Figures

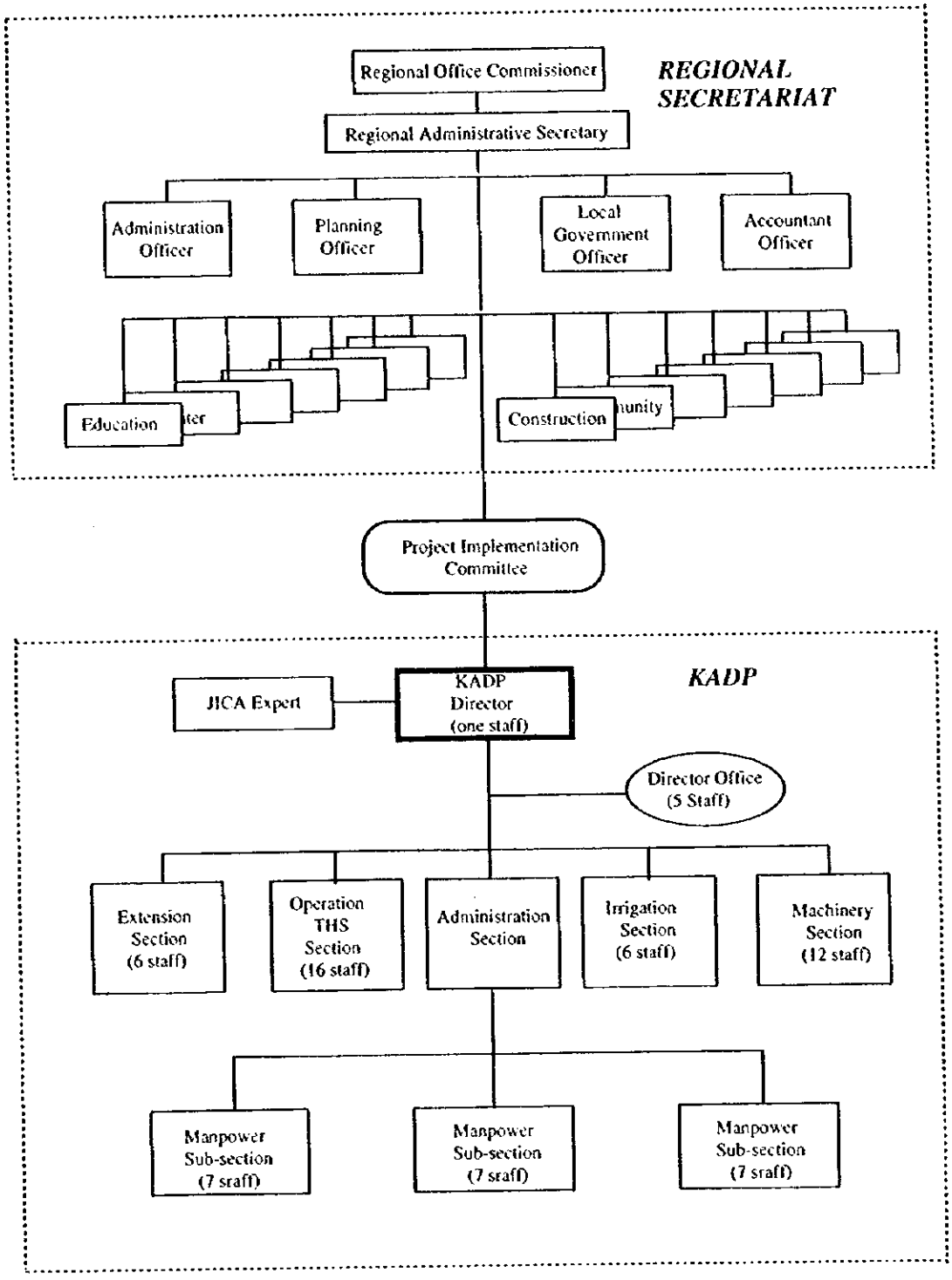


Figure N.2.1

Organisation Chart of KADP

The Feasibility Study on Lower Moshi Integrated Agriculture and Rural Development Project in the United Republic of Tanzania

Japan International Coopertion Agency

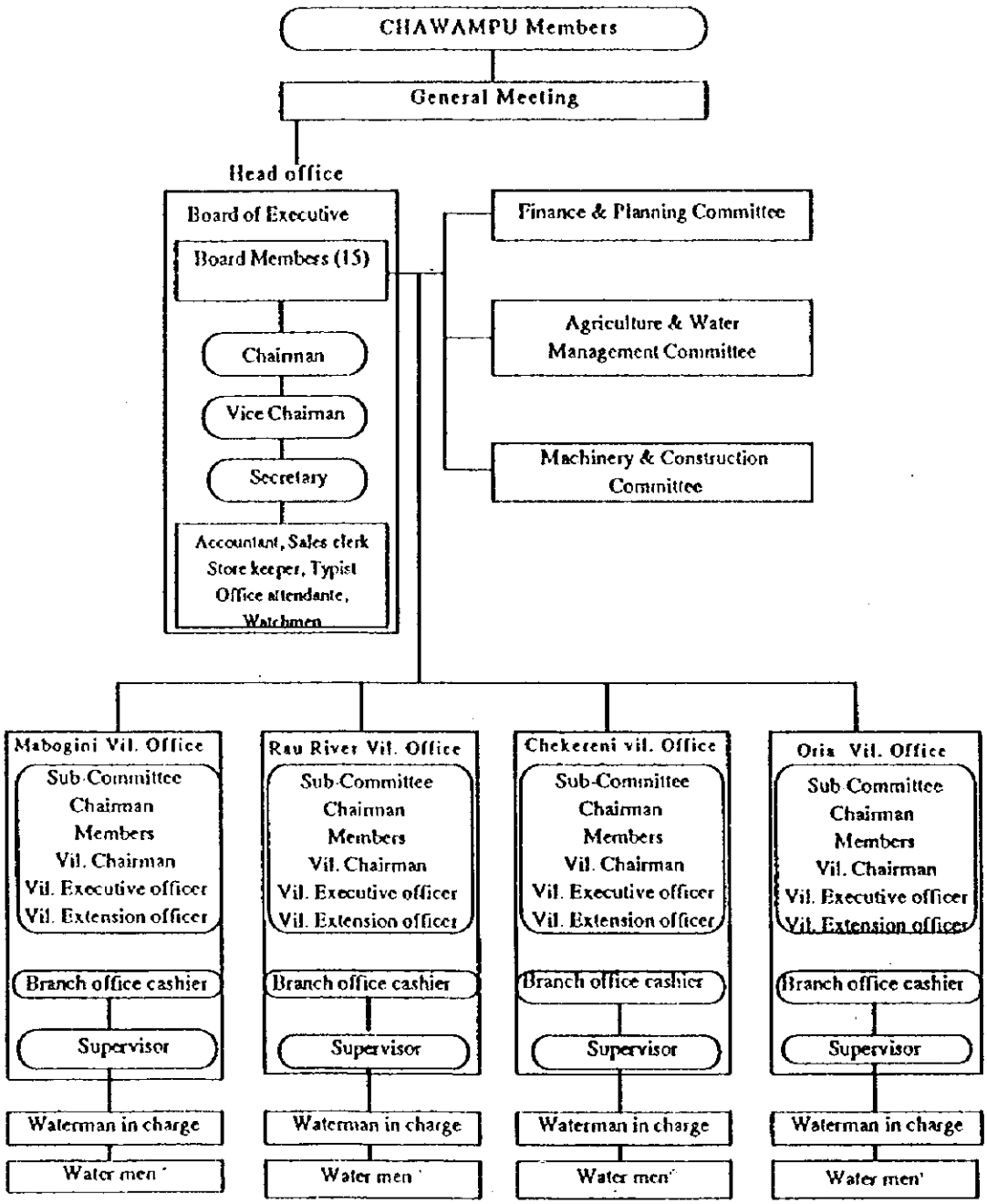


Figure N. 2.2

Organisation Chart of CHAWAMPU

The Feasibility Study on Lower Moshi Integrated Agriculture and Rural Development Project in the United Republic of Tanzania

Japan International Cooperation Agency

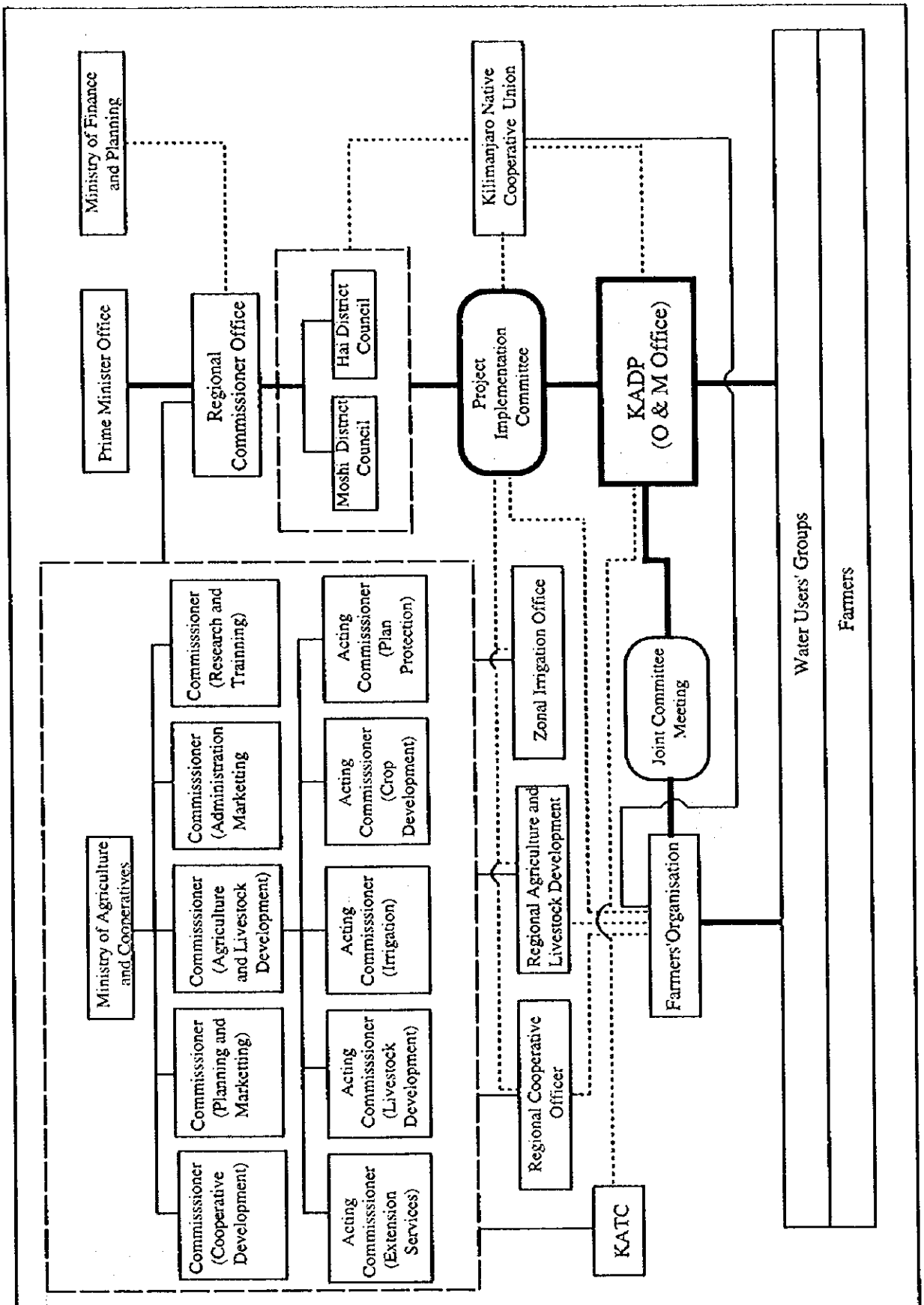


Figure N.3.1

Overall Organisation Chart for O & M

The Feasibility Study on Lower Moshi Integrated Agriculture and Rural Development Project in the United Republic of Tanzania

Japan International Cooperation Agency

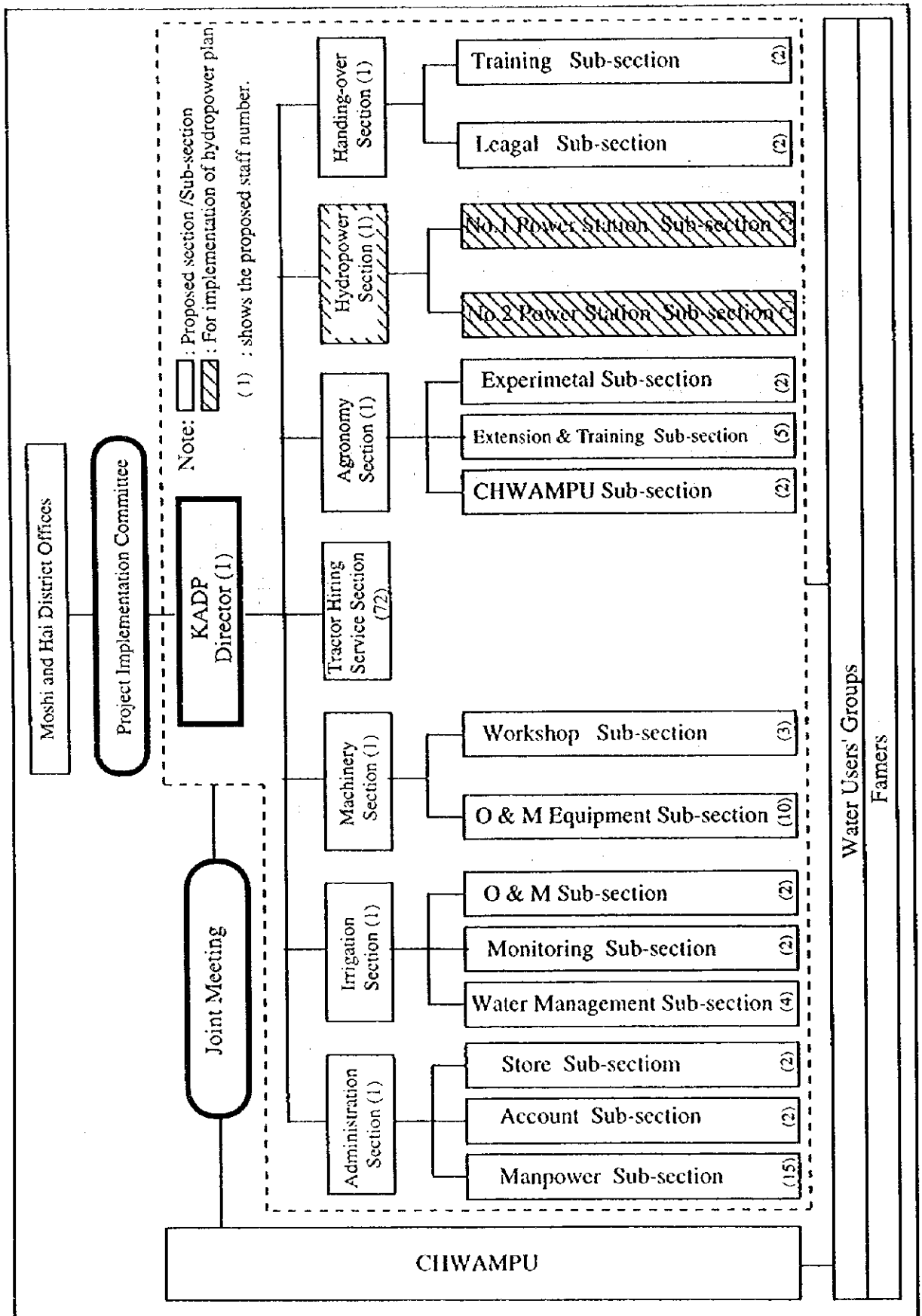


Figure N.3.2

Proposed Organisation Structure of KADP at 1st Stage

The Feasibility Study on Lower Moshi Integrated Agriculture and Rural Development Project in the United Republic of Tanzania

Japan International Cooperation Agency

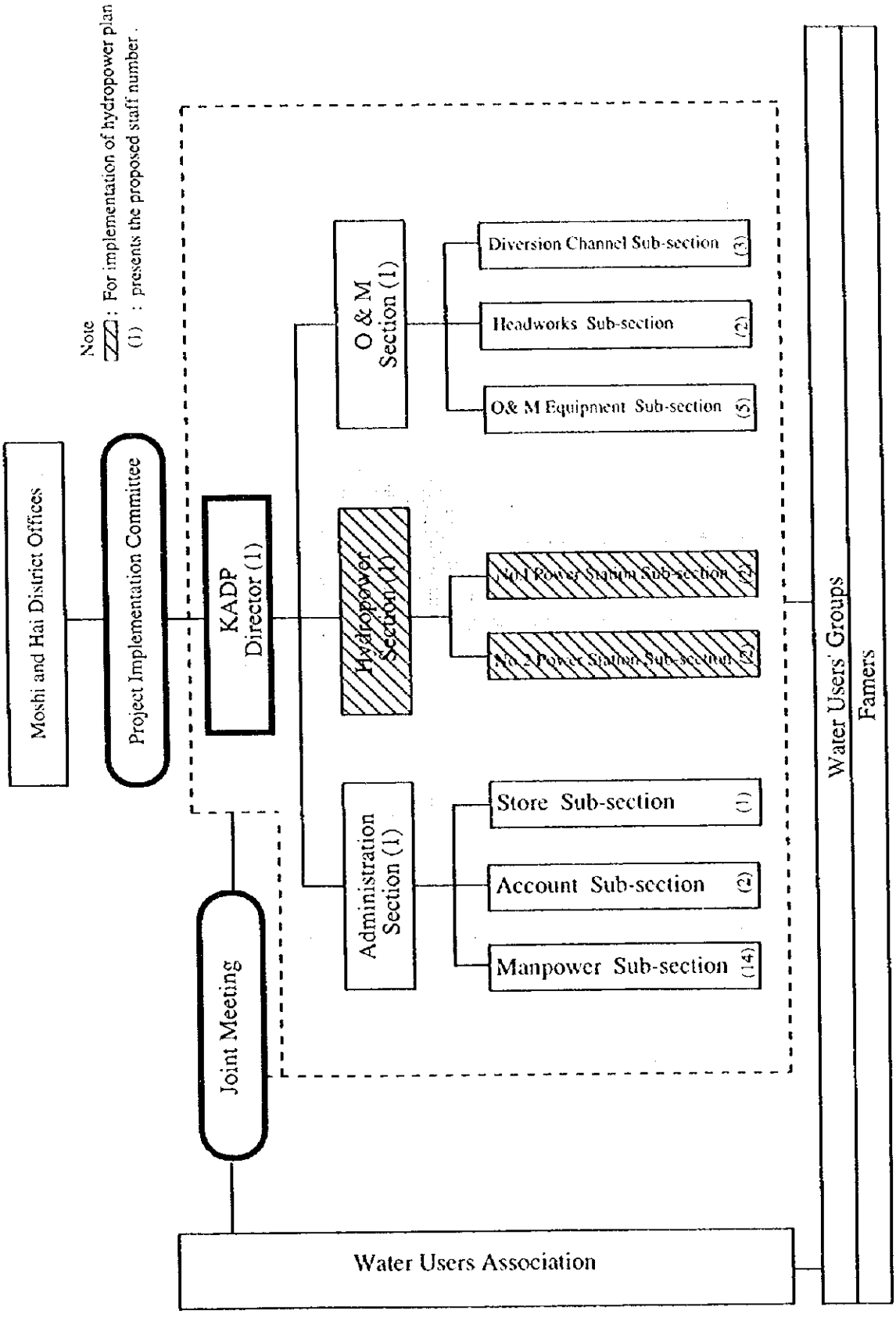


Figure N.3.3

Proposed Organisation Structure of KADP at 2nd Stage

The Feasibility Study on Lower Moshi Integrated Agriculture and Rural Development Project in the United Republic of Tanzania

