonnen Zekarias	Design Engineer	Branch Office	M.Sc. (Irrigation Engg)

The intensive training program was designed to cover each subject in detail and practice the exercise intensively. One computer was provided to each participant to practice independently and intensively to learn the subject clearly.

The following topics were decided for the intensive training based on their background and requirements. The training schedule is presented in Table X.2.5.

Table X.2.5 Intensive Training Program

Day	Date	Program
1	26th June 2001	Data Checking, Data Management and Data Analysis
2	27th June 2001	Rainfall Runoff Analysis
3	28th June 2001	Correlation and Regression Analysis
4	29th June 2001	Flow Analysis
5	2nd July 2001	Crop Water Requirements
6	3rd July 2001	Probability Analysis
7	4th July 2001	Flood Analysis
8	5th July 2001	Revision and Test Exercise

2.3.2 Data Analysis Using Microsoft Excel

The use of Microsoft Excel for data analysis was demonstrated. The use of formula for calculation of sum, standard deviation, averages, multiplication of column, calculation of mass curve and residual mass curve was explained and demonstrated. The preparation of various kinds of graphs such as X-Y, Bar, Line and Pie graphs was explained and demonstrated. The use of copy and paste, auto fill and relative and absolute cell reference were also demonstrated. Several exercises were carried out by trainees to understand the use of Microsoft Excel for data analysis.

2.3.3 Correlation and Regression Analysis for Estimating Missing Data

The estimation of missing records of hydrological or meteorological data is generally required hydrological analysis. In cases where portions of observed rainfall or runoff records are missing, the missing records are estimated by correlation with those recorded at other observation stations. The correlation analysis is performed with other stations to get the highest correlation coefficient. The procedure for the correlation analysis is demonstrated using StatView software using sample rainfall data. The missing values are then estimated by applying regression equation with the observation stations having the highest correlation. The both simple or bivariate and multivariate regression analysis were explained and procedure was demonstrated. The participants carried out exercise to fill-in missing data using the multiple regression equation in order to complete the record.

2.3.4 Rainfall Runoff Analysis

The runoff estimation is required for the design of diversion structure in a watershed.

The runoff estimation can be carried from rainfall and characteristics of watershed. HEC-HMS program can efficiently calculate the runoff from a watershed. Procedure for calculation runoff from HEC-HMS program was demonstrated using sample example. The trainees practiced the sample example to understand the procedure and use the program for calculation of runoff from a watershed.

2.3.5 Flow Analysis

The design engineers carry out design calculation of weir, open channel, or orifice. They solved flow equation for design of the control structure or channel. The use of Microsoft Excel for solving Manning's formula was demonstrated to design the trapezoidal channel. Trainees also practiced the exercise to solve the Manning's formula to design the channel section. Use of FlowMaster software was also demonstrated to design weir, trapezoidal channel, irregular channel and orifice. Trainees also practiced the exercise to design channel, pipe, weir using FlowMaster software.

2.3.6 Crop Water Requirements using CropWat

The crop water requirements or diversion water requirements are required to design the intake channel or decide the irrigation area according to available water resources. The required data and procedure for calculation of potential evapotranspiration using Penman-Monteith Method was explained and demonstrated using FAO's CropWat program. Trainees practiced the calculation of potential evapotranspiration with sample data using CropWat program.

The calculation dependable rainfall was explained and participants calculated dependable rainfall for the dry year, average and wet year. The method of calculation of effective rainfall was also explained. Selection of crop coefficient during various growing stages and land preparation period and initial water requirement for land preparation were explained. The calculation of crop water requirements for the sample cropping pattern was demonstrated and practiced by the trainees.

2.3.7 Probability Analysis

The probability analysis of rainfall and discharge data is important for the design of the diversion structures for the irrigation. The probability distribution functions such as Normal, Log-Normal, Log Pearson Type III and Gumbel were explained. SMADA software was used to fit the distribution and determine the rainfall at different return periods. Trainees carried out the exercise to fit distribution and

determine the probability of rainfall at different period. Use of the Microsoft Excel for determining the plotting positions using Weibull method and to determine the probability with the Log Pearson III distribution were demonstrated. Trainees carried out the exercise to determine the probability of discharge data with Log Pearson Type III distribution using Microsoft Excel and distribution table.