Japan International Cooperation Agency

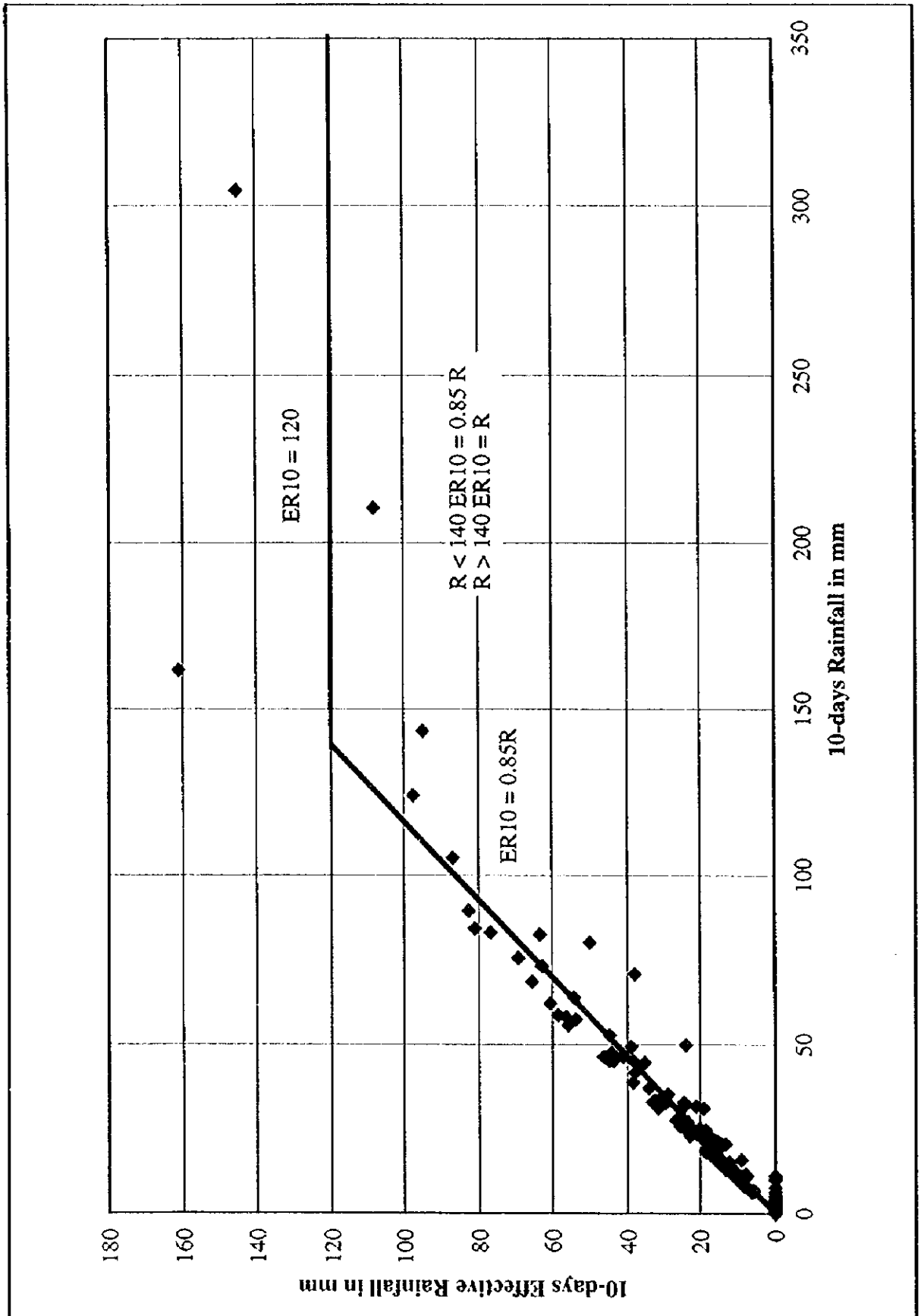


Figure N.3.4
10 days Rainfall - Effective Rainfall Curve at Chekereni

The Feasibility Study on Lower Moshi Integrated Agriculture and Rural Development Project in the United Republic of Tanzania
Japan International Cooperation Agency

ATTACHMENT-N.1

PROPOSED BY-LAW

ON

OPERATION AND MAINTENACE WORKS (DRAFT)

Draft

GOVERNMENT NOTICE NO._____PUBLISHED ON_____

THE LOCAL GOVERNMENT (DISTRICT AUTHORITIES) ACT, 1982

(NO.__OF 19___)

BY LAWS

MADE UNDER SECTION 148

THE MOSHI AND HAI DISTRICTS (OPERATION AND MAINTENANCE OF LOWER MOSHI INTEGRATED AGRICULTURE AND RURAL DEVELOPMENT PROJECT) BY-LAWS, 19__.

PART I

GENERAL PROVISIONS

Title

1. These By-Laws may be cited as the Moshi and Hai District Councils (Operation and Maintenance of Lower Moshi Integrated Agriculture and Rural Development Project) By-Laws, 19__ and shall be deemed to have come into operation on the

.....day of .....19___.

Interpretation

2. In these By-Laws unless the context requires otherwise,

"RAS" means the Regional Assistant Secretary, Kilimanjaro Region,

"COUNCIL" means the Moshi District Council.

"KADP Office" means the office for execution of the operation and maintenance of the Project Facilities (hereinafter defined),

"Project" means the Lower Moshi Integrated Agriculture and Rural Development Project situated in Moshi and Hai Districts, Kilimanjaro Region,

"Project Facilities" means all facilities constructed and applicable to the project, and comprises of:

(a) Kikuletwa headworks, No.1 and No.2 Hydropower Stations, diversion channel and their related structures,

(b) Intake weirs, supply, main and secondary irrigation canals and their related structures, including water gates and any other items attached to and or installed in those structures,

(c) Main and secondary drains and their related structures,

(d) Trunk farm road, main and secondary farm roads and their related structures,

(e) Flood dikes and their related structures, including gates and other items attached to and or installed in those structures,

(f) Warehouse, residential quarters and utility facilities related to those buildings,

(g) Tertiary irrigation canals, tertiary drains and tertiary roads and their related structures,

(h) Watercourses, field drains and field roads and their related structures,

"Major Facilities" means the facilities mentioned in sub-clauses (a) to (f) above,

"Terminal Facilities" means the facilities mentioned in sub-clauses (g) and (h),

"Agricultural Land" means any land for agricultural use, which is located within the boundary of the Project and served by the Project Facilities,

"Project Beneficiaries" means any person or community holding Agricultural Land, but does not include a tenant.

"CHAWAMPU" means Chama cha Wakulima wa Mpunga formed by the Project Beneficiaries under the Cooperative Societies Act, 1991.

Application, modification and exemption

3(1) Subject to the provisions of sub-clause (2) of this Clause, these By-Laws shall apply to whole area of the Project, which is situated in the area under the jurisdiction of the COUNCIL.

(2) Where in the opinion of the Project Implementation Committee (hereinafter defined) the circumstances so require, the by resolution modify the application of any of the provisions of these By-Laws to or in relation to any area under the Project or in relation to any category of persons in such manner' as the COUNCIL may deem fit, and may likewise exempt any person or category of persons in the administration of the Project from all or any of the provisions of these By-Laws,

PART II

ORGANIZATION

Powers of RAS

4(1) The RAS shall be responsible for the organization of the Project and shall have jurisdiction over the whole activities relating to the operation and maintenance of the Project Facilities.

Project Implementation Committee

5(1) The Project Implementation Committee (hereinafter called the "Project Committee") shall be established as the highest execution body of the operation and maintenance of the Project Facilities and all other activities relating to the Project. The Project Committee shall be constituted of the following members:

Chairman : Regional Assistant Secretary
Secretary : Director of KADP
Members : Regional Agriculture Development Officer
: Zonal Irrigation Officer
: District Cooperative Officers of Moshi and Hai
: District Executive Directors of Moshi and Hai
: District Agriculture and Livestock Development Officers of Moshi and Hai
: District Irrigation Officers of Moshi and Hai
: District Administrative Officers of Moshi and Hai
: Councilors (2) of Moshi and Hai District Council
: Councilors (2) of the Project Area
: General Manager, KNCU
: Representatives of CHAWAMPU
: Representatives (3) of Water Users' Groups

(2) The RAS shall convene ordinary Project Committee meetings four times every business year and may if necessary convene extra-ordinary Project Committee meetings at any time.

Functions of Project Committee

6. The functions of the Project Committee shall include inter-alia the discussions, review and approval of:

(a) Past performance of the KADP Office (hereinafter defined) in relation to the operation and maintenance of the Project Facilities and other activities relating to the Project,

(b) Annual program for the operation and maintenance of the Project Facilities and other activities relating to the Project,

(c) Expenditures and budgets on the running of the KADP Office,

(d) Amount of water charges to be imposed on the Project Beneficiaries,

(e) Past performance and program of agricultural extension to the Project Beneficiaries,

(f) Assessment of annual agricultural production and farm inputs,

(g) Any matter relating to the operation and maintenance.

Powers and Functions of COUNCIL

7. The COUNCIL shall be the highest executing body of the organization formed among the Beneficiaries and shall be responsible for;

(a) Supervision, direction and coordination of all the activities of CHAWAMPU (hereinafter defined),

(b) Examination and approval of annual plans of the activities of CHAWAMPU, and

(c) Preparation and approval of By-Laws and other regulations relating to the operation and maintenance of the Project Facilities.

Joint Meeting

8(1) The Joint Meeting shall be constituted of representatives of KADP Office and CHAWAMPU and any other person appointed by the COUNCIL.

(2) The functions of the Central Water Users' Committee shall inter alia include:

(a) Supervision, direction and coordination of the activities of CHAWAMPU,

(b) Preparation of annual plans on operation and maintenance of the Terminal Facilities, agricultural production and other activities relating to the project,

(c) Discussion and decision on rules of the operation and maintenance of Terminal facilities,

(d) Discussion and decision on irrigation plans and methods,

(e) Discussion and decision on methods of imposition and collection of water charge,

(f) Assistance and guidance to the Beneficiaries on processing and marketing of agricultural products, and

(g) Any matter relating to the operation and maintenance of the Project Facilities and farming activities in the Project area.

Water Users' Group

9(1) A Water Users' Group shall be a terminal organ of the operation and maintenance of the Project Facilities, and shall be formed among the Beneficiaries, holding the Agricultural Land in the area served by each tertiary irrigation canal (hereinafter called" the Tertiary Block")

(2) The Water Users' Group shall perform all the duties relating to:

(i) Adjustment and coordination of the activities of respective water users,

(ii) Preparation and execution of water distribution plans within the Tertiary Blocks,

(iii) Maintenance of the Terminal Facilities,

(iv) Collection of water charges from respective water users, and

(v) Execution of the instructions and orders from the Project Office and KADC.

KADP Office

10(1) The KADP Office shall be responsible for the operation and maintenance of the Major Facilities.

(2) The functions of the KADP Office shall inter alia include:

(i) Preparation of irrigation schedules,

(ii) Control and regulation of intake discharges and canal flows for the Major Facilities,

(iii) Preparation of maintenance programs for the Major Facilities,

(iv) Execution of periodic inspection of the Major Facilities,

(v) Execution of maintenance and repair works for the Major Facilities, and

(vi) Assistance and guidance of the CHAWAMPU in the water management and facility maintenance within the Tertiary Blocks.

PART III

OPERATION AND MAINTENANCE

Notice

11. The RAS shall give public notices on the rules and regulations on the operation and maintenance of the Project Facilities and other instructions relating to the Project, which have been discussed and approved by the Project Committee.

Operation Rules

12(1) The Project Beneficiaries shall execute farming operations and water management in strict accordance with irrigation rules and plans, cropping schedules and other rules and instructions given by the KADP Office and approved by the COUNCIL and CHAWAMPU.

(2) Irrigation water created by the Project and conveyed with the use of the Project Facilities shall not be delivered to any land except that entitled to receive it.

(3) The Agricultural Land shall be entitled to receive irrigation water in accordance with the predetermined irrigation schedule.

(4) Supply of irrigation water to the Agricultural Land shall be effected for 24 hours a day throughout the irrigation periods, except the time or period that the KADP Office may determine.

(5) The KADP Office shall have a right to change the irrigation schedule or to stop the supply

of irrigation water to any Agricultural Land in consideration of whether conditions or in accordance with the provisions of these By - Laws.

(6) The Project Beneficiaries shall not be entitled to receive the supply of irrigation water exceeding the amount allocated to them in the irrigation schedules unless they have obtained prior approval from the KADP Office on the increase of water supply.

(7) The Project Beneficiaries shall be responsible for any improvement work of the Terminal Facilities and fields and shall execute such work at their own expenses.

Maintenance and Destruction

13(1) The Project Beneficiaries shall execute maintenance and repair works of the Terminal Facilities at their own expenses in strict accordance with rules and instructions given by the KADP Office and the provisions of these By-Laws.

(2) Any Project Beneficiaries or any other person, who has distracted and damaged any of the Project Facilities, shall repair and reinstate such destruction's and damages at his own expenses in accordance with the instructions and directions from the KADP Office.

(3) Any lorry, vehicle and equipment with a weight exceeding four tons shall be prohibited to enter tertiary and field roads in the Project area.

Water Right

14. The amount of water to be drawn from the Kikuletwa River, the Rau River and the Njoro River to the Project shall not exceed the amount of water granted under the Water Right approved by Ministry of Water.

Determination of Water Charges

15(1) The COUNCIL shall impose to the Project Beneficiaries water charges in respect of the use of the Project Facilities and the delivery of irrigation water.

(2) The Project Committee shall determine water charges in consideration of kinds of crops grown and cropping schedules adopted and shall notify the Project Beneficiaries through the COUNCIL.

Collection of Water Charges

16(1) CHAWAMPU shall collect from the Project Beneficiaries all water charge according to the Water Management Act 1974.

(2) The water charges for one cropping season shall be collected before the commencement of the cropping season.

(3) In case any Project Beneficiary fail to pay water charges pursuant to the provision of Sub-Clauses 16(1) and (2) hereof, the KADP Office shall immediately cease the supply of irrigation water to the Agricultural Land owned by such Project Beneficiaries and shall not resume the supply until the water charges with interest for the same have been paid.

PART IV

RIGHT OF ENTRY AND INSPECTION

Survey and Inspection

17. Any person mentioned hereunder shall bona fide have a right to enter the land of any Project Beneficiaries without prior notice for the purpose of surveying and inspection relating to the operation and maintenance of the Project Facilities and conditions of the Agricultural Land.

(a) Staff of KADP Office

(b) Member of Project Committee

(c) Any other persons authorized by the RAS or the COUNCIL.

Service During Imminent Cases

18. In case it is necessary to prevent any Project Facilities from imminent damages caused by the floods, storms, or erosions, the KADP Office shall have a right to make temporary use of any Agricultural Land, trees and any other thing of the Project Beneficiaries.

Prohibition of Tenancy Farming

19. All Agricultural Land shall be cultivated and managed by the Project Beneficiaries, and no tenant farming shall be permitted. For the purpose of these By-Laws tenant farming means a type of farming in which the Project Beneficiaries entrust third persons with a portion of their Agricultural Lands for the purpose of sharing the benefits which may accrue from the cultivation by the tenant. Cultivation of the Agricultural Land by hired temporary laborers on a piece meal basis may not be considered as the tenant farming.

Form of Farming

20. Any Project Beneficiary shall not alter the form and nature of the Agricultural Land without written approval of the COUNCIL.

Crop Plan

21. All Agricultural Lands shall be utilized strictly in accordance with the cropping plans and schedules prepared by the KADP Office and approved by CHAWAMPU.

Petition for Impracticalness of Farming

22. Any Project Beneficiary who is unable to cultivate the Agricultural Land shall petition for impracticalness of farming to the KADP Office before the commencement of each cropping season and such petition may be accepted with or without conditions.

Grazing in the Project Area

23. It is strictly prohibited to graze or cause grazing of livestock within the Project Area. If anybody grazes or to be grazed any livestock within the Project Area , shall be guilty of an offense.

Heavy Duty Plants or Vehicles not allowed

24. Heavy duty plants or vehicles weighing more than three tons are not allowed within the Project Terminal Facility Area.

Use of Chemicals and Paddy Seeds

25. It is prohibited to use unrecommended chemicals and paddy seeds in the Agricultural Land of the Project.

Bathing and Washing in Canals

26. Nobody is allowed to take bath or wash clothes in the Project canals.

PART V

SUPERVISION AND INSPECTION

Report on Inspection

27. The KADP Office shall have a right to inspect at any time the conditions of the operation and maintenance of the Terminal Facilities and the Use of Agricultural Land and shall report the matters to the COUNCIL.

Inspection and Auditing

28. The RAS shall inspect and audit the KADP Office and their activities and accounting affairs once every business year or more.

Sale of Products

29. Every Project Beneficiary shall sale to CHAWAMPU portion of the paddy produced from the Agricultural Land as may be determined by CHAWAMPU.

PART VI

PENAL PROVISIONS

30. Any Project Beneficiary who has contravened the provisions of Clauses 20, 22 and 26 of these By-Laws, or any condition attached hereto shall be guilty of an offense and shall be liable on conviction to a fine not exceeding Tsh.5,000/= or to imprisonment for a term not exceeding one year or to both such fine and imprisonment.

31. Any Project Beneficiary who contravenes any provisions of these By-Laws shall be guilty of an offense and may be liable to punishment.

    (a) In case of first offender, a fine not exceeding five thousand shillings or imprisonment for a term not exceeding one year or both fine and imprisonment.

    (b) In case of second offender or subsequent violation of these regulations, in addition to the penalty, described in Sub-Clause 31 (a), the offender may be barred from the Agricultural Land for a period not exceeding three years.

32. Any Project Beneficiary or any person who takes water without authorization, or break operation and maintenance rule 12 and 13 may be sentenced to a fine not exceeding five thousand shillings or six months imprisonment or both fine and imprisonment.

33(1) Any Beneficiary or any other person who moves, stains, breaks or removes any sign set up for the purpose of executing the operation and maintenance of the Project Facilities shall be guilty of an offense and may be punished to pay a fine not exceeding five thousands shillings or one year imprisonment or to both fine and imprisonment.

(2) Any Beneficiary or any other person who is found guilty of an offense under Clause 32 and is a second offender may have his Agricultural Land confiscated by the Council.

The official seal of the Moshi District Council was affixed to these By-Laws in pursuance of a resolution passed at meeting of the council duly convened and held on the day of _____ and the same was affixed in the presence of :

.....

CHAIRMAN

.....

DISTRICT EXECUTIVE DIRECTOR

I APPROVE

DODOMA

PRIME MINISTER AND FIRST
VICE PRESIDENT

_____

ANNEX-O

PROJECT IMPLEMENTATION AND COST ESTIMATE

ANNEX - O

PROJECT IMPLEMENTATION AND COST ESTIMATE

Table of Contents

List of Tables

List of Figures

ANNEX - O

PROJECT IMPLEMENTATION AND COST ESTIMATE

1. INTRODUCTION

This Annex deals the project implementation plan and the project cost estimate for Lower Moshi Integrated Agriculture and Rural development Project.

Chapter 2 presents the formulation of project implementation describing the work description of the respective phases. The work quantities and construction plans of the respective construction works are also presented.

Chapter 3 presents the project cost estimate for the all works of the project including annual disbursement schedule for the project implementation.

2. PROJECT IMPLEMENTATION

2.1 Basic Consideration of Project Implementation

The Project implementation plan was formulated on the basis of the following considerations:

(1) A mechanized construction method will be principally introduced for the all of construction works, and construction by manpower will be adopted in the construction of small canals such as field canal, drain, road and structures on on- farm level in order to increase job opportunities.

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

(3) The implementation will be considered stage-wise development due consideration of work scale of the development.

(4) The engineering consultant will assist the Project executing agency in the preparation of detailed design and bid document, and the supervision of the construction works of the Project facilities.

2.2 Implementation Schedule

The implementation of the project will be formulated with the Phase-wise development largely divided into two(2) phases. The works of the respective phases are as follows:

(1) Phase-I Development:

- Headworks and Related Structures
- Diversion Channel and Related Structures
- Rehabilitation and Enhancement Works of Existing Lower Moshi Area(2,150ha)

(2) Phase-II Development;

- Development of Irrigation and Drainage System of Expanded Area (460ha) and Extension Area(2,090ha)

Each of the phase includes the detailed design works, pre-construction works and the construction works. The construction works of Phase-I will be commenced from July 1999 and will take 2 years, up to June 2001. Phase-II works will be commenced from July 2001 and will take 3 years, up to June 2004. Thus the total period required for the completion of all works from the beginning of detailed design is estimated at 6 years. The proposed implementation schedule is shown in Figure O.2.1.

2.3 Work Quantities and Construction Materials

The work quantities of major works and major construction materials are summarized as shown in Table O.2.1.

2.4 Construction Plan

2.4.1 Workable Day

Workable day was estimated and construction plan of major works was studied for estimate of required construction equipment and construction costs. Workable days for each of months are estimated based on daily rainfall data obtained from the Chekereni meteorological station on the following conditions:

Rainfall and Suspended Day

Daily rainfall depth (mm)	Time to be suspended (day)
3 - 10	0.5
10 - 30	1.0
30 - 50	1.5
more than 50	2.0

Then holidays are deducted from the workable day. Details are shown in Table O.2.2. The averaged workable day a year is estimated at 271 days. The construction plan of the respective works is prepared on the basis of this workable days a year.

2.4.2 General Condition of Concrete Production

(1) Estimate of aggregates quantity required

Concrete volumes in each Phase are estimated as follows:

Phase-I

(a) Headworks	:	18,000 m^3
(b) Diversion Channel	:	15,000 m^3
(c) Existing Lower Moshi Area	:	2,500 m^3
Total-I	:	35,500 m^3

Phase-II

(d) Extension Area	:	4,000 m^3
(e) Expanded Area	:	1,000 m^3
Total-II		5,000 m^3
Total(I+II)		40,500 m^3

From the above, required quantity of concrete aggregates and cement are estimated as follows:

Required Cement and Aggregates

Materials	Cement(ton)	Coarse aggregate(m^3)	Fine aggregate(m^3)
Phase-I	12,000	84,000	40,000
Phase-II	2,000	15,000	7,000
Total	14,000	99,000	47,000

The quarry site of coarse and fine aggregates will be determined at the downstream part of the Longoi river. Aggregates will be produced using by crushing plant, screening plant and washing plant .

(2) Production of concrete

Concrete batching plant will be installed at near the quarry site and a capacity of plant will be equal or more than 50m^3/hr on Phase-I works and 30 m^3/hr on Phase-II works. Transportation of concrete to the working sites will be done by 3m^3 and 4.5 m^3 class truck mixer.

(3) Pouring of concrete

Pouring of concrete will be executed by bucket and concrete pump according to site conditions. Bucket pouring will be done mainly for the construction of weir portion of headworks and concrete pump will be used under the normal site conditions such as related structures of diversion channel and related structure of irrigation canals.

(4) Production of precasted products

Followings are to be produced at factory as precasted products:

(a) Concrete block for canal lining
(b) Small size of bridge slab for foot path
(c) Concrete pipe
(d) Division boxes and culverts on tertiary canal and water course level
(e) On-farm facilities

Production of precast products should be made under the strict quality control, and factory will be constructed near concrete plant.

2.4.3 Construction Plan of Headworks

Construction work of headworks is broadly divided into 2 work sections, namely i)diversion weir and ii)intake structure sections. Works of diversion weir section are further divided into i)diversion works of Kikultwa river, ii) foundation treatment works, iii) concrete works and iv) closing of diversion channel.

(1) Diversion works of Kikultwa river

The diversion channel will be constructed on the left side of river, excavating the flat terrace of left side. Width of channel will be approximately 10 m, and design discharge of channel is applied for 2 year's return period(50 m^3/s) taking into account of construction period required. After excavation of channel, corrugated pipe with diameter 2.0 m and 4 rows will be lied. The process of diversion works will be executed with following manner:

(a) Excavation of terrace on left side with 10 m width and excavate up to EL.789 m. On the same time, rock excavation of left side abutment up to design foundation level is to be executed by blasting and mechanical excavation methods.
(b) Pouring of 1st lift concrete with 1.0 m height.
(c) Consolidation and curtain grouting to foundation rock for left side portion.
(d) Install corrugate pipes (d = 2.0 m, 4 rows)on 1st layer, and continue concreting up to EL.796 m(up to 7 lifts).
(e) Construction of cofferdam with concrete.

(f) Diversion of river flow, right side to left side.
(g) Foundation excavation of right half portion.
(h) Concrete pouring of 1st lift at right half portion.
(i) Consolidation and curtain grouting.
(J) Concreting up to same lift of left half portion.

At the inlet and outlet of diversion channel, stoplog slots will be provided for the function of final blockage of diversion channel. The diversion works will be commenced and completed during the dry season(up to end of November).

(2) Foundation excavation of right side river bed and abutment

After divert the river flow from right side to left side, foundation excavation on right side will be executed by blasting and machinery method. Required month of excavation is expecting 1 month.

(3) Concrete pouring of weir

Continuing completion of excavation of right side, concrete pouring will be continued throughout the year. Averaged pouring volume of concrete will be 2,500 m^3 per month and completed within 10 month after 1st lift concreting.

(4) Foundation grouting

Consolidation and curtain grouting will be executed to the foundation rock. Depth of consolidation grout will be 5 m, and total 340 m and grouting will be done from the surface of poured concrete layer by drilling of concrete and rock. Curtain grout will be also done in same manner of consolidation grout. Depth of curtain grout will be 10 m, and total 550 m.

(5) Installation of sluice gate

On the left site of weir, 2 sets of roller gate with 2.0m width and 3 m height will be installed and required month of gates installation will be 1 month.

(6) Construction of intake facility

In line with construction of weir, construction of intake facility will be executed. Net required period of construction is estimated almost 6 months considering quantity of concrete volume.

(7) Blockade of diversion channel

Blockade of diversion channel will be made after completion of all of works, and should be done in dry season. Blockade works will be executed with following process and order:

(a) Provide steel stoplogs at inlet and outlet of diversion channel.
(b) Immediately concrete pouring into channel through grouting holes which have been provided from top of channel to crest of weir. Concrete pouring will be executed by concrete pump machine and continue up to fulfill the channel. Concrete agents for rapid solidification of concrete is to be used for this works.
(c) Continue same works to remaining channels.
(d) To confirm blockade condition and plug grouting holes.

(8) Construction equipment

Major construction equipment to be used for the works is estimated as follows:

Major Construction Equipment

Equipment	Capacity	Number
Earth works		
Bulldozer	21ton	2
Bulldozer with ripper	32ton	2
Backhoe	1.0m^3	2
Dump truck	10ton	3
Crawler drill	150kg	2
Htdraulic breaker	1,300kg	2
Grouting works		
Boring machine	46mm	1
Grout pump and plant	-	1
Concrete works		
Batching plant	30 m^3 / hr	1
Concrete mizer truck	4.5 m^3	3
Concrete pump car	90-100 m^3 /hr	1
Truck crane	25ton	1

The work schedule of headworks construction is shown in Figure O.2.2.

2.4.4 Construction Plan of Diversion Channel

(1) Work quantity

The work quantities for the construction of the diversion channel are estimated as follows:

1)	Excavation, common soil	:	200,000 m^3
2)	Excavation, rock	:	300,000 m^3
3)	Embankment	:	60,000 m^3
4)	Shotcrete lining	:	7,000 m^3
5)	Concrete block lining	:	80,000 m^2
6)	Lining concrete(Plain)	:	5,700 m^3
7)	Structure concrete	:	9,000 m^3

(2) Earth works

Category of earth works will be broadly divided into 3 works, namely i)rock excavation , ii) common soil excavation and iii) embankment works.

(a) Rock excavation

For the rock excavation, blasting method is to be employed totally for the high land portion about 12 km. Blasting materials are Dynamite and AN-FO. Drilling will be executed by crawler drill(150 kg class) and after blasting, ripper dozer and hydraulic breaker will be used. Shaping of excavated rock will be smoothed by pick hammer and manpower. Required month of rock excavation will be 15 months with 3 working groups.(6,000 m^3/group/month).

(b) Common soil excavation

After stripping of top soil, excavation is executed totally by machinery works. Major construction equipment for excavation will be 1.0m^3 class backhoe and bulldozer will be used as assisting and pilling purpose. Excavated soil will be used for embankment materials and remaining will be transported to spoil bank. Transportation of excavated soil will be made by 10 ton class dump truck to embankment site and spoil bank. Required month of common soil excavation will be 12 months with 4 numbers of 1.0 m^3 class backhoe.

(c) Embankment works

In parallel with excavation works, embankment of channel will be executed. Construction equipment will be i)bulldozer 16 ton and 3.7 m motor grader class for spreading, and ii) tire roller with 8-20 ton and vibration roller 5 ton class for compacting works.

(3) Lining works

(a) Shotcrete lining

On the high land area, shotcrete lining (design thickness ;7 cm) for side slopes is executed. Lining is to be executed by specified shotcrete machine with design mix of concrete. After shotcrete lining of side slope portion, channel bed lining with plan concrete will be poured. Required month of lining will be 10 months(say 1,200 m/month).

(b) Precast concrete lining

Precast concrete block lining is adopted to the low land area with 12 km. Production of block is made by factory which will be constructed near concrete plant and transported to construction site. Lining works of block are executed by man-power, and after side slope portion, bottom concrete will be poured. Required month of works will be depending upon number of man-power forces, however, to be completed before 2 months of completion date.

(4) Related structures

Schedule of construction works of related structures will be considered separately from schedule of earthworks and lining works. All of works will be completed before 2 months of completion date for test operation of system. Supply of concrete will be transported from concrete plant and pouring by concrete pump. Concrete mixing of structure at site will be strictly prohibited from the view points of quality control. Substructure of brides, aqueduct, and construction of siphon will be executed during dry season to reduce the costs of temporary works such as coffering works and dewatering.

(5) Major construction equipment

Major construction equipment to be used for the works are estimated as follows:

Major Construction Equipment

Equipment	Capacity	Number
Earthworks		
Bulldozer	21ton	3
Bulldozer with ripper	32ton	3
Backhoe	1.0 m^3	5
Dump truck	10ton	10
Crawler drill	150kg	3
Hydraulic breaker	1,300kg	3
Motor grader	3.7m	1
Tire roller	8-20ton	1
Tamping roller	5ton	1
Lining and concrete works		
Batching plant	30 m^3/hr	1
Shotcrete machine	25PS	2
Concrete mixer truck	4.5 m^3	4
Concrete pump car	90-100 m^3/hr	1
Truck crane	25ton	1

The work schedule of construction of diversion channel is shown in Figure O.2.2.

2.4.5 Construction Plan of Rehabilitation and Enhancement Works of Irrigation and Drainage System of Existing Lower Moshi Area

(1) Scope of works

The scope of works are to be broadly divided into 3 catalogues as below:

(a) Rehabilitation works of existing system
(b) Reconstruction of facilities to adjust improvement system
(c) On-farm works for remaining 1,050 ha including construction of field drain, road, water course and their related structures.

(2) Work schedule

Works will be executed independently taking into consideration of scale of respective works. Rehabilitation works such as repairing of trunk road, gates, reshaping of drainage canals will be executed within 1 year to avoid cultivation activity as minimize as possible. Reconstruction works will be also executed and to be completed within 1 year. On-farm works will be necessary 1.5 years taking into consideration of area to be developed. Total construction period will be 2 years as shown in Figure O.2.2.

2.4.6 Construction Plan of Irrigation and Drainage System of Expanded and Extension Area

(1) Expanded Area

(a) Scope of works

The scope of works for the Expanded Area are summarizes as follows:

Scope of Works

Works	Quantity
Irrigation Canal	
Main and SupplyCanal	9.0km
Secondary Canal	10.3km
Tertiary Canal	12.1km
Drainage Canal	
Main & Secondary Drain	7.4km
Tertiary Drain	13.4km
Related Structure	164 nos
On-farm works	460ha

(b) Work schedule

Works of irrigation and drainage system, and on-farm works will be executed independently. Excavated soils of drainage canals will be used for embankment materials of irrigation canals, farm roads and flood dike as much as possible. Lining works and construction of related structures are to be executed in parallel with earth works of canals. On-farm works will be completed within 1.5 years, and all of works will also be completed within 1.5 years.

(3) Construction equipment for Expanded Area

Major construction equipment to be used for the works are estimated as follows:

Major Construction Equipment

Equipment	Capacity	Number
Irrigation and drainage works		
Bulldozer, swamp type	16ton	1
Backhoe	0.4 m^3	2
Dump truck	10ton	5
Tire roller	8-10 m^3	1
Portable concrete mixer	0.5m^3	4
On-farm works		
Bulldozer, swamp type	16ton	2
Backhoe	0.4m^3	2
Dump truck	10ton	2

(4) Scope of works for Extension Area

The scope of works for the Extension Area are summarizes as follows:

Works	Quantity
Irrigation Canal	
- Main Canal	9.6km
- Secondary Canal	26.6km
- Tertiary Canal	70.3km
Drainage Canal	
- Main Canal	10.5km
- Secondary Canal	26.5km
- Tertiary Canal	60.5km
Related Structure	
- On-farm works	2,090 ha

(5) Work schedule for Extension Area

Works of irrigation and drainage system, and on-farm works will be executed independently. For the irrigation and drainage system, works will be executed from upstream part to downstream part for irrigation system and downstream to upstream part for drainage system. Excavated soils of drainage canals will be used for embankment materials of irrigation canals and farm roads as much as possible. Lining works and construction of related structures are to be executed in parallel with earth works of canals. On-farm works will be completed within 2.5 years, and all of works will be completed within 3 years.

(6) Construction equipment for Extension Area

Major construction equipment to be used for the works are estimated as follows:

Major Construction Equipment

Equipment	Capacity	Number
Irrigation and drainage works		
Bulldozer	21ton	5
Backhoe	1.0 m^3	5
Backhoe	0.7 m^3	5
Backhoe	0.4 m^3	3
Dump truck	10ton	15
Tire roller	8-10ton	2
Road roller	8ton	2
Batching plant	30 m^3/hr	1
Truck mixer	3 m^3	5
Block making plant	3000 nos./day	1
Concrete pump car	50m^3/hr	3
Truck crane	15ton	2
Truck with crane/2.5ton	6/2.5ton	3
On-farm works		
Bulldozer	16ton	5
Backhoe	1.0 m^3	3
Backhoe	0.7 m^3	3
Dump truck	10ton	5

The work schedule of construction is shown in Figure O.2.2.

3. PROJECT COST

3.1 Conditions

The cost for the implementation of the project is estimated based on the preliminary design of project facilities and the following assumptions, taking into account the construction method, productivity of labor and construction machinery.

(a) The exchange rate used in the estimate is determined considering current exchange rate as follows:
US$ 1.00 = Tsh. 620=¥125 (as of December, 1997)

(b) The construction works will be carried out by the contractors selected through the international competitive bidding.

(c) The construction machinery and equipment and construction material little available in local markets in Tanzania will be imported by the contractors.

(d) Taxes on the construction materials, construction machinery, plant and equipment tobe imported from abroad are exempted.

(e) The unit prices are divided into local currency(L/C) and foreign currency (F/C) portions. Local currency portions is estimated based on the current prices in 1997 in Kilimanjaro Region(Moshi city). Foreign currency portion is estimated based on CIF prices at Tanga, making reference to FOB prices of materials and equipment in Japan in 1997.

(f) Non-compensation will be considered for land acquisition and right of way forthe project facilities.