2.3.8 Flood Analysis

A synthetic unit hydrograph may be developed for ungauged areas, when streamflow records are not available, based on the known physical characteristics of the basin. These synthetic unit hydrographs are computed either from direct analogy with the basin or from an indirect analogy with a large number of other basin through the application of empirical relationship.

This SCS method is easy to apply. The only parameters that need to be determined are the peak discharge and time to peak. A standard unit hydrograph is constructed using two parameters. For the development of the SCS Unit hydrograph, the curvilinear unit hydrograph is approximated by a triangular unit hydrograph.

The 40-Step procedure for calculation of peak runoff or flood discharge using SCS method was demonstrated using Microsoft Excel. The trainees carried out the exercise to calculate flood discharge using sample data by Microsoft Excel.

2.3.9 Feedback of Intensive Training Program

The feedback of the participants was taken at the end of the intensive training in the comment sheet, which is attached in Annex. The comments of the participants on the intensive training program are summarized below.

(1) Participants recognized the use of computer for data analysis and hydrological calculations.

(2) Participants felt that they have gained the knowledge of using computer for data analysis and hydrological calculation so it is application to their future activities such as design works.

(3) Participants suggested that computer should be used for design works by engineers and it should not be used exclusively for writing letters or documents as a typewriter.

(4) Participants were satisfied with computer-aided analytical hydrological training program and they were confident in using computer for the design of small-scale irrigation projects.

2.4 Conclusion and Recommendation

2.4.1 Present Status of Hydrologist/Engineers of OIDA

The hydrologists, hydraulic engineers, and irrigation design engineers of OIDA carry out the hydrology or hydraulic calculations for the design of irrigation structure. The hydrologists and hydraulic engineers are stationed at the head office while the design engineers are stationed at branch office. The design engineers at the branch office carry out the diversion water requirements, probability analysis, flood analysis, low flow analysis and hydraulic calculations for the design of diversion structure for irrigation. The present status of the hydrologists/engineers of OIDA determined through questionnaire survey is presented in Table X.2.6.

Table X.2.6 Present Status of Hydrologists/Engineers of OIDA

Description	Hydrologist	Hydraulic Engineer	Design Engineer
Technical degree	Engineering Hydrology	Hydraulic Engineering	Irrigation Engineering or Agricultural Engineering
Job Location	Head Office	Head Office	Branch Office
Responsibilities	Check the hydrology analysis in the design report prepared by the engineers of branch office. Technical support to design engineers of branch office in hydrological analysis. Prepare TOR for branch office. Examine the consultant's technical report and give his comments.	Check the hydraulic analysis in the design report prepared by the engineers of branch office. Technical support to design engineers of branch office in hydraulic analysis. Prepare TOR for branch office. Examine the consultant's technical report and give his comments.	Study & design small-scale irrigation scheme. Carry out hydrological and hydraulic calculation, crop water requirement calculation and prepare design report
Analytical Hydrology Knowledge	- Flood Analysis - Low Flow Analysis - Probability Analysis	- Crop Water Require. - Flow Analysis - Flood Analysis	- Crop Water Requirement - Flow Analysis - Flood Analysis - Low Flow Analysis

2.4.2 Major Difficulties of OIDA Staff in Hydrological Analysis

The major difficulties faced by the engineers of OIDA are determined through the questionnaire survey and presented in Table X.2.7.

Table X.2.7 Major Difficulties Faced by the Engineer in Hydrological Analysis

Item	Problem Faced
Data	Lack of meteorological and hydrological data especially of rainfall intensity and river discharge is the main problem for the design engineers.
Reference Material	Lack of literature on hydrological analysis methods, FAO Irrigation and Drainage papers and other reference materials on recent topics and methods.
Flood Discharge	Design engineers facing problem in determining the flood discharge for the design of weir or diversion structure where rivers are not gauged.
Computer Knowledge and Facilities	The lack of computer knowledge and no access to computer system
Experience	Design engineers have not enough experience in hydrological data analysis as well as lack of training for hydrological analysis

2.4.3 Hydrological Analysis Target for Hydrologists/Engineers

The target level of the hydrologists/engineers is set based on their responsibilities and experience. The set targets for the hydrologists and design engineers are presented in Table X.2.8.