(g) The classification of local and foreign currency portions is defined as follows:

Local currency portion;
- Labor force
- Sand, gravel, sand, earth, wooden materials
- Inland transportation cost
- Administration expenses

Foreign currency portion;
- Blasting materials
- Reinforcement bars and structural steels
- Cement
- Fuel, lubricant
- Concrete agent
- Gates, penstock, electrical and mechanical equipment for power station
- Depreciation cost of construction machinery and equipment
- Contractor's general expenses and profits
- Expenses and fees of engineering services of consultant

(h) Physical contingencies to the variation of work quantities is considered 10 % of direct construction cost.

(i) Price contingency is assumed to be 3% per annum for the foreign currency portion and 17% per annum for the local currency portions of all above cost items.(Data Source: Economc Bulletin for The Quarter Ended 31st Mrch, 1997, Vol. XXV No.1, published by Bank Of Tanzania.)

(j) The costs for rural fundamental facilities such as facilities for rural water supply, roads, washing basins and animal drinking places are also included.

(k) The administration expenses and cost of engineering services are estimated as shown in TableO.3.7 and O.3.8.

3.2 Cost Estimate

The total Project costs is estimated at 53.6million US$ consisting of US$ 36.1 million of foreign currency portion and Tsh.10,892 million of local currency as summarized below and shown in Table O.3.1.

Summary of Project Cost

Work Description	Foreign Currency (US$1,000)	Local Currency (MillionTsh.)	Equivalent (US$1,000)
(1) Phase-I Works			
(a) Headworks	2,597	429	3,289
(b) Diversion Channel	8,454	1,485	10,850
(c) Existing Lower Moshi Area	3,434	892	4,874
Sub-total	18,485	2,806	19,013
(2) Phase-II Works			
(a) Extension and Expanded Area	11,388	2,616	15,606
Sub-total	11,388	2,616	15,606
(3) O&M Eqipment	1,000	0	1,000
(4) Administration Expenses	-	521	841
(5) Engineerring Services	3,629	562	4,536
Sub-total((1) - (5))	30,502	6,505	40,996
(6) Physical Contingency	3,050	651	4,100
(7) Price Contingency	2,506	3,736	8,533
Total	36,058	10,892	53,629

The breakdowns of direct construction costs of respective works are shown in Table O.3.2. The procurement cost of O & M equipment is shown in Table O.3.3, and the local materials and labor wages used in the cost estimate and unit rates of major works are shown in Table O.3.4, O.3.5 and O.3.6, respectively. The estimate of administrator expences during construction period and engineering services are shown in Table O.3.7 and O.3.8.

3.3 Annual Disbursement Schedule

The annual disbursement schedule is worked out on the basis of the construction schedule as shown in Table O.3.9 and summarized as below:

Disbursement Schedule

(Unit:US$1,000)

FY1998 (1st Year)	FY1999 (2nd Year)	FY2000 (3rd Year)	FY2001 (4th Year)	FY2002 (5th Year)	FY2003 (6th Year)
781	13,280	14,007	9,902	8,353	7,306

3.4 Annual O & M Cost

The following criteria for annual operation and maintenance costs for the irrigation and drainage system and the hydropower system are applied:

(1) 1st Stage (for 5years after completion of all project facilities) :US$35 / ha
(2) 2nd Stage (for remaining project period) :US$25 / ha
Details are presented in Annex N.

3.5 Replacement Cost

Some of the facilities, especially gates of headworks and irrigation related structures have a shorter life than civil works and have to be replaced periodically. The useful lives and costs of replacement of such facilities are listed in Table O.3.10.

Tables

Table O.2.1 Summary of Work Quantity

Work	unit	Quantity
Phase-I		
Headworks		
-Excavation, rock	m3	21,500
-Concrete, plain	m3	12,000
-Concrete, structure	m3	6,000
-Reinforcement bar	ton	150
Diversion Channel		
-Excavation, common soil	m3	200,000
-Excavation, rock	m3	300,000
-Embankment	m3	60,000
-Shotcrete for lining	m3	7,000
-Precast concrete block	m2	80,000
-Structure concrete	m3	8,000
-Reinforcement bar	ton	650
-Steel pipe, dia.2,200mm	ton	45
-Structure steel for girder	ton	140
ExistingLower Moshi Area		
-Excavation	m3	10,000
-Embankment	m3	68,000
-Precast concrete block	m2	40,000
-On-farm works	ha	1,050
Phase-II		
Extension and Expanded Area		
-Excavation	m3	190,000
-Embankment	m3	750,000
-Precast concrete block	m2	220,000
-Structure concrete	m3	60,000
-On-farm works	ha	2,550

Table O.2.2 Estimate of Workable Days

Item	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
-Monthly day	31	28	31	30	31	30	31	31	30	31	30	31	365
-Frequency of rainfall													
3mm - 10mm	1	1	2	5	5	1	1	1	1	1	2	2	23
10mm - 30mm	1	1	2	3	2	0	0	0	0	0	2	1	12
30mm - 50mm	0	0	0	1	1	0	0	0	0	0	0	0	2
more than 50mm	0	0	0	1	0	0	0	0	0	0	0	0	1
-Time length to be suspended	2	2	3	9	6	1	1	1	1	1	3	2	32
-Holidays	6	5	6	6	6	4	7	4	5	5	4	7	65
-Total days to be suspended	8	7	9	15	12	5	8	5	6	6	7	9	97
-Workable days	23	21	22	15	19	25	23	26	24	25	23	22	268

Table O.3.1 Summary of Construction Cost

Work Description	Foreign Currency (US $ 1,000)	Local Currency (Million Tsh.)	Equivalent (US $ 1,000)
(1) Phase - I Works			
Headworks	2,597	429	3,289
Diversion Channel	8,454	1,485	10,850
Existng Lower Moshi Area	3,434	892	4,874
Sub-total (1)	**14,485**	**2,806**	**19,013**
(2) Phase - II Works			
Extension and Expanded Area	11,388	2,616	15,607
Sub-total (2)	**11,388**	**2,616**	**15,607**
Total (1)+(2)	**25,873**	**5,422**	**34,620**
(3) O & M Equipment	1,000	0	1,000
(4) Administration Expences	0	521	841
(5) Engineering Services	3,629	562	4,536
Sub-total(1)-(5)	30,502	6,505	40,997
(6) Physical Contingency	3,050	651	4,100
(7) Price Contingency	2,506	3,736	8,533
(8) Total Project Cost	**36,058**	**10,892**	**53,630**

Table O.3.2 Direct Construction Cost(1/2)

Work Description	Foreign Currency (US$1,000)	Local Currency (Tsh.1,000)	Equivalent (US$1,000)
1.Phase-I Work			
A. Headworks			
- Preparatory Works	125	21,000	159
- Diversion Works	96	10,782	113
- Diversion Weir	1,985	342,332	2,537
- Intake Structure	166	33,022	219
- Metal Works	176	12,035	195
- Control Facility	50	9,600	65
Total A	**2,597**	**428,771**	**3,290**
B. Diversion Channel			
- Preparatory Works	160	30,000	208
- Earth Works	3,126	383,806	3,745
- Lining Works	2,657	677,886	3,750
- Related Structure	2,306	351,230	2,873
- Domestic Facility	108	4,972	116
- Metal Works	96	37,559	157
Total B	**8,453**	**1,485,453**	**10,849**
C. Rehabilitation and Enhancement Works of Existing Lower Moshi Area			
- Preparatory Works	165	43,000	234
- Rehabili. Intake	5	584	6
- Rehabili. Irrigation, Main System	10	42,100	78
- Rehabili. Irrigation, Structure	17	69,011	128
- Rehabili. Drainage	37	6,926	48
- Rehabili. Farm Road	702	202,050	1,028
- Rehabili. Flood Protection Dike	0	28,967	47
- Rehabili. On-Farm	0	16,949	27
- Enhancement, Irrigation System	356	104,832	525
- Enhancement, Drainage System	25	10,609	42
- Enhancement, Farm Road	172	93,627	323
- Enhancement, On-Farm	1,931	265,836	2,360
- Rural Facility	14	8,000	27
Total C	**3,434**	**892,491**	**4,874**
Tatal Phase-I	**14,484**	**2,806,715**	**19,012**

Table O.3.2 Direct Construction Cost (2/2)

Work Description	Foreign Currency (US$1,000)	Local Currency (Tsh.1,000)	Equivalent (US$1,000)
2. Phase-II Work			
A. Extension Area			
- Preparatory Works	430	95,000	583
- Main Irrigation Canal, Earth Works	37	10,852	55
- M.Irrigation Canal, Lining Works	211	88,223	354
- M.Irrigation Canal, Structure Works	56	33,309	110
- M.Irrigation Canal, Gate Works	43	2,585	47
- Sec.Irrigation Canal, Earth Works	174	41,175	240
- S.Irrigation Canal, Lining Works	506	223,341	866
- S.Irrigation Canal, Structure Works	100	69,001	211
- S.Irrigation Canal, Gate Works	32	5,964	42
- Tertiary Irrigation Canal, Earth Works	1,494	480,488	2,269
- Tertiary Irrigation Canal, Structure	71	28,664	118
- Main Drainage Canal, Earth Works	23	2,960	28
- Main Drainage Canal, Structure Works	58	21,382	92
- Sec. Drainage Canal, Earth Works	30	3,840	36
- Sec. Drainage Canal, Structure Works	57	21,898	93
- Tert. Drainage Canal, Earth Works	36	4,416	43
- Tert. Drainage Canal, Structure Works	29	21,766	64
- Main Farm Road	256	43,041	325
- Secondary Farm Road	424	70,952	538
- Tertiary Farm Road	379	64,146	483
- On-Farm	4,537	613,143	5,526
- Rural Facility	30	13,274	52
Sub-total: (1) Extension Area	**9,013**	**1,959,421**	**12,174**
B. Expanded Area			
B-1 Mandaka Munono Area			
- Preparatory Works	94	27,000	138
- Intake Facility	16	4,833	24
- Main Irrigation Canal	123	50,886	205
- Secondary Irrigation Canal	451	186,232	751
- Tertiary Irrigation Canal	199	72,925	316
- Main Drainage Canal	0	0	0
- Secondary Drainage Canal	14	3,893	21
- Tertiary Drainage Canal	11	4,513	19
- Main Farm Road	21	3,579	27
- Secondary Farm Road	111	18,545	141
- Tertiary Farm Road	67	11,315	85
- Flood Dike	158	48,842	237
- On-Farm	599	95,805	754
- Rural Facility	113	31,071	164
Sub-total (2)-1 Mandaka	**1,978**	**559,439**	**2,880**
B-2 Kaloreni Area			
- Preparatory Works	20	4,700	28
- Intake Facility	29	6,629	40
- Main Irrigation Canal	21	10,007	37
- Secondary Irrigation Canal	0	0	0
- Tertiary Irrigation Canal	97	35,142	154
- Main Drainage Canal	0	0	0
- Secondary Drainage Canal	10	4,110	17
- Tertiary Drainage Canal	3	563	4
- Main Farm Road	0	0	0
- Secondary Farm Road	4	613	5
- Tertiary Farm Road	32	5,448	41
- Flood Dike	0	0	0
- On-Farm	166	26,613	209
- Rural Facility	15	3,036	20
Sub-total (2)-2 Kaloreni	**397**	**96,860**	**553**
Sub-total (2) Expanded Area	**2,375**	**656,299**	**3,433**
Total Phase-II	**11,388**	**2,615,720**	**15,607**
Total Phase I+II	**25,872**	**5,422,436**	**34,620**

Table O.3.3 Procurement Cost of O & M Equipment

(Unit:US$)

Equipment	Type / class	Unit Price	Q'ty	Amount
- Backhoe	0.4m3	100,000	1	100,000
- Bulldozer	12ton	120,000	1	120,000
- Motor grader	3.1m	107,000	1	107,000
- Tire roller	8-20ton	80,000	1	80,000
- Dump truck	6ton	45,000	2	90,000
- Pickup truck	2ton	20,000	2	40,000
- Cargo truck	6ton	37,000	1	37,000
- Cargo truck with crane	4ton/2ton	50,000	1	50,000
- Inspection car	4WD/3000cc	30,000	4	120,000
- Motor cycle	125cc	6,000	15	90,000
- Biocycle	-	150	50	7,500
- Workshop equipment and tools	-	50,000	L.S	50,000
- Spare parts	10%			50,000
- Others	-	30,000	L.S	30,000
Total				**971,500**

Table O.3.4 Material Cost (1/2)

(Unit:Tsh.)

Item	Unit	Price	Remarks
(1) Fuel, Lubricant			
-Petrol, super	liter	470	
-Petrol, regular	liter	460	
-Diesel	liter	364	
-Engine oil	liter	1,100	
-Hydrant oil	liter	2,800	
-Gear oil	liter	1,200	
-Grease	kg	2,800	
-LPG	kg	500	
-Acetylene gas(big cylinder)	cylinder	43,000	
-Oxygen	cylinder	16,500	
(2) Construction Materials			
-Ordinary Portland cement	ton	80,000	
-Fine aggregate	m3	7,000	
-Coarse aggregate	m3	16,000	
-Cobble for riprap	m3	5,000	
-Concrete agent(Pozzolith No.8)	kg	-	Not available at market
-Concrete agent for shotcrete	kg	-	Not available at market
-Reinforced steel bar, deformed	ton	340,000	
-Reinforced steel bar, plain(large)	ton	330,000	
-Reinforced steel bar, plain(small)	ton	350,000	
-Binding wire	kg	1,000	
-Structural steel L-shape(large)	ton	-	Not available at market
-Structural steel I-shape(large)	ton	-	Not available at market
-Structural steel H-shape(large)	ton	-	Not available at market
-Steel pipe, dia 25mm	m	12,000	
-Steel pipe, dia 38mm	m	17,000	
-Steel pipe, dia 50mm	m	28,000	
-Steel pipe, dia 75mm	m	40,000	
-Steel pipe, dia 100mm	m	60,000	
-Steel pipe, dia 150mm	m	80,000	
(3) Wooden Material			
-Timber, 1st class	m3	82,000	
-Timber, 2nd class	m3	64,000	
(4) Materials for structures			
-PVC waterstop, b=150mm	m	-	Not available at market
-PVC waterstop, b=230mm	m	-	Not available at market
-PVC waterstop, b=300mm	m	-	Not available at market
(5) Blasting material			
-Dynamite(Kiri No.3)	kg	-	Not available at market
-AN-FO	kg	-	Not available at market
-Detonator	nos.	-	Not available at market

Table O.3.4 Material Cost(2/2)

(Unit:Tsh.)

Item	Unit	Price	Remarks
(6) Corrugated pipe(t=3.2mm)			
-D=1000mm	m	-	Not available at market
-D=1200mm	m	-	Not available at market
-D=1500mm	m	-	Not available at market
-D=1800mm	m	-	Not available at market
(7) Concrete Pipe			
-D=300mm(Unreinforced)	m	8,000	
-D=400mm(Unreinforced)	m	13,000	
-D=500mm	m	16,000	
-D=600mm	m	25,000	
-D=800mm	m	32,000	
-D=1000mm	m	50,000	
(8) Small size of steel material			
(8)-1 L-shape angle			
-20x20x3mm	m	3,000	
-25x25x3mm	m	3,500	
-30x30x3mm	m	4,000	
-40x40x3mm	m	7,500	
-40x40x4mm	m	8,500	
-40x40x6mm	m	12,000	
-50x50x3mm	m	9,000	
-50x50x4mm	m	11,500	
-50x50x6mm	m	16,000	
(8)-2 Steel plate			
-t=0.8mm	m2	11,500	
-t=1.0mm	m2	14,500	
-t=1.2mm	m2	17,000	
-t=1.5mm	m2	20,500	
-t=2mm	m2	24,000	

Table O.3.5 Labor Wages

(Unit: Tsh.)

Labor	Unit	Wage	Over time(hr.)
1. Operator and Driver			
-Operator for heavy equipment	month	100,000	
-Assistant operator for heavy equipment	month	80,000	
-Driver for dump truck	month	100,000	
-Driver	month	60,000	
-Mechanic	month	60,000	
-Assistant mechanic	month	40,000	
2. Labor			
-Forman	man/day	7,500	500
-Mason	man/day	2,500	250
-Welder	man/day	2,500	250
-Steel worker for reinforcement bar	man/day	2,500	250
-Steel worker for structure steel	man/day	2,500	250
-Blaster	man/day	3,000	300
-Carpenter	man/day	3,000	300
-Form worker	man/day	2,500	250
-Mason	man/day	2,000	200
-Mechanic	man/day	2,500	250
-Electrician	man/day	2,500	250
-Plumber	man/day	2,500	250
-Skilled labor	man/day	3,000	300
-Common labor	man/day	1,500	150
-Surveyor	man/day	3,000	300
-Assistant surveyor	man/day	2,500	250
3. Office Staff			
-Clerk	month	40,000	
-Secretary	month	30,000	
-Typist	month	30,000	
-P.C operator	month	30,000	
-Draftsman	month	60,000	
-Watchman	month	30,000	

Table O.3.6 Unit Cost of Major Works

Work Item	Unit	Unit Cost		Equivalent
		F/C(US$)	L/C(Tsh.)	Cost (US$)
1.Headworks				
-Excavation, common	m3	1	110	1
-Excavation, Rock-A	m3	13	1,540	15
-Excavation, Rock-B	m3	12	1,464	15
-Concrete, Type-A	m3	98	14,133	121
-Concrete, Type-B	m3	94	14,148	116
-Concrete, Type-C	m3	92	14,371	115
-Concrete, Type-D	m3	78	13,433	100
-Reinforcement Bar	ton	592	60,745	690
-Form for concrete	m2	4	9,071	19
2.Diversion Channel & Hydropower Station				
-Excavation, common	m3	1	88	1
-Excavation, Rock-A	m3	9	894	10
-Excavation, Rock-B	m3	10	1,088	12
-Embankment of dike	m3	3	452	4
-Sod facing	m2	0	476	1
-Shotcrete lining	m3	155	20,170	188
-Precast block lining(t=10 cm)	m2	13	5,627	22
-Concrete lining for base portion	m3	95	14,472	118
-Structure concrete, Type-A	m3	100	14,229	123
-Structure concrete, Type-B	m3	109	15,642	135
-Structure concrete, Type-C	m3	-	-	-
-Structure concrete, Type-D	m3	92	14,861	116
-Reinforcement bar	ton	619	63,506	721
-Form for concrete	m2	0	2,447	4
-Wet stone masonry	m3	39	11,703	58
-Miscellaneous metal works	ton	813	92,252	962
3.Irrigation & Drainage System				
-Stripping of top soil	m3	3	337	3
-Excavation, Main irr. canal	m3	1	87	1
-Excavation, Secondary irr. canal	m3	1	85	1
-Excavation, Tertiary irr. canal	m3	1	92	1
-Excavation, main and sec. drainage canal	m3	1	80	1
-Excavation, tertiary drainage canal	m3	1	92	1
-Emb. of main and sec. irri. canal by exc. material	m3	3	436	3
-Emb. by main and sec. canal borrowed material	m3	4	644	5
-Emb. tertiary by borrowed material	m3	4	644	5
-Emb. main and sec. road by exca. material	m3	4	620	5
-Emb. main and sec. road by borrowed material	m3	4	644	5
-Emb. tertiary road by excavated material	m3	3	341	3
-Emb. tertiary road by borrowed material	m3	4	644	5
-Concrete block lining, main ans sec. canal	m2	8	3,724	14
-Concrete block lining, tertiary canal	m2	8	3,724	14
-Structure concrete, Type-A	m3	100	14,229	123
-Structure concrete, Type-B	m3	95	13,999	117
-Reinforcement bar	ton	592	60,745	690
-Form for concrete	m2	0	9,363	15
-On-farm works for Exist. and Extension Area	ha	1,811	249,370	2,213
-On-farm works for Expanded Area	ha	1,445	226,126	1,810

Table O.3.7 Administration Expences during Construction Period(1/2)
(Staff Salary of Construction Office)

(Unit: Tsh)

No.	Section and Staff	Required Nos.	Annual Salary	Ammount
1	Project director	1	600,000	600,000
2	Administration section			
	Senior staff	1	480,000	480,000
	Junior staff	24	300,000	7,200,000
3	Account Section			
	Senior staff	1	480,000	480,000
	Junior staff	5	300,000	1,500,000
4	Supervision Section			
	Senior staff	2	480,000	960,000
	Junior staff	41	300,000	12,300,000
5	Survey and Design Section			
	Senior staff	1	480,000	480,000
	Junior staff	8	300,000	2,400,000
6	Farmers Participation Section			
	Senior staff	1	480,000	480,000
	Junior staff	2	300,000	600,000
	Total			**27,480,000**
				(44,350 US$)

Table O.3.7 Administration Expences During Construction Period(2/2)
(Office Running Cost)

(Unit: US $)

No.	Description	Unit cost	Q'ty	Cost Per Year
1	Office expenses			
	Main office	3,000/month	12 month	36,000
	Branch office	1,000/month	12 month	12,000
2	Procurement Cost of Veihicles			
	Field car(3000cc)	30,000/5 years	5	30,000
	Motor cycle(100cc)	1,200/5 years	20	4,800
3	Operation and Maintenance Cost			
	Field car	200/month	5	12,000
	Motor cycle	25/month	20	6,000
4	Others	20 % of above		20,160
	Total			**120,960**

Table O.3.8 Engineering Services Cost

(Unit: 1000US$)

	Amount
I. Detailed design Stage	
1.1 Remuneration	1,760,000
1.2 Direct Cost	440,000
Sub-total	2,200,000
II. Supervision Stage	
2.1 Remuneration	2,650,000
2.2 Direct Cost	650,000
Sub-total	3,300,000
Total	5,500,000

Table O.3.9 Annual Disbursement Schedule

(Unit: 1,000 US$)

Work Description	Diect Cost	Fiscal Year						Total
		1,998	1,999	2,000	2,001	2,002	2,003	
1. Construction Works								
(1) Phase-I Works								
-Headworks	3,289	0	2,193	1,096	0	0	0	3,289
-Diversion Channel	10,850	0	5,425	5,425	0	0	0	10,850
-Existing Lower Moshi Area	4,874	0	2,437	2,437	0	0	0	4,874
Sub -total: Phase-I	19,013	0	10,055	8,958	0	0	0	19,013
(2) Phase-II Works								
Extension Area	12,173	0	0	0	4,058	4,058	4,057	12,173
Expanded Area	3,433	0	0	0	2,473	960	0	3,433
Mandaka Area	2,880	0	0	0	1,920	960	0	2,880
Kaloreni Area	553	0	0	0	553	0	0	553
Sub-total: Phase-II	15,606	0	0	0	6,531	5,018	4,057	15,606
Total: Construction Works	34,619	0	10,055	8,958	6,531	5,018	4,057	34,619
2. O & M Equipment	1,000	0	0	500	0	0	500	1,000
3. Administration Expences	841	140	140	140	140	140	141	841
4. Engineering Services	4,536	570	1,140	1,140	562	562	562	4,536
Sub-total: 2+3+4	6,377	710	1,280	1,780	702	702	1,203	6,377
Total: 1+2+3+4	40,996	710	11,335	10,738	7,233	5,720	5,260	40,996
5. Physical Contingency	4,100	71	1,134	1,074	723	572	526	4,100
Total: (1+2+3+4+5)	45,096	781	12,469	11,812	7,956	6,292	5,786	45,096
6. Price Contingency (FC: 3%, LC: 17%)	8,533	0	812	1,645	1,946	2,061	2,069	8,533
Grond Total	53,629	781	13,281	13,457	9,902	8,353	7,855	53,629

Table O.3.10 Replacement Cost and Useful Life of Equipment

(Unit: US$1,000)

Equipment	Useful Life (Year)	Replacement cost	Remarks
(1) O & M equipment			
-Existing Lower Moshi Area	10	500	
-Extension and Expanded Area	10	500	
(2) Gate and Metal Works for Irrigation and Drainage System			
-Headworks	25	210	
-Diversion Channel	25	1,000	
-Existing Lower Moshi Area	20	500	For 2,150ha
-Extension and Expanded Area	25	500	For 2,550ha

Figures

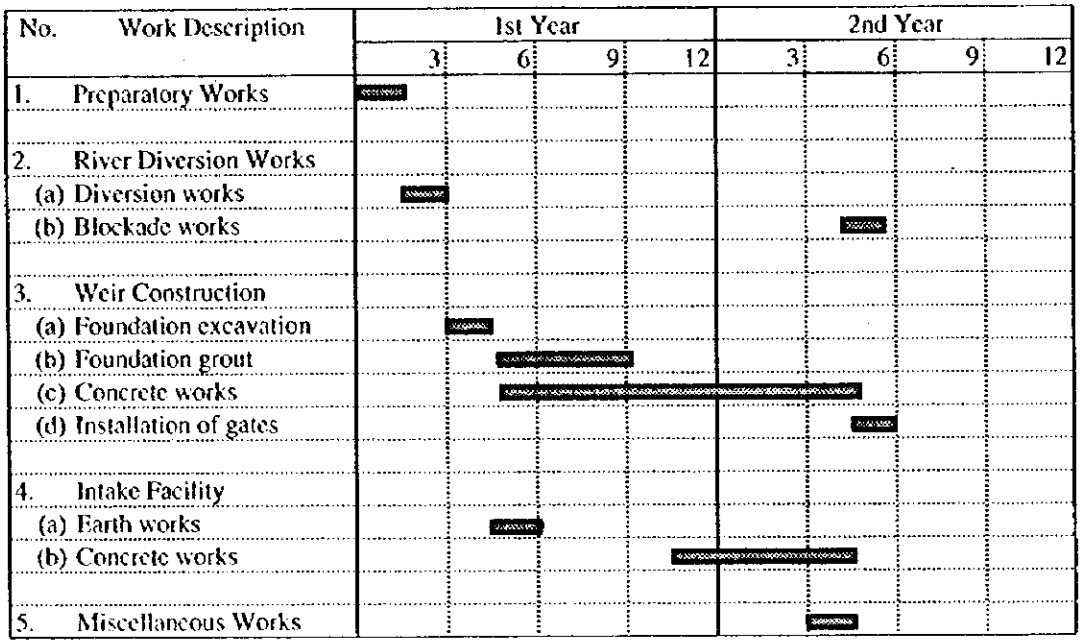
Implementation Schedule

Figure O.2.1
Implementation Schedule

The Feasibility Study on Lower Moshi Integrated Agriculture and Rural Development Project in the United Republic of Tanzania

Japan International Cooperation Agency

Work Schedule of Headworks (Phase-I)



Work Schedule of Diversion Channel (Phase-I)

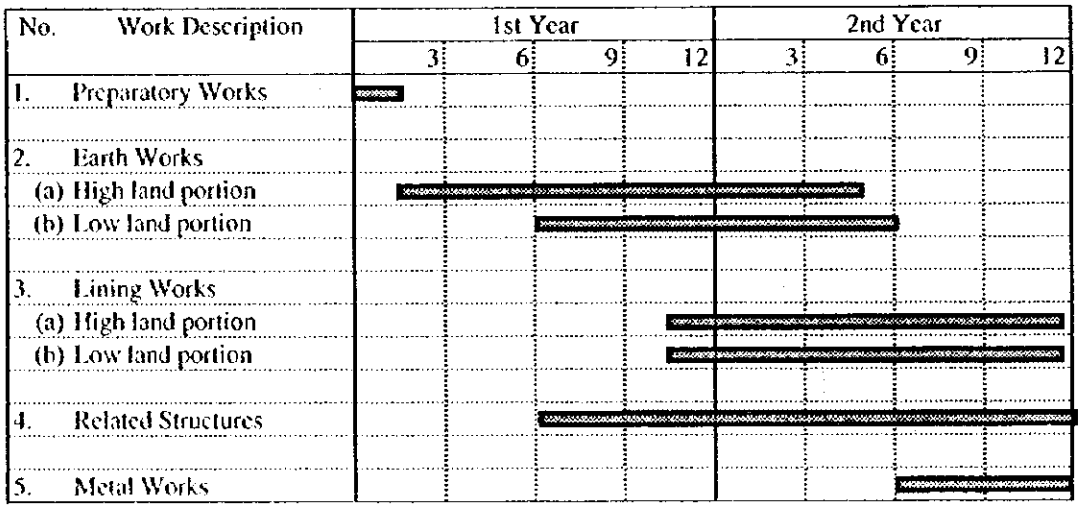
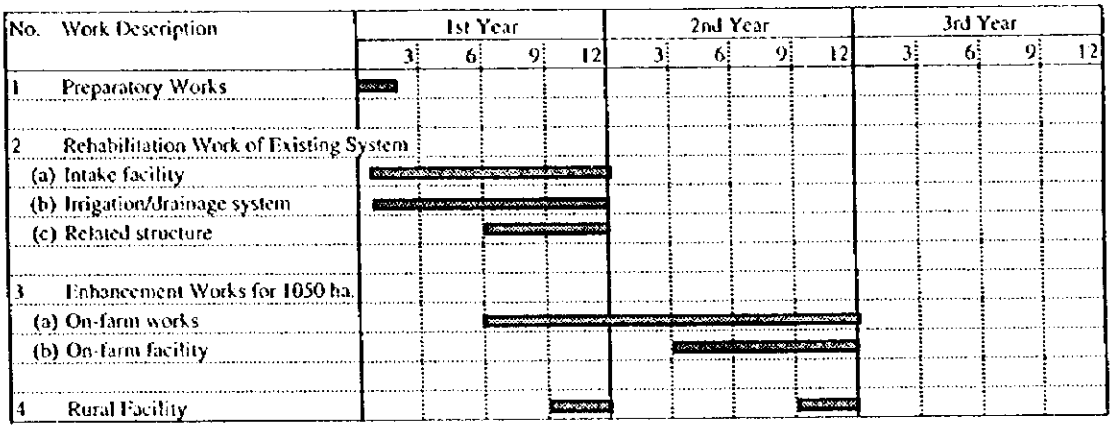


Figure O.2.2
Construction Time Schedule(1/2)

The Feasibility Study on Lower Moshi Integrated Agriculture and Rural Development Project in the United Republic of Tanzania

Japan International Cooperation Agency

Work Schedule of Existing Lower Moshi Area(Phase-I)



Work Schedule of Extension and Expanded Area(Phase-II)

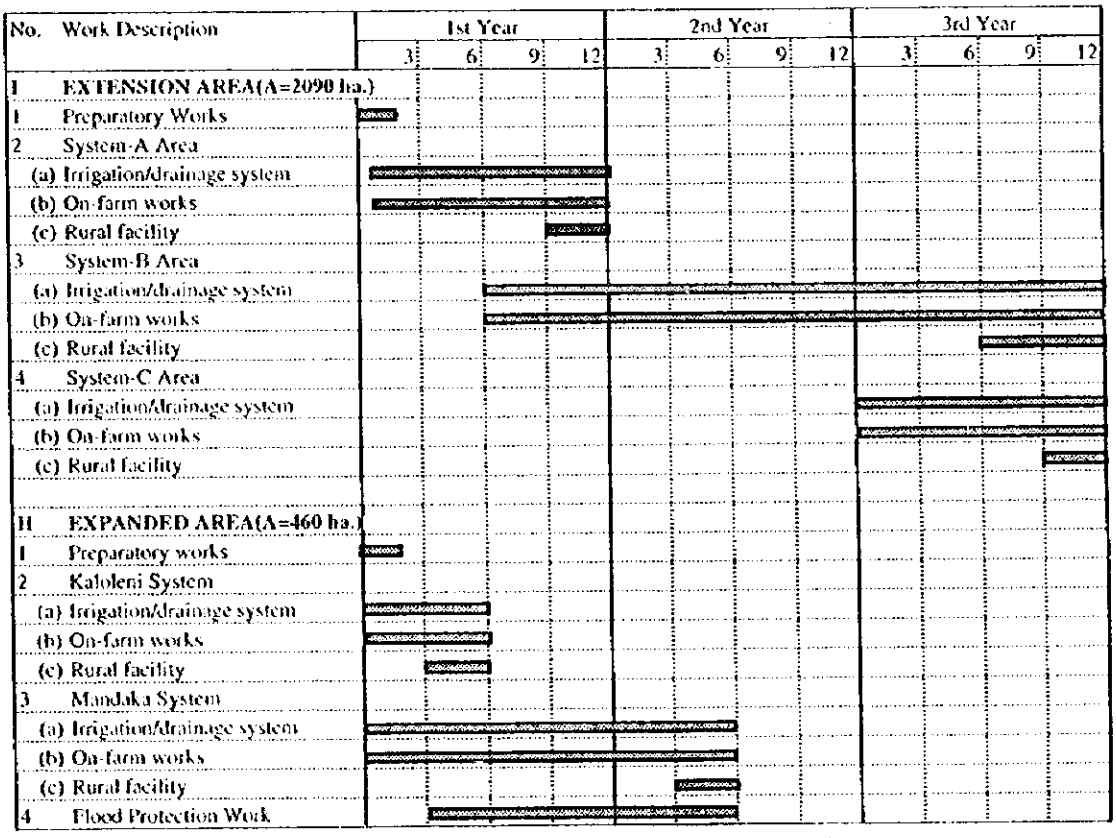


Figure O.2.2
Construction Time Schedule(2/2)

The Feasibility Study on Lower Moshi Integrated Agriculture and Rural Development Project in the United Republic of Tanzania

Japan International Cooperation Agency

ANNEX-P

PROJECT EVALUATION

ANNEX - P

PROJECT EVALUATION

Table of Contents

List of Tables

ANNEX - P

PROJECT EVALUATION

1 INTRODUCTION

This Annex evaluates the viability of the proposed project by estimating economic internal rate of return (EIRR) for each Area individually and for the whole Area respectively with hydropower plan and without hydropower plan. The indirect benefits and socio-economic impacts from the implementation of the project are also studied.

Chapter 2 details the basic assumptions of economic evaluation such as economic life of the Project, exchange rate, construction period, standard conversion factor (SCF), construction cost conversion factors (CCF) etc. and economic benefits. Economic costs as well as replacement costs are also shown in this chapter. Calculation of economic internal rate of returns (EIRR) are also conducted for the whole project Area and for each Area individually i.e. Existing Lower Moshi Project Area and New Extension Area combined with Expanded Area. A sensitivity analysis is made in order to elucidate the economic viability of the Project against adverse changes.

Chapter 3 shows the results of financial evaluation which was executed by a cash flow statement and a farm budget analysis. The cash flow statement was prepared from the viewpoint of CHAWAMPU, to grasp the financial soundness of the Project. The farm budget analysis is conducted to assess whether the project will generate enough income in the farmers' economy. Capacity to pay of the farmers for operation and maintenance is also analysed for three cases i.e. farmers with land holding size of 0.5 ha, 1.5 ha and 3 ha respectively.

Chapter 4 evaluates various intangible benefits expected from the implementation of the Project. Socio-economic impacts such as impacts on living standard, availability of food, employment opportunity, local transportation, rural water supply, etc. are studied.

Chapter 5 evaluates the Project including the small-scaled hydropower development by means of the same economic and financial analysis methods mentioned in Chapter 3.

2. ECONOMIC EVALUATION

2.1 General

The proposed Lower Moshi Integrated Agriculture and Rural Development Project Area is composed of the Existing Lower Moshi Project Area, Expanded Area and the New Extension Areas. The project evaluation is made through assessment of the project feasibility in view of economic and socio-economic aspects. The economic viability of the Project is found by estimating economic internal rate of return (EIRR) for each Area individually and for the whole Area. Sensitivity analysis is made in order to elucidate the economic viability of the whole Project Area against adverse changes such as over running the project cost, decrease in expected benefit etc. Financial analysis is carried out by analysing the capacity to pay for the water charges at the farm level. The indirect benefits and socio-economic impacts from the implementation of the Project are also studied.

2.2 Basic Assumptions

Basic assumptions for economic evaluation are as follows:

(a) The economic life of the project is 50 years.
(b) All prices are expressed in 1997 constant prices.
(c) The exchange rate of US$ 1.00 = Tsh. 620 = ¥ 125 is applied.
(d) The construction period is 6 years including 1 year for the preparatory works, detailed design, and tendering and evaluation for the whole period.
(e) Only economic benefits of crop production electricity generation are counted in the economic evaluation , and economic benefits generated from livestock production etc. are not taken into account.
(f) Construction cost conversion factor and the conversion factor is 0.8 .
(g) Shadow price of labour works used for evaluation is 75% of the market price. O&M cost per hectare was estimated at US$ 35 for 5 years and US$ 25 from 6th year on. In addition, water charge including above O&M cost, was calculated at US$ 75 for 5 years and US$ 65 from 6th year on

2.3 Evaluation of Economic Factors

2.3.1 Standard Conversion Factor

In order to evaluate the project costs and benefits with respect to world market prices, a SCF of 0.95 is applied to the prices of non traded goods and services. This figure is calculated on the basis of export and import statistics for the years 1991 to 1995 as shown in the following table.