Table X.2.8 Target Level for Analytical Hydrology

Description	Target Level
Hydrologists/Hydraulic Engineers (Head Office)	1. He/She should have B.S. degree in engineering plus 5 years experience or M.S. degree in engineering (hydrology/hydraulic/irrigation) plus 3 years experience. 2. He/She should have knowledge of the following analytical hydrological methods - Data Checking - Estimation of Missing Data - Probability Analysis - Flood Analysis - Low Flow Analysis - Crop Water Requirements - Flow Analysis 3. He/She can provide technical support to the design engineers on the above methods of analytical hydrology 4. Evaluate the technical report prepared by the design engineer of branch offices 5. He/She can use computer and perform data analysis using computer 6. He/She can prepare the TOR for the branch office 7. He/She can understand the technical report prepared by the consultant and can provide comments
Design Engineers (Branch Office)	1. He/She should have B.S. degree in engineering 2. He/She should have knowledge of the following analytical hydrological methods - Data Checking - Estimation of Missing Data - Probability Analysis - Flood Analysis - Low Flow Analysis - Crop Water Requirements - Flow Analysis 3. He/She can use computer and perform data analysis using computer 4. He/She can prepare design report

2.4.4 Required Training Program to Achieve the Target Level

The training program is necessary to achieve the target level of hydrologist/design engineers for analytical hydrology calculations. The training program may be cover the following topics of the analytical hydrology:

(1) Use of Computer for Data Analysis

(2) Data Checking

(3) Estimation of Missing Data

(4) Calculation of Crop Water Requirements

(5) Probability Analysis

(6) Flood Analysis

(7) Low Flow Analysis

(8) Preparation of Design Report

(9) Preparation of TOR

Attachment X-2-1

Comments on Workshop on Analytical Hydrology

21st June 2001

Queen of Sheba Hotel, Addis Ababa

Personal

Name _____

Present Position _____

Please write your comments/impression on the Analytical Hydrology Workshop on the following:

Analytical Hydrology

Hydrology analysis methods _____

_____

_____

_____

_____

_____

_____

_____

Computer Knowledge

Basic Computer Knowledge _____

Computer Use for Data Analysis _____

Computer Use for Hydrological Analysis _____

_____

_____

_____

_____

_____

Attachment X-2-2

Comments on Intensive Training on Analytical Hydrology

Personal

Name _____

Present Position _____

Please write your comments/impression on the Analytical Hydrology Intensive Training:

Analytical Hydrology

Data Management _____

_____

Data analysis _____

_____

Hydrological analysis _____

_____

Other Comment _____

_____

Computer Use for Hydrological Analysis

Write the impact of intensive training on the following:

Basic Computer Use _____

_____

Computer Use for Data analysis _____

_____

Software Use for Hydrological Analysis _____

_____

Data management and presentation _____

_____

Other Comments _____

_____

Chapter 3

Program 2 of Verification Study

Establishment of Management Information System of the OIDA Irrigation Schemes

CHAPTER 3 ESTABLISHMENT OF MANAGEMENT INFORMATION SYSTEM OF THE OIDA IRRIGATION SCHEMES

3.1 Overview of Irrigation Development in Oromia

3.1.1 Category of Irrigation Schemes

The Oromia Region is the largest region in Ethiopia with a total coverage of 353,007 km^2 or 34% of the national land and provides livelihood to 22.35 million or 37% of the national population in 2000. The economic active population in the Region accounts for 75% of the age of 10 years and above, of which 93% was engaged with agriculture, forestry and fishery sector.

Oromia has 63 river systems and 688 tributary streams, which annually generate 58 billion m^3 of surface water, the equivalent of half the nation's surface water resources. Irrigated agriculture constitutes less than 5% of the potential and about 2.14% of the total cultivated area. In 1998, about 92,000 ha of land were under both traditional and modern irrigation.

Four (4) major categories of irrigation schemes are known to exist in Oromia. They are traditional, large-scale, modern communal and private.

(1) Traditional Schemes

Traditional schemes have long been practiced in Oromia, particularly in Welega and Harar. They are based generally on simple diversion structures constructed with mud, rocks, twigs, etc. by peasants. These structures are generally washed away by floods during the rainy seasons and require maintenance or reconstruction at the end of each rainy season. The schemes are generally less than 100 ha. It is estimated that the total extent of the traditional schemes amounts to 49,000 ha in the Region.