Standard Conversion Factor

(Unit: Tsh Million)

Particulars/Year	1991	1992	1993	1994	1995	Average
Export (F.O.B.) (E)	74,708	123,966	181,147	265,177	390,378	207,075
Import (C.I.F.) (I)	338,990	449,480	615,990	765,757	968,910	627,825
Export Subsidy (Es)	0	0	0	0	0	0
Export Tax (Et)	0	0	0	0	0	0
Import Subsidy (Is)	0	0	0	0	0	0
Import Tax (It)	31,504	38,617	31,637	56,651	81,318	47,945
SCF	0.93	0.94	0.96	0.95	0.94	0.95

Source: Bank of Tanzania Economic Bulletin, Vol. XXIV No.3, 1996;
Tanzania the Challenge of Reforms: Growth, Incomes and Welfare, IBRD, May 31, 1996
Note: 1) SCF=(E+I)/{(E+Es-Et)+(I-Is+It)}

2.3.2 Economic Farm-gate Prices of Agricultural Outputs and Inputs

Economic farm gate prices of crop production e.g. paddy, maize and farm inputs are estimated based on the projected international market price forecast by IBRD in 1997 current US$ (Commodity Markets and the Developing Countries, A World Bank Business Quarterly, August 1997 (refer to Tables P.2.1 and P.2.2). Financial prices such as alfalfa, packing bags etc. are converted to economic prices applying a SCF of 0.95 as described above.

2.4 Economic Benefit

(1) Economic Benefit from Irrigation Development

The direct benefit to be expected in the project area is derived from the increased crop production attributed to a stable irrigation water supply. The balance of total amount of economic net return obtained from crop production between future with project and without project conditions is the direct benefit and is summarised in the following Table. The benefit is expected to increase year by year after the completion of irrigation project. The anticipated incremental net production values in each area i.e. The Existing Lower Moshi Project Area, New Extension Area combined with Expanded Area are summarised in the following Table. The cropped Area in the Existing Lower Moshi Project Area under "Without Project Conditions" is estimated at 670 ha, taking into considerations the results of probability analysis on the past 5 years cropped area (80% dependability) at the water balance study. For the New Extension Area and the Expanded Area refer to ANNEX - E.

Economic Benefit

(Unit: US$'000)

Area	Without Project Condition	With Project Condition	Incremental Benefit
Whole Project Area (4,700 ha)	1,065	7,654	6,589
Existing Lower Moshi Project Area (2,150 ha)	819	3,537	2,718
New Extension Area and Expanded Area (2,550 ha)	246	4,117	3,871

2.5 Economic Cost

The project cost broadly comprises: direct construction cost, O & M equipment, engineering service, administration physical contingencies. The financial construction costs are converted into the economic construction costs by applying CCF for each of major components with and without Hydropower Plan as described before. The economic capital cost is summarised as follows. Detailed cost allocation and disbursement are mentioned in Table P. 2.3.

Economic Cost

(Unit: US$'000)

Area/Items	Direct Construction Cost	O & M Equipment	Engineering Service	Administration	Physical Contingencies	Total
Whole Project Area	27,695	1,000	4,536	841	3,407	37,479
Existing Lower Moshi Project Area	9,027	500	2,075	385	1,199	13,186
New Extension Area and Expanded Area	18,668	500	2,461	456	2,208	24,293

The above tables show that economic cost is US$ 37,479 thousand for the whole Project Area, US$ 13,186 thousand for the Existing Lower Moshi Project Area and US$ 24,293 thousand for the New Extension Area combined with Expanded Area. Costs for head works, diversion channel, and trunk roads are not allocated for the Expanded Area (460 ha) and 417 ha of land in the Existing Lower Moshi Project Area because they do not use the water from

Kikuletwa River System and the construction cost for those items are evenly distributed to 3,823 ha i.e. 1733 ha in the Existing Lower Moshi Project Area and 2,090 ha in the New Extension Area respectively.

2.6 Replacement Cost

The replacement costs comprise, O&M equipment, gate and metal works for irrigation system, electrical and mechanical equipment for hydropower station. Replacement cost will occur in 10 years interval for O&M equipment, 25 years interval for gate and metal works for irrigation systems . Replacement costs are summarised in the following table.

Replacement Cost

(Unit: US$ '000)

Area	Equipment	Useful Life (Years)	Replacement Cost
Existing Lower Moshi Project Area	(1) O & M Equipment	10	500
	(2) Gates and Metal Works for Irrigation and Drainage System		
	- Head works	25	95
	- Diversion Channel	25	454
	- for Existing Lower Moshi Project Area	20	500
New Extension and Expanded Areas	(1) O & M Equipment	10	500
	(2) Gates and Metal Works for Irrigation and Drainage System		
	- Head Works	25	115
	- Diversion Channel	25	548
	- for New Extension and Expanded Area	25	500

Note: Costs for head works, diversion channel are allocated to Existing Lower Moshi Project Area and New Extension Area as described before

2.7 Calculation of Economic Internal Rate of Return

The economic internal rate of return (EIRR) is calculated on the basis of the flows of economic benefits and costs individually for the Existing Lower Moshi Project Area, New Extension Area combined with the Expanded Area and for the whole Project Area (refer to Table P.2.4). The calculation of EIRR was conducted for the following cases.

EIRR

Case		Description	EIRR (%)
(a)	Case -1:	Whole Project Are (4,700 ha)	13.4
(b)	Case -2:	Existing Lower Moshi Project Area (2,150 ha)	17.2
(c)	Case -3:	New Extension Area and Expanded Area(2,550 ha)	11.2

The evaluation results show that the Project is economically feasible. The results also show that the Existing Lower Moshi Project Area shows the highest EIRR followed by the whole Project Area. Even the New Extension Area combined with the Expanded Area show still feasible values (11.2%).

2.8 Sensitivity Analysis

A sensitivity analysis for each Area individually and for the whole Area is made to evaluate the soundness of the project against unexpected adverse changes in future for the following cases:

(a) If the project cost runs over the price and physical contingencies by 10%
(b) If the expected benefit decreases by 10%
Combination of (a) and (b)

The effects of these changes in EIRR are summarised as follows:

Sensitivity Analysis

Case/Area	Existing Lower Moshi Project Area	New Extension Area and Expanded Area	Project Area Whole
(a) 10% increase of cost	15.7 %	10.3 %	12.0 %
(b) 10% decrease of benefit	15.5 %	10.2 %	12.2 %
(c) Combination of (a) and (b)	14.6 %	9.4 %	11.2 %

As shown in the above table, the elasticity of the project feasibility for the critical condition is no sensitive in the Existing Lower Moshi Project Area. Concerning the New Extension Area it ranges from 9.4 % to 10.3% . The analysis indicates that the Project even under adverse cases of cost increase and benefit decrease, is still viable.

3. FINANCIAL EVALUATION

3.1 General

The financial evaluation of the project is made from the view point of the farmer. Farm budget analysis is conducted to assess whether the project will generate enough income in the farmers' economy. The repayment capability for the capital investment is studied by analysing capacity to pay for water charges at the farmers' level. To analyse the capacity to pay, three cases are studied i.e. marginal farmers with land holding size of 0.5 ha, small farmers with land holding size of 1.5 ha and medium farmers with land holding size of 3.0 ha respectively.

3.2 Cash Flow Statement Analysis

The financial sustainability of the Project was assessed using a cash flow statement analysis which presents the financial soundness of the Project by comparing all revenues collected from the benificial farmers with the fund requiement for the project operation. For the assessment, the following assumptions have been applied:

(1) The capital funds of the project works and tractor hiring services will be arranged by the Government of Tanzania.

(2) The cash flow statement analysis was prepared from the viewpoint of CHAWAMPU.

(3) Revenue sources for the project operation are:1) annual water charge of Tsh.46,500/ha (US$ 75) in the 1st stage and Tsh.40,300/ha (US$ 65), and 2) tractor hiring services fees of Tsh.50,000/ha for paddy cultivation and Tsh.12,500/ha for alfalfal cultivation. The water charge consists of replacement cost and O & M cost of the project facilities including O & M equipment, administration cost, etc. The tractor hiring service fees includes the O & M cost and replacement cost of tractors.

On the basis of these assumptions, the cash flow statement of the project implementation and operation stages was tabulated as shown in Table P.2.5. The results of the analysis indicated that the anticipated revenues collected from the beneficial farmers would be able to provide sufficient funds for O & M cost and replacement cost of O & M equipment and tractors for the Project, and thus the financial sustainability of the Project for CHWAMPU.

3.3 Farm Budget Analysis and Capacity to Pay

The payment capacity is defined as the ability of the beneficiary farmers to bear the expenses required for operation and maintenance of the Project facilities. The analysis results for respective cases are summarised in the following table.

Results of Farm Budget Analysis

(Unit:Tsh.)

Description	Ex Lower Moshi Project Area			Expanded Area			New Extension Area		
	Marginal 0.5 ha	Small 1.5 ha	Medium 3.0 ha	Marginal 0.5 ha	Small 1.5 ha	Medium 3.0 ha	Marginal 0.5 ha	Small 1.5 ha	Medium 3.0 ha
(1) Income Structure									
(a) Net farm crop income									
- Gross farm income	885,500	2,656,500	5,313,000	819,900	2,459,600	4,919,300	885,500	2,656,500	5,313,000
- Production cost*	237,600	712,800	1,425,500	231,200	693,600	1,387,300	237,600	712,800	1,425,500
- Net farm crop income	647,900	1,943,700	3,887,500	588,700	1,766,000	3,532,000	647,900	1,943,700	3,887,500
(b) Livestock income	99,600	83,000	66,400	213,600	178,000	142,400	51,600	43,000	34,400
(c) Homestead income	12,500	12,500	12,500	61,000	61,000	61,000	35,000	35,000	35,000
(d) Non-farm income	290,000	130,000	0	250,000	221,000	0	290,000	153,000	0
(e) Household income	1,050,000	2,169,200	3,966,400	1,113,300	2,226,000	3,735,400	1,024,500	2,174,700	3,956,900
(2) Living Expenditure	854,000	915,800	1,089,900	950,000	1,078,000	1,293,600	872,000	1,003,000	1,203,600
(3) Net Reserve	196,000	1,253,400	2,876,500	163,600	1,148,000	2,441,800	152,500	1,171,700	2,753,300
- in US$	316	2,022	4,640	263	1,852	3,938	246	1,890	4,441
(4) Water Charge	23,250	69,750	139,500	23,250	69,750	139,500	23,250	69,750	139,500
- in US$	38	113	225	38	113	225	38	113	225
(5) Payment Ratio(4/5)	12 %	6 %	5 %	14 %	6 %	6 %	15 %	6 %	5 %
(6) Balance	172,750	1,183,650	2,737,000	140,050	1,078,250	2,302,300	129,250	1,101,950	2,613,800
- in US$	279	1,909	4,415	226	1,739	3,713	208	1,777	4,216

**: Production cost consists of farm inputs cost, chemicals cost, labour cost, O&M costs of tractors.*

The analysis result shows that even the marginal farmers with land holding of 0.5 ha in the New Extension Area will have a substantial amount of reserve to pay O&M costs. The estimated per farm household income is US$ 1,650 (Tsh one million) for farmers with land holding of 0.5 ha which is largely higher than US$ 310 of the averaged income mentioned in ANNEX-F. Deducting the living expenditure, the capacity to pay is estimated at US$ 246 to US$ 316 for marginal farmers, US$ 1,852 to US$ 2,022 for small farmers, and more than US$ 3,938 for medium farmers. The payment ratio ranges from 4 % to 15% of net reserve, and comes to about 6 % in average as a whole since the average farm size in the whole Project Area is about 1.5 ha. From this analysis, it is clear that the water charge including O & M cost could be covered even by the marginal farmers and would not represent a heavy financial burden.

4. SOCIO-ECONOMIC IMPACTS

There are various intangible benefits expected from the implementation of the Project. Major impacts expected after the implementation of the Project are described here.

(1) Technical Impacts

(a) Improvement of farm and village roads in the Project Area

Local transportation will be improved by the construction of the farm roads along the canals and improvement of village roads. In particular, the inspection road along the diversion channel will play an important role to connect the presently isolated western area of the Project with the Moshi urban area. On the other hand, the social and economic activities in the eastern area of the Project will be much improved by constructing one road bridge on the Rau and Njoro rivers.

(b) Improvement of domestic water supply condition

The Project has a plan to provide the water supply facilities for domestic use and livestock using canal water. After completion of these facilities, the farmers in the Project Area will obtain stable water supply through these facilities, which will lead to improvement of rural sanitary situation and prevention of sickness of farmers and livestock.

(c) Demonstration effect to other similar projects

The successful implementation of the Project including operation, maintenance and water management , will bring the demonstration effect to other similar irrigation projects. Especially, technical knowledge on operation, maintenance and water management for irrigated paddy cultivation can be transferred to other relevant staff.

(2) Social Impacts

(a) Improvement of Living Conditions

The development of irrigation, drainage, farm roads and rural infrastructures included in the Project will provide the farmers with increase of income and finally improvement of living conditions.

(b) Increase of Employment Opportunity

The Project will generate employment opportunities during the construction period. Farmers will gain more experience, technical know-how, skills in various working fields and those skills would be applied to the future development in the region as well as O&M activities. In addition the Project will create a demand of farm labour due to increased farming activities with double cropping of paddy and intensification of land use.

(c) Contribution of National Food Security

The Project will increase agricultural production of paddy from present about 7,700 tons to 46,700 tons, which will contribute to food security in the region as well as national food security. In addition, GOT imported rice of about 50,000 tons in 1994 and still continues the similar import tendency of rice. The large increase in rice production by the Project will be thus conducive for saving of foreign currency, and contribute to national economy.

(d) Enpowerment of Women

The Project will create the improvement of agricultural production condition and bring income increase to farmers. Such income increase will enable women to have a time to participate in activities related to education, culture, leisure, etc, which will elevate their social standing.

5. ECONOMIC EVALUATION OF SMALL-SCALE HYDROPOWER DEVELOPMENT PLAN

(1) Basic Assumptions

The same basic assumptions mentioned in Sub-section 2.2 are applied, but the O&M cost per ha are US$ 46 for 5 years and US$ 36 from 6th year on and the water charge US$ 100 for 5 years and US$ 90 from 6th year on

(2) Economic Benefits from Electricity Generation

In addition to the irrigation benefits mentioned in Sub-section 2.4, the average revenue per kWh is estimated at US Cents 7.95 which is derived from Feasibility Study on Small-Scale Hydroelectricity Power Development Project in Kilimanjaro Region in 1989. The estimated total revenue from No. 1 and No.2 Hydro Power Plants are US$ 539 thousand and US$ 1,631 thousand per year respectively. The basic of calculation is as follows.

No.1 Hydropower Plan

(a) Rated Capacity of Plant: 790 kW
(b) Annual Electricity Generation: 790 kW x 24 hr x 365 days x 0.98 (2% for p.s use)=6,782 x 10^3 kW/year
(c) Annual Revenue: 6,782 x 10^3 kW x US$ 0.0795=US$ 539,000/year

No.2 Hydropower Plan

(a) Rated Capacity of Plant: 2,390 kW
(b) Annual Electricity Generation: 2,390 kW x 24 hr x 365 days x 0.98 (2% for p.s use)= 20,517 x 10^3 kW/year
(c) Annual Revenue: 20,517 x 10^3 kW x US$ 0.0795=US$ 1,631,000/year

(3) Economic Cost

Economic cost for the whole project area with hydropower plan is estimated at US$ 45,187 thousand, consisting of US$ 16,685 thousand for the Existing Lower Moshi Project Area, US$ 28,502 thousand for the New Extension Area with Expanded Area respectively, and summarised below:

Economic Cost with Hydropower Plan

(Unit: US$'000)

Area/Items	Direct Construction Cost	O & M Equipment	Engineering Service	Administration	Physical Contingencies	Total
Whole Project Area	33,559	1,000	5,500	1,020	4,108	45,187
Existing Lower Moshi Project Area	11,685	500	2,516	467	1,517	16,685
New Extension Area and Expanded Area	21,874	500	2,984	553	2,591	28,502

Table P.2.6 presents the detailed cost allocation and disbursement. Costs for head works, diversion channel, trunk roads and hydropower plan are not allocated for the Expanded Area (460 ha) and 417 ha of land in the Existing Lower Moshi Project Area because they do not use the water from Kikuletwa River System and the construction cost for those items are evenly distributed to 3,823 ha i.e. 1733 ha in the Existing Lower Moshi Project Area and 2,090 ha in the New Extension Area respectively.

(4) Replacement Cost

In addition to the replacement cost mentioned in Sub-section 2.6, replacement cost for

hydro-mechanical equipment such as turbine, generator and penstock are considered. Tabulated below are the useful life and its replacement cost.

Replacement Cost and Useful Life

(Unit: US$'000)

Equipment	Useful Life	Replacement Cost
(a) Penstock, turbine, generator for No.1 Power Station	50 years	2,045
(b) Penstock, turbine, generator for No.2 Power Station	50 years	3,400

(5) Calculation of Economic Internal Rate of Return

The economic internal rate of return (EIRR) is calculated on the basis of the flows of economic benefits and costs individually for the Existing Lower Moshi Project Area, New Extension Area combined with the Expanded Area and for the whole Project Area (refer to Table P.2.6). The calculation of EIRR was conducted for the following cases.

EIRR

Case	Description	EIRR (%)
(a) Case -1:	Whole Project Are (4,700 ha)	15.5
(b) Case -2:	Existing Lower Moshi Project Area (2,150 ha)	19.1
(c) Case -3:	New Extension Area and Expanded Area (2,550 ha)	13.2

The evaluation results show that the development plan with hydropower is more economically feasible and even EIRR for the Expanded Area and New Extension Area combined show still feasible value with 13.2%.

(6) Sensitivity Analysis

A sensitivity analysis for each Area individually and for the whole Area with hydropower development plan is made in the same manner described in Section 2.8.

(a) If the project cost runs over the price and physical contingencies by 10%
(b) If the expected benefit decreases by 10%
(c) Combination of (a) and (b)

The effects of these changes in EIRR are summarised as follows:

Sensitivity Analysis

Case/Area	Existing Lower Moshi Project Area	New Extension Area and Expanded Area	Project Area Whole
(a) 10% increase of cost	17.6 %	12.2 %	14.2 %
(b) 10% decrease of benefit	17.4 %	12.1 %	14.1 %
(c) Combination of (a) and (b)	15.9 %	11.1 %	12.9 %

The results indicate that the economic viability of the Project is rather insensitive to the most sever case of cost increase and benefit decrease.