(2) Modern Communal Schemes

The previous government constructed communal schemes in support of communities mainly in settlement areas. Following the severe drought of 1984, the small-scale irrigation was extensively constructed in the Region for the purposes of food security and income generation. The schemes are based on springs, streams and small rivers in size from a few ha to 200 ha with simple headworks and water distribution systems. The existing modern communal schemes are estimated to cover an area of 16,840 ha. The schemes were operational until the change of the government in 1991, after which most of them were abandoned along with the dissolution of farmers' co-operatives.

(3) Irrigated State Farms

There are nine (9) schemes in Oromia run by the Federal Government. They produce sugar canes, fruits and vegetables. Wanji, Matahara and Funchaa sugar estates comprise a total area of 20,916 ha and produce 240,700 ton of sugar annually. Nura Era produces horticultural crops and maize in a total area of 5,334 ha. It is said that large irrigation schemes have adverse social impacts especially to nomadic population by reducing their traditional grazing areas.

(4) Private Farms

There are a few private farms, which are of recent origin. They are limited to the eastern shore of the Ziway lake within the Rift Valley system. Some 180 small pumps have been introduced for horticultural production by private investors.

3.1.2 Irrigation Development by the Government

The Government continued to direct their efforts for the community-based irrigation development since 1992 immediately after the previous regime. As of May 2000, 96 irrigation schemes are developed with a total command area of 9,644 ha (Attachments X-3-1 and X-3-2).

Most of them were constructed by the previous water bureau and currently under the control of Oromia Irrigation Development Authority (OIDA). The expansion of irrigation area in Oromia is illustrated below.

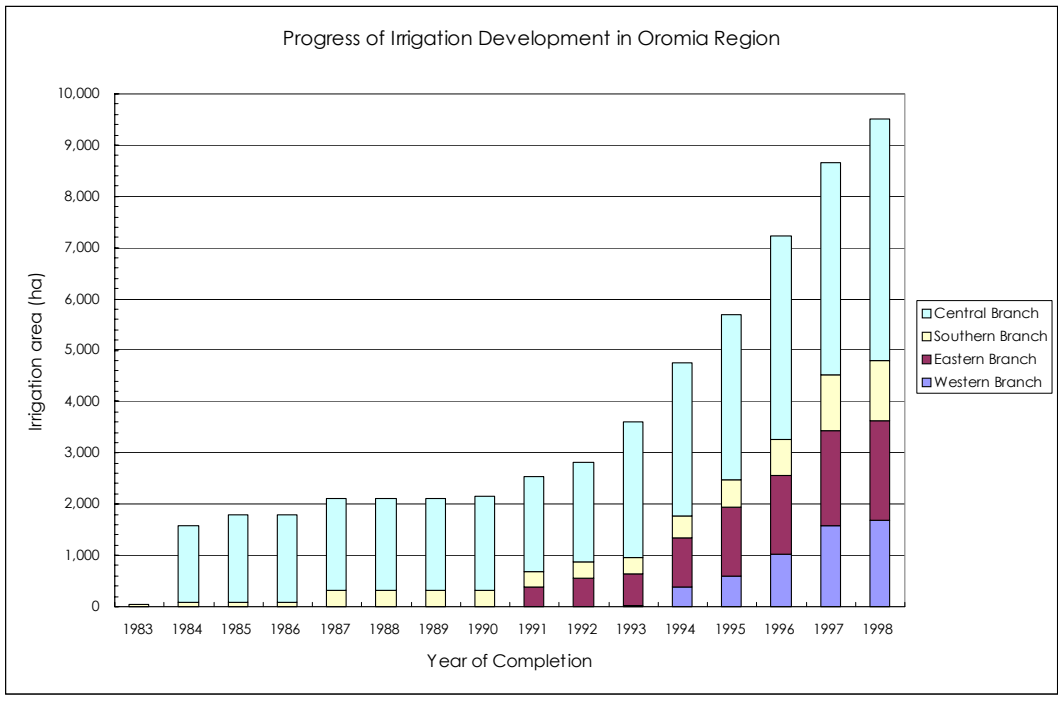

Figure X.3.1 Irrigation Development in Oromia Region

3.1.3 Oromia Irrigation Development Authority (OIDA)

OIDA was established in July 1999 with aims at streamlining overall irrigation development under the sole organizational framework. The main task is to develop irrigation schemes in line with the national policy of food security and poverty reduction. According to "Oromia Regional State Irrigation Development Authority Establishment Proclamation, No. 30/1999," the major tasks of OIDA includes:

i. Study, design and construction of irrigation schemes in potential areas,
ii. Contribution towards hastening the socio-economic development in rural areas,
iii. Assistance to rural communities to benefit from irrigation projects through participation in study, construction and operation,
iv. Provision of technical assistance in irrigation extension, operation and water management of community-based irrigation schemes, and
v. Promote environmental conservation through watershed management relevant to irrigation development.