(7) Financial Evaluation

(a) Cash flow statement analysis

The financial sustainability of the Project was assessed using a cash flow statement analysis which presents the financial soundness of the Project by comparing all revenues collected from the benificial farmers with the fund requirement for the project

operation. For the assessment, the following assumptions have been applied:

1) The capital funds of the project works and tractor hiring services will be arranged by the Government of Tanzania.
2) The cash flow statement analysis was prepared from the viewpoint of CHAWAMPU.
3) Revenue sources for the project operation are:1) annual water charge of Tsh.62,000/ha (US$ 100) in the 1st stage and Tsh.55,800/ha (US$ 90), and 2) tractor hiring services fees of Tsh.50,000/ha for paddy cultivation and Tsh.12,500/ha for alfalfal cultivation. The water charge consists of replacement cost and O & M cost of the project facilities including O & M equipment, administration cost, etc. as shown in Clause 6.4. The tractor hiring service fees includes the O & M cost and replacement cost of tractors.

On the basis of these assumptions, the cash flow statement of the project implementation and operation stages was tabulated as shown in Table P.2.8. The results of the analysis indicated that the anticipated revenues collected from the beneficial farmers would be able to provide sufficient funds for O & M cost and replacement cost of O & M equipment and tractors for the Project, and thus the financial sustainability of the Project for CHAWAMPU.

(b) Farm budget analysis and capacity to pay

The payment capacity is defined as the ability of the beneficiary farmers to bear the expenses required for operation and maintenance of the Project facilities. The analysis results for respective cases are summarised in the following table.

Results of Farm Budget Analysis

(Unit:Tsh.)

Description	Ex.Lower Moshi Project Area			Expanded Area			New Extension Area		
	Marginal 0.5 ha	Small 1.5 ha	Medium 3.0 ha	Marginal 0.5 ha	Small 1.5 ha	Medium 3.0 ha	Marginal 0.5 ha	Small 1.5 ha	Medium 3.0 ha
(1) Income Structure									
(a) Net farm crop income									
- Gross farm income	885,500	2,656,500	5,313,000	819,900	2,459,600	4,919,300	885,500	2,656,500	5,313,000
- Production cost*	237,600	712,800	1,425,500	231,200	693,600	1,387,300	237,600	712,800	1,425,500
- Net farm crop income	647,900	1,943,700	3,887,500	588,700	1,766,000	3,532,000	647,900	1,943,700	3,887,500
(b) Livestock income	99,600	83,000	66,400	213,600	178,000	142,400	51,600	43,000	34,400
(c) Homestead income	12,500	12,500	12,500	61,000	61,000	61,000	35,000	35,000	35,000
(d) Non-farm income	290,000	130,000	0	250,000	221,000	0	290,000	153,000	0
(e) Household income	1,050,000	2,169,200	3,966,400	1,113,300	2,226,000	3,735,400	1,024,500	2,174,700	3,956,900
(2) Living Expenditure	854,000	915,800	1,089,900	950,000	1,078,000	1,293,600	872,000	1,003,000	1,203,600
(3) Net Reserve	196,000	1,253,400	2,876,500	163,600	1,148,000	2,441,800	152,500	1,171,700	2,753,300
- in US$	316	2,022	4,640	263	1,852	3,938	246	1,890	4,441
(4) Water Charge	31,000	93,000	186,000	31,000	93,000	186,000	31,000	93,000	186,000
- in US$	50	150	300	50	150	300	50	150	300
(5) Payment Ratio(4/5)	16 %	7 %	6 %	19 %	8 %	8 %	20 %	8 %	7 %
(6) Balance	165,000	1,160,400	2,690,500	132,600	1,055,000	2,255,800	121,500	1,078,700	2,567,300
- in US$	266	1,872	4,340	214	1,702	3,638	196	1,740	4,141

**: Production cost consists of farm inputs cost, chemicals cost, labour cost, O&M costs of tractors.*

The analysis result shows that the payment ratio ranges from 6 % to 20% of net reserve, and comes to about 8 % in average as a whole since the average farm size in the whole Project Area is about 1.5 ha. From this analysis, it is apparent that the water charge including O & M cost could be covered even by the marginal farmers and would not represent a heavy financial burden.

As mentioned in Item (1) of Sub-section 10.6, the total revenue from both Hydro-power Stations is estimated at US$ 2,170,000/year (Tsh.1,345 million/year). It is also possible that not only the water charge (Tsh.262 million/year), but also the tractor hiring services fee (Tsh.372 million/year) will be covered by this revenue can cover.

Tables

Table P.2.1 Summary of Financial and Economic Prices of Crops and Farm Inputs

(Unit: Tsh)

Particulars		Unit	Financial Price	Economic Price
Crops				
Paddy	1)	kg	175.0	157.5
Maize	1)	kg	115.0	99.3
Alfalfa	2)	kg	35.0	33.3
Seeds				
Paddy	2)	kg	350.0	333.0
Maize	2)	kg	1,000.0	950.0
Alfalfa	2)	kg	1,000.0	950.0
Fertilisers				
Urea	1)	kg	220.0	126.3
TSP	1)	kg	280.0	134.1
SA	1)	kg	160.0	67.0
Agrochemicals				
Basudin	2)	liter	9,000.0	8,550.0
Endosulfan	2)	kg	8,000.0	7,600.0
Packing Materials				
Bag	2)		500.0	475.0
Farm Labour				
Family Labour	3)	day	0.0	1,125.0
Hired Labour	3)	day	1,500.0	1,125.0
Machinery				
Tractor (4 Wheel)		hr	3,125.0	6,250.0

Note: 1) Economic farm gate prices are derived from the data of IBRD document (refer to Table P.2.2)
2) Financial value is adjusted by a SCF of 0.95 to convert to economic value
3) A shadow wage rate of 0.75 is applied to convert to economic value

Table P.2.2 Economic Farm Gate Price Calculation for Paddy, Maize and Fertilizers

Particulars/Items/Prices	Unit	Paddy (1)		Maize (2)		Urea (3)		TSP (4)		SA(5)	
		US$	TSh	US$	TSh	US$	TSh	US$	TSh	US$	TSh
Market Prices (1997, FOB, Bangkok)	per ton	330.0		118.0		160.0		172.0		73.6	
Add: Freight	per ton	25.0		25.0		25.0		25.0		25.0	
Insurence (1.5%)	per ton	5.0		1.8		2.4		2.6		1.1	
CIF Price at Tanga Port	per ton	360.0		144.8		187.4		199.6		99.7	
Add: Wharfage (1.5%)	per ton	5.4		2.2		2.8		3.0		1.5	
Clearing Charge (2%)	per ton	7.2		2.9		3.7		4.0			
Handling Charge	per ton	4.0		4.0		4.0		4.0			
Landed Price	per ton	376.5	233,460	153.8	95,379	198.0	122,735	210.6	130,550	101.2	62,744
Add: Transport to Main Market to Tanga (8 Km)	per ton		2,000		2,000		2,000		2,000		2,000
Off Loading	per ton		1,000		1,000		1,000		1,000		1,000
Storage Charge/Month	per ton		15,000		15,000		15,000		15,000		15,000
Wholesale Price at Tanga	per ton		251,460		113,379		140,735		148,550		80,744
	per kg		251.5		113.4		140.7		148.6		80.7
Add: Quality Adjustment (Add 15%), (6)	per kg		289.2		-		-		-		-
Deduct: Processing Ratio 35%	per kg		101.2		-		-		-		-
Processing Cost	per kg		15.0		-		-		-		-
In Land Transport: Tanga to Moshi (380 Km)	per kg		12.0		12.0		12.0		12.0		12.0
Losses/Rebagging 1%	per kg		2.5		1.1		1.4		1.5		0.8
Local Handling/ Storage	per kg		1.0		1.0		1.0		1.0		1
Economic Farm Gate Price TSh/Kg			157.5		99.3		126.3		134.1		67.0

Note (1) Rice : Thai white milled, 5% broken, FOB, Bangkok

(2) Maize: (US), no.2, yellow, FOB US Gulf ports

(3) Urea: Variying origins, bagged, spot, FOB West Europe

(4) TSP (triple superphosphate), bulk, spot, FOB US Gulf

(5) SA: Calculated based on its own nitrogen contents (21%) and that of Urea (46%)

(6) The price of rice produced in Lower Moshi(IR 54) is about 15% higher than the foreign one

Source: Commodity Markets and the Developing Countries, World Bank, August, 1997. Additional information from MAC, MDV and traders in Moshi Municipality

Table P.2.3 Cost Allocation and Disbursement

Case-1 Whole Project Area (4,700 ha) (Unit :US$1,000)

Item	Financial Cost	C.F.	Economic Cost	Fiscal Year 1998	1999	2000	2001	2002	2003	2004	2005
1 CivilWorks and Hydropower Plants Cost to be allocated											
(a) Headworks	3,289	0.8	2,631	0	1,763	868	0	0	0	0	0
(b) Diversion channel	9,944	0.8	7,955	0	3,978	3,977	0	0	0	0	0
(c) Trucnk road	906	0.8	725	0	377	348	0	0	0	0	0
Sub total of Item 1	14,139		11,311	0	6,118	5,193	0	0	0	0	0
2 Original Cost for Each Area											
(a) Existing Lower Moshi Project Area (2,150ha)	4,874	0.8	3,899	0	1,950	1,949	0	0	0	0	0
(b) New Extension Areas (2,090ha)											
- System-A (224 ha)	1,305	0.8	1,044	0	0	0	1,044	0	0	0	0
- System -B (1,526ha)	8,887	0.8	7,110	0	0	0	1,422	2,844	2,844	0	0
- System-C (340 ha)	1,981	0.8	1,585	0	0	0	1,327	258	0	0	0
(c) Expanded Area (460ha)											
- Mandaka Mnono Area (360 ha)	2,880	0.8	2,304	0	0	0	1,544	760	0	0	0
- Kaloleni Area (100 ha)	553	0.8	442	0	0	0	442	0	0	0	0
Sub-total of (2)	20,480		16,384	0	1,950	1,949	5,779	3,862	2,844	0	0
Total of Item 1 and 2	34,619		27,695	0	8,068	7,142	5,779	3,862	2,844	0	0
3 O & M equipment	1,000	1.0	1,000	0	0	500	0	0	500	0	0
4 Administration cost	841	1.0	841	204	205	204	76	76	76	0	0
5 Engineering Services	4,536	1.0	4,536	1,102	1,102	1,101	411	410	410	0	0
Total of Items 1, 2, 3, 4 and 5	40,996		34,072	1,306	9,375	8,947	6,266	4,348	3,830	0	0
6 Physical Contengency (10% of Items 1,2,3,4 and 5)	4,100		3,407	130	938	894	627	435	383	0	0
Grand Total	45,096		37,479	1,436	10,313	9,841	6,893	4,783	4,213	0	0

Case-2 Existing Lower Moshi Project Area (2,150 ha) (Unit :US$1,000)

Items	Financial Cost	C.F.	Economic Cost	Fiscal Year 1998	1999	2000	2001	2002	2003	2004	2005
1 Construction Works											
(1) Allocated Cost for civil works & hydropower plant											
(a) Headworks	1,491	0.8	1,193	0	800	393	0	0	0	0	0
(b) Diversion channel	4,508	0.8	3,606	0	1,803	1,803	0	0	0	0	0
(c) Trucnk road	411	0.8	329	0	171	158	0	0	0	0	0
Sub-total of (1)	6,410		5,128	0	2,774	2,354	0	0	0	0	0
(2) Original Cost											
(a) Rehabilitation, rural infrastructure and on-farm works	4,874	0.8	3,899	0	1,950	1,949	0	0	0	0	0
Sub-total of (2)	4,874		3,899	0	1,950	1,949	0	0	0	0	0
Total of Item 1	11,284		9,027	0	4,724	4,303	0	0	0	0	0
2 O & M equipment	500	1.0	500	0	0	500	0	0	0	0	0
3 Administration cost	385	1.0	385	128	129	128	0	0	0	0	0
4 Engineering Services	2,075	1.0	2,075	692	692	691	0	0	0	0	0
Total of Items 1, 2, 3 and 4	14,244		11,987	820	5,545	5,622	0	0	0	0	0
5 Physical Contengency (10% of Items 1,2,3 and 4)	1,425		1,199	82	555	562	0	0	0	0	0
Grand Total	15,669		13,186	902	6,100	6,184	0	0	0	0	0

Case-3 New Extension Area Area (2,090 h) and Expanded Area (460 ha) (Unit :US$1,000)

Item	Financial Cost	C.F.	Economic Cost	Fiscal Year 1998	1999	2000	2001	2002	2003	2004	2005
1 Construction Works											
(1) Allocated Cost for civil works & hydropower plant											
(a) Headworks	1,798	0.8	1,438	0	963	475	0	0	0	0	0
(b) Diversion channel	5,436	0.8	4,349	0	2,175	2,174	0	0	0	0	0
(c) Trucnk road	495	0.8	396	0	206	190	0	0	0	0	0
Sub-total of (1)	7,729		6,183	0	3,344	2,839	0	0	0	0	0
(2) Original Cost of New Extension Area											
(a) System-A (224 ha)	1,305	0.8	1,044	0	0	0	1,044	0	0	0	0
(b) System-B (1,526 ha)	8,887	0.8	7,110	0	0	0	1,422	2,844	2,844	0	0
(c) System C(340 ha)	1,981	0.8	1,585	0	0	0	1,327	258	0	0	0
Sub-total of (2)	12,173		9,739	0	0	0	3,793	3,102	2,844	0	0
(3) Original Cost for Expanded Area											
(a) Mandaka Area (360 ha)	2,880	0.8	2,304	0	0	0	1,544	760	0	0	0
(b) Kaloleni Area (100 ha)	553	0.8	442	0	0	0	442	0	0	0	0
Sub-total of (3)	3,433		2,745	0	0	0	1,986	760	0	0	0
Total of Item 1	23,335		18,668	0	3,344	2,839	5,779	3,862	2,844	0	0
2 O & M equipment	500	1.0	500	0	0	0	0	0	500	0	0
3 Administration cost	456	1.0	456	76	76	76	76	76	76	0	0
4 Engineering Services	2,461	1.0	2,461	410	410	410	411	410	410	0	0
Total of Items 1, 2, 3 and 4	26,752		22,085	486	3,830	3,325	6,266	4,348	3,830	0	0
5 Physical Contengency (10% of Items 1,2,3 and 4)	2,675		2,208	48	383	332	627	435	383	0	0
Grand Total	29,427		24,293	534	4,213	3,657	6,893	4,783	4,213	0	0

Note C.F. : Conversion Factor

Table P.2.4 Economic Cost and Benefit Stream (1/3)

Case-1: Whole Project Area (4,700ha)

(Unit: US$1,000)

Year in Order	Year	Cost Stream								Benefit Stream	Net Cash Flow
		Capital	O & M Equipment	Administration	Engineering Service	Physical Contingency	Replacement	O & M	Total		
1	1998	0		204	1,102	130			1,436		-1,436
2	1999	8,068		205	1,102	938			10,313		-10,313
3	2000	7,142	500	204	1,101	894			9,841		-9,841
4	2001	5,779		76	411	627		75	6,968	2,279	-4,689
5	2002	3,862		76	410	435		75	4,858	2,492	-2,366
6	2003	2,844	500	76	410	383		75	4,288	3,670	-618
7	2004							164	164	4,653	4,489
8	2005							164	164	5,089	4,925
9	2006							143	143	5,645	5,502
10	2007							143	143	6,066	5,923
11	2008							143	143	6,483	6,340
12	2009							118	118	6,589	6,471
13	2010						500	118	618	6,589	5,971
14	2011							118	118	6,589	6,471
15	2012							118	118	6,589	6,471
16	2013						500	118	618	6,589	5,971
17	2014							118	118	6,589	6,471
18	2015							118	118	6,589	6,471
19	2016							118	118	6,589	6,471
20	2017							118	118	6,589	6,471
21	2018							118	118	6,589	6,471
22	2019							118	118	6,589	6,471
23	2020						1,000	118	1,118	6,589	5,471
24	2021							118	118	6,589	6,471
25	2022							118	118	6,589	6,471
26	2023						500	118	618	6,589	5,971
27	2024							118	118	6,589	6,471
28	2025						1,210	118	1,328	6,589	5,261
29	2026							118	118	6,589	6,471
30	2027							118	118	6,589	6,471
31	2028						500	118	618	6,589	5,971
32	2029							118	118	6,589	6,471
33	2030						500	118	618	6,589	5,971
34	2031							118	118	6,589	6,471
35	2032							118	118	6,589	6,471
36	2033						500	118	618	6,589	5,971
37	2034							118	118	6,589	6,471
38	2035							118	118	6,589	6,471
39	2036							118	118	6,589	6,471
40	2037							118	118	6,589	6,471
41	2038							118	118	6,589	6,471
42	2039							118	118	6,589	6,471
43	2040						500	118	618	6,589	5,971
44	2041							118	118	6,589	6,471
45	2042							118	118	6,589	6,471
46	2043						500	118	618	6,589	5,971
47	2044							118	118	6,589	6,471
48	2045						500	118	118	6,589	6,471
49	2046							118	118	6,589	6,471
50	2047							118	118	6,589	6,471
	Total	27,695	1,000	811	4,536	3,407					

Economic Internal Rate of Return : 13.4%

Table P.2.4 Economic Cost and Benefit Stream (2/3)

Case-I-2: Existing Lower Moshi Area (2,150ha)

(Unit: US$1,000)