All the activities of OIDA are under the control of 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 district offices. Central Branch Office is responsible for irrigation development in the central part of the Region consisting of four (4) zones, namely East Shoa, North Shoa, West Shoa and Arsi Zones.

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. Engineering staff such as agricultural and irrigation engineers, hydrologists, geologists, etc. accounts for 195 staff or 84% of the total technical staff. In addition, 31 social workers take responsibility for community development and capacity building. The staff structure of OIDA is presented in Table X.3.1.

Table X.3.1 Staff Structure of OIDA (November 2000)

No.	Headquarters and Offices	Total Staff		Technical Staff	
		No.	%	No.	%
1	Addis Ababa HQ	102	14.2	45	10.5
2.	Central Branch Office	136	18.9	72	16.7
3.	Western Branch Office	121	16.8	51	11.9
4.	Eastern Branch Office	82	11.4	32	7.4
5.	Southern Branch Office	68	9.4	32	7.4
6.	District Office (32)	211	29.3	198	46.0
Total		720	100.0	430	100.0

3.1.4 Irrigation Performance

According to the inventory in May 2000 (Attachment X-3-2), the irrigation performance of 96 schemes remained at only 5,560ha or 58% of the plan area, i.e. 9,644 ha. The performance varies by scheme. They are summarized in Table X.3.2.

Table X.3.2 Irrigation Area by Branch Office (May 2000)

Branch Office	Nos. of Scheme	Planed Irrigation Area		Actually Irrigated Area		Achieve-ment (%)
		(ha)	(%)	(ha)	(%)	
Central	37	4,823	51%	3,034	55%	63%
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%
Total/Average	96	9,644	100%	5,560	100%	58%

The comparison between plan area and actually irrigated area is illustrated in Attachment X-3-3. The relationship between the performance (actual area / plan area) and the years after construction completion are illustrated in Figure X.3.2.

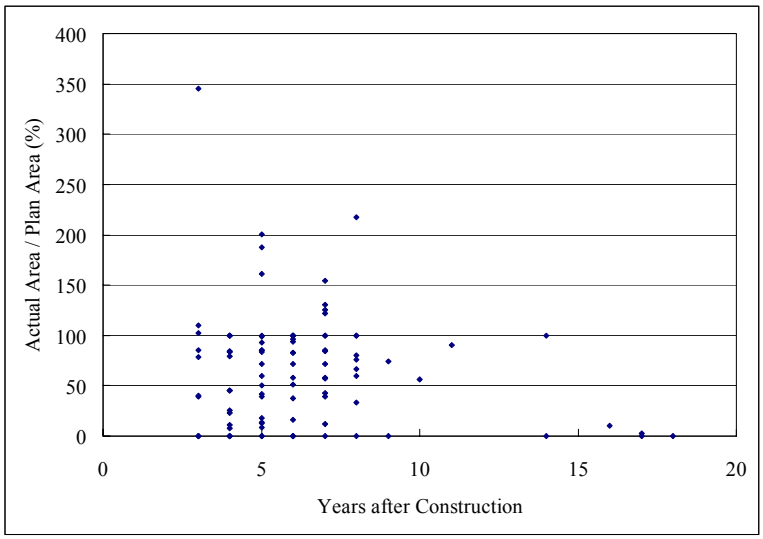

Figure X.3.2 Irrigation Performance and Years after Construction

The relationship between the irrigation performance and the years after construction do not show significance. This means that the lower performance is not always caused by deteriorated irrigation facilities. The analysis implies the necessity of further data collection and analysis focusing on both project facilities and project management. It was expected that the study would provide valuable information for rehabilitation of project facilities linked with reinforcement of water users association (WUA).