Year in Order	Year	Cost Stream								Benefit Stream	Net Cash Flow
		Capital	O & M Equipment	Administration	Engineering Service	Physical Contingency	Replacement	O & M	Total		
1	1998	0		128	692	82			902		-902
2	1999	4,724		129	692	555			6,100		-6,100
3	2000	4,303	500	128	691	562			6,184		-6,184
4	2001							75	75	2,279	2,204
5	2002							75	75	2,279	2,204
6	2003							75	75	2,786	2,711
7	2004							75	75	2,724	2,649
8	2005							75	75	2,651	2,576
9	2006							54	54	2,718	2,664
10	2007							54	54	2,718	2,664
11	2008							54	54	2,718	2,664
12	2009							54	54	2,718	2,664
13	2010						500	54	551	2,718	2,164
14	2011							54	54	2,718	2,664
15	2012							54	54	2,718	2,664
16	2013							54	54	2,718	2,664
17	2014							54	54	2,718	2,664
18	2015							54	54	2,718	2,664
19	2016							54	54	2,718	2,664
20	2017							54	54	2,718	2,664
21	2018							54	54	2,718	2,664
22	2019							54	54	2,718	2,664
23	2020						1,000	54	1,054	2,718	1,664
24	2021							54	54	2,718	2,664
25	2022							54	54	2,718	2,664
26	2023							54	54	2,718	2,664
27	2024							54	54	2,718	2,664
28	2025						554	54	608	2,718	2,110
29	2026							54	54	2,718	2,664
30	2027							54	54	2,718	2,664
31	2028							54	54	2,718	2,664
32	2029							54	54	2,718	2,664
33	2030						500	54	554	2,718	2,164
34	2031							54	54	2,718	2,664
35	2032							54	54	2,718	2,664
36	2033							54	54	2,718	2,664
37	2034							54	54	2,718	2,664
38	2035							54	54	2,718	2,664
39	2036							54	54	2,718	2,664
40	2037							54	54	2,718	2,664
41	2038							54	54	2,718	2,664
42	2039							54	54	2,718	2,664
43	2040						500	54	554	2,718	2,164
44	2041							54	54	2,718	2,664
45	2042							54	54	2,718	2,664
46	2043							54	54	2,718	2,664
47	2044							54	54	2,718	2,664
48	2045						500	54	554	2,718	2,164
49	2046							54	54	2,718	2,664
50	2047							54	54	2,718	2,664
	Total	9,027	500	385	2,075	1,199					

Economic Internal Rate of Return : 17.2%

Table P.2.4 Economic Cost and Benefit Stream (3/3)

Case-3: New Extension Area (2,090ha) and Expanded Area (460 ha)

(Unit: US$1,000)

Year in Order	Year	Cost Stream								Benefit Stream	Net Cash Flow
		Capital	O & M Equipment	Administration	Engineering Service	Physical Contingency	Replacement	O & M	Total		
1	1998	0		76	410	48			534		-534
2	1999	3,344		76	410	383			4,213		-4,213
3	2000	2,839		76	410	332			3,657		-3,657
4	2001	5,779		76	411	627			6,893		-6,893
5	2002	3,862		76	410	435			4,783	213	-4,570
6	2003	2,844	500	76	410	383			4,213	884	-3,329
7	2004							89	89	1,929	1,840
8	2005							89	89	2,438	2,349
9	2006							89	89	2,927	2,838
10	2007							89	89	3,348	3,259
11	2008							89	89	3,765	3,676
12	2009							64	64	3,871	3,807
13	2010							64	64	3,871	3,807
14	2011							64	64	3,871	3,807
15	2012							64	64	3,871	3,807
16	2013						500	64	564	3,871	3,307
17	2014							64	64	3,871	3,807
18	2015							64	64	3,871	3,807
19	2016							64	64	3,871	3,807
20	2017							64	64	3,871	3,807
21	2018							64	64	3,871	3,807
22	2019							64	64	3,871	3,807
23	2020							64	64	3,871	3,807
24	2021							64	64	3,871	3,807
25	2022							64	64	3,871	3,807
26	2023						500	64	564	3,871	3,307
27	2024							64	64	3,871	3,807
28	2025						656	64	720	3,871	3,151
29	2026							64	64	3,871	3,807
30	2027							64	64	3,871	3,807
31	2028						500	64	564	3,871	3,307
32	2029							64	64	3,871	3,807
33	2030							64	64	3,871	3,807
34	2031							64	64	3,871	3,807
35	2032							64	64	3,871	3,807
36	2033						500	64	564	3,871	3,307
37	2034							64	64	3,871	3,807
38	2035							64	64	3,871	3,807
39	2036							64	64	3,871	3,807
40	2037							64	64	3,871	3,807
41	2038							64	64	3,871	3,807
42	2039							64	64	3,871	3,807
43	2040							64	64	3,871	3,807
44	2041							64	64	3,871	3,807
45	2042							64	64	3,871	3,807
46	2043						500	64	564	3,871	3,307
47	2044							64	64	3,871	3,807
48	2045							64	64	3,871	3,807
49	2046							64	64	3,871	3,807
50	2047							64	64	3,871	3,807
	Total	18,668	500	456	2,461	2,208					

Economic Internal Rate of Return : 11.2%

Table P.2.5 Cash Flow Statement of Project Implementation and Operation

Year	(1) Cash Outflow (Tsh.1,000)								(2) Cash Inflow (Tsh.1,000)							Balance	
	Capital Costs 1/			O&M Works		Tractor Hiring Services		Total Cash Outflow	Capital Investment 1/			Revenue			Total Cash Inflow	Annual (II - I)	Cummulative
	Project Works	Tractor Hiring Services	Total	Total O&M Cost	Replacement Costs	Operation Costs	Replacement Costs		Project Works	Tractor Hiring Services	Total	Water Charge 2/	Tractor Hiring Service Fees 3/	Total			
1998	484,220		484,220					484,220	484,220		484,220			0	484,220	0	0
1999	8,234,220		8,234,220					8,234,220	8,234,220		8,234,220			0	8,234,220	0	0
2000	8,374,340		8,374,340					8,374,340	8,374,340		8,374,340			0	8,374,340	0	0
2001	6,139,240	154,700	6,293,940	46,500		48,913		6,389,353	6,139,240	154,700	6,293,940	99,975	75,250	175,225	6,469,165	79,812	79,812
2002	5,178,860	136,400	5,315,260	46,500		121,996		5,483,756	5,178,860	136,400	5,315,260	99,975	187,688	287,663	5,602,923	119,167	198,979
2003	4,839,100	221,000	5,060,100	46,500		148,841		5,255,441	4,839,100	221,000	5,060,100	99,975	228,988	328,963	5,389,063	133,622	332,601
2004		66,300	66,300	101,680		163,076		331,056		66,300	66,300	218,550	250,888	469,438	535,738	204,682	537,283
2005		445,800	445,800	101,680		214,277		761,757		445,800	445,800	218,550	329,675	548,225	994,025	232,268	769,551
2006		154,700	154,700	88,660		226,854		470,214		154,700	154,700	205,220	349,025	554,245	708,945	238,731	1,008,282
2007		73,900	73,900	88,660		236,739	41,000	440,299		73,900	73,900	205,220	366,300	571,520	645,420	205,121	1,213,403
2008				88,660		236,739	95,000	420,399				205,220	369,000	574,220	574,220	153,821	1,367,224
2009				73,160		236,739	95,000	404,899				189,410	369,000	558,410	558,410	153,511	1,520,735
2010				73,160	310,000	236,739	95,000	714,899				189,410	369,000	558,410	558,410	-156,489	1,364,246
2011				73,160		236,739	95,000	404,899				189,410	369,000	558,410	558,410	153,511	1,517,757
2012				73,160		236,739	117,100	426,999				189,410	370,295	559,705	559,705	132,706	1,650,463
2013				73,160	310,000	236,739	153,100	772,999				189,410	371,905	561,315	561,315	-211,684	1,438,779
2014				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,541,180
2015				73,160		236,739	149,000	458,899				189,410	371,700	561,110	561,110	102,211	1,643,391
2016				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,745,792
2017				73,160		236,739	149,000	458,899				189,410	371,700	561,110	561,110	102,211	1,848,003
2018				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,950,404
2019				73,160		236,739	153,100	462,999				189,410	371,905	561,315	561,315	98,316	2,048,720
2020				73,160	620,000	236,739	153,100	1,082,999				189,410	371,905	561,315	561,315	-521,684	1,527,036
2021				73,160		236,739	149,000	458,899				189,410	371,700	561,110	561,110	102,211	1,629,247
2022				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,731,648
2023				73,160	310,000	236,739	149,000	768,899				189,410	371,700	561,110	561,110	-207,789	1,523,859
2024				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,626,260
2025				73,160	750,200	236,739	149,000	1,209,099				189,410	371,700	561,110	561,110	-647,989	978,271
2026				73,160		236,739	153,100	462,999				189,410	372,095	561,505	561,505	98,506	1,076,777
2027				73,160		236,739	153,100	462,999				189,410	371,905	561,315	561,315	98,316	1,175,093
2028				73,160	310,000	236,739	149,000	768,899				189,410	371,890	561,300	561,300	-207,599	967,494
2029				73,160		236,739	149,000	458,899				189,410	371,700	561,110	561,110	102,211	1,069,705
2030				73,160	310,000	236,739	149,000	768,899				189,410	371,700	561,110	561,110	-207,789	861,916
2031				73,160		236,739	149,000	458,899				189,410	371,700	561,110	561,110	102,211	964,127
2032				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,066,528
2033				73,160	310,000	236,739	153,100	772,999				189,410	371,905	561,315	561,315	-211,684	854,844
2034				73,160		236,739	153,100	462,999				189,410	372,095	561,505	561,505	98,506	953,350
2035				73,160		236,739	149,000	458,899				189,410	371,700	561,110	561,110	102,211	1,055,561
2036				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,157,962
2037				73,160		236,739	149,000	458,899				189,410	371,700	561,110	561,110	102,211	1,260,173
2038				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,362,574
2039				73,160		236,739	149,000	458,899				189,410	371,700	561,110	561,110	102,211	1,464,785
2040				73,160	310,000	236,739	153,100	772,999				189,410	371,905	561,315	561,315	-211,684	1,253,101
2041				73,160		236,739	153,100	462,999				189,410	371,905	561,315	561,315	98,316	1,351,417
2042				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,453,818
2043				73,160	310,000	236,739	149,000	768,899				189,410	371,700	561,110	561,110	-207,789	1,246,029
2044				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,348,430
2045				73,160	310,000	236,739	149,000	768,899				189,410	371,700	561,110	561,110	-207,789	1,140,641
2046				73,160		236,739	149,000	458,899				189,410	371,890	561,300	561,300	102,401	1,243,042
2047				73,160		236,739	153,100	462,999				189,410	371,905	561,315	561,315	98,316	1,341,358
2048				73,160		236,739	153,100	462,999				189,410	372,095	561,505	561,505	98,506	1,439,864
2049				73,160		236,739	149,000	458,899				189,410	371,700	561,110	561,110	102,211	1,542,075
2050				73,160		236,739	149,000	458,899				189,410	371,700	561,110	561,110	102,211	1,644,286

1/: Cpital funds of the project works and tractor hiring services are arranged by the Government of Tanzania

2/: Revenue from water charge to be collected from the beneficiaries

3/: Tractor Hiring Service fees to be collected from the beneficiaries(paddy cultivation Tsh. 50,000/ha & alfalfa cultivation Tsh. 12,500/ha) + salvage value of machinery(5%)

Table P. 2. 6 Cost Allocation and Disbursement with Hydropower Development Plan

Case-1: Whole Project Area (4,700 ha)

(Unit :US$1,000)

Item	Financial Cost	C.F.	Economic Cost	Fiscal Year 1998	1999	2000	2001	2002	2003	2004	2005
1 CivilWorks and Hydropower Plants Cost to be allocated											
(a) Headworks	3,289	0.8	2,631	0	1,764	867	0	0	0	0	0
(b) Diversion channel	9,941	0.8	7,955	0	3,978	3,977	0	0	0	0	0
(c) Trucnk road	906	0.8	725	0	377	348	0	0	0	0	0
(d) No.1 Hydropower station	2,760	0.8	2,208	0	0	0	1,480	728	0	0	0
(e) No.2 Hydropower station	4,570	0.8	3,656	0	1,829	1,827	0	0	0	0	0
Sub-total of Item 1	21,469		17,175	0	7,948	7,019	1,480	728	0	0	0
2 Original Cost for Each Area											
(a) Existing Lower Moshi Project Area (2,150ha)	4,874	0.8	3,899	0	1,950	1,949	0	0	0	0	0
(b) New Extension Area (2,090ha)											
- System-A (224 ha)	1,305	0.8	1,044	0	0	0	1,044	0	0	0	0
- System -B (1,526ha)	8,887	0.8	7,110	0	0	0	1,422	2,844	2,844	0	0
- System-C (340 ha)	1,981	0.8	1,585	0	0	0	1,327	258	0	0	0
(c) Expanded Area (460ha)											
- Kalolemi Area (100 ha)	553	0.8	442	0	0	0	442	0	0	0	0
- Mandaka Mnono Area (360 ha)	2,880	0.8	2,304	0	0	0	1,544	760	0	0	0
Sub-total of (2)	20,480		16,384	0	1,950	1,949	5,779	3,862	2,844	0	0
Total of Item 2	41,949		33,559	0	9,898	8,968	7,259	4,590	2,844	0	0
3 O & M equipment	1,000	1.0	1,000			500	0	0	500	0	0
4 Administration cost	1,020	1.0	1,020	185	186	186	186	185	92	0	0
5 Engineering Services	5,500	1.0	5,500	1,000	1,000	1,001	1,000	1,001	498	0	0
Total of Items 1, 2, 3,4 and 5	49,469		41,079	1,185	11,084	10,655	8,445	5,776	3,934	0	0
6 Physical Contingency (10% of Items 1,2,3,4 and 5)	4,947		4,108	119	1,108	1,066	845	577	393	0	0
Grand Total	54,416		45,187	1,304	12,192	11,721	9,290	6,353	4,327	0	0

Note C.F. : *Conversion Factor*

Case-2 : Existing Lower Moshi Project Area (2,150 h)

(Unit :US$1,000)

Items	Financial Cost	C.F.	Economic Cost	Fiscal Year 1998	1999	2000	2001	2002	2003	2004	2005
1 Construction Works											
(1) Allocated Cost for civil works & hydropower plant											
(a) Headworks	1,491	0.8	1,193	0	800	393	0	0	0	0	0
(b) Diversion channel	4,508	0.8	3,606	0	1,803	1,803	0	0	0	0	0
(c) Trucnk road	411	0.8	329	0	171	158	0	0	0	0	0
(d) No.1 Hydropower station	1,251	0.8	1,001	0	0	0	671	330	0	0	0
(e) No.2 Hydropower station	2,071	0.8	1,657	0	829	828	0	0	0	0	0
Sub-total of (1)	9,732		7,786	0	3,603	3,182	671	330	0	0	0
(2) Original Cost											
(a) Rehabilitation, rural infrastructure and on-farm works	4,874	0.8	3,899	0	1,950	1,949	0	0	0	0	0
Sub-total of (2)	4,874		3,899	0	1,950	1,949	0	0	0	0	0
Total of Item 1	14,606		11,685	0	5,553	5,131	671	330	0	0	0
2 O & M equipment	500	1.0	500	0	0	500	0	0	0	0	0
3 Administration cost	467	1.0	467	93	94	94	93	93	0	0	0
4 Engineering Services	2,516	1.0	2,516	503	503	504	503	503	0	0	0
Total of Items 1, 2, 3 and 4	18,089		15,168	596	6,150	6,229	1,267	926	0	0	0
5 Physical Contingency (10% of Items 1,2,3 and 4)	1,809		1,517	60	615	623	127	92	0	0	0
Grand Total	19,898		16,685	656	6,765	6,852	1,394	1,018	0	0	0

Note C.F. : *Conversion Factor*

Case-3: New Extension Area (2,090 ha) and Expanded Area (460 ha)

(Unit :US$1,000)

Items	Financial Cost	C.F.	Economic Cost	Fiscal Year 1998	1999	2000	2001	2002	2003	2004	2005
1 Construction Works											
(1) Allocated Cost for civil works & hydropower plant											
(a) Headworks	1,798	0.8	1,438	0	964	474	0	0	0	0	0
(b) Diversion channel	5,436	0.8	4,349	0	2,175	2,174	0	0	0	0	0
(c) Trucnk road	495	0.8	396	0	206	190	0	0	0	0	0
(d) No.1 Hydropower station	1,509	0.8	1,207	0	0	0	809	398	0	0	0
(e) No.2 Hydropower station	2,499	0.8	1,999	0	1,000	999	0	0	0	0	0
Sub-total of (1)	11,737		9,389	0	4,345	3,837	809	398	0	0	0
(2) Original Cost											
(a) System-A (224 ha)	1,305	0.8	1,044	0	0	0	1,044	0	0	0	0
(b) System-B (1,526 ha)	8,887	0.8	7,110	0	0	0	1,422	2,844	2,844	0	0
(c) System C(340 ha)	1,981	0.8	1,585	0	0	0	1,327	258	0	0	0
Sub-total of (2)	12,173		9,739	0	0	0	3,793	3,102	2,844	0	0
(3) Original Cost											
(a) Kalolemi Area (100 ha)	553	0.8	442	0	0	0	442	0	0	0	0
(b) Mandaka Mnono Area (360 ha)	2,880	0.8	2,304	0	0	0	1,544	760	0	0	0
Sub-total (3)	3,433		2,746	0	0	0	1,986	760	0	0	0
Total of Item 1	27,343		21,874	0	4,345	3,837	6,588	4,260	2,844	0	0
2 O & M equipment	500	1.0	500	0	0	0	0	0	500	0	0
3 Administration cost	553	1.0	553	92	92	92	93	92	92	0	0
4 Engineering Services	2,984	1.0	2,984	497	497	497	497	498	498	0	0
Total of Items 1, 2, 3 and 4	31,380		25,911	589	4,934	4,426	7,178	4,850	3,934	0	0
5 Physical Contingency (10% of Items 1,2,3 and 4)	3,138		2,591	59	493	443	718	485	393	0	0
Grand Total	34,518		28,502	648	5,427	4,869	7,896	5,335	4,327	0	0

Note C.F. : *Conversion Factor*

Table P.2.7 Economic Cost and Benefit Stream with Hydropower Development Plan (1/3)

Case-1: Whole Project Area (4,700ha)

(Unit US$1,000)

Year in Orde	Year	Cost Stream								Benefit Stream	Net Cash Flow
		Capital	O & M Equipment	Administration	Engineering Service	Physical Contingency	Replacement	O & M	Total		
1	1998	0		185	1,000	119			1,304		-1,304
2	1999	9,898		186	1,000	1,108			12,192		-12,192
3	2000	8,968	500	186	1,001	1,066			11,721		-11,721
4	2001	7,259		186	1,000	845		99	9,389	3,910	-5,479
5	2002	4,590		185	1,001	577		99	6,452	4,123	-2,329
6	2003	2,844	500	92	498	393		99	4,426	5,840	1,414
7	2004							216	216	6,823	6,607
8	2005							216	216	7,259	7,043
9	2006							194	194	7,815	7,621
10	2007							194	194	8,236	8,042
11	2008							194	194	8,653	8,459
12	2009							169	169	8,759	8,590
13	2010						500	169	669	8,759	8,090
14	2011							169	169	8,759	8,590
15	2012							169	169	8,759	8,590
16	2013						500	169	669	8,759	8,090
17	2014							169	169	8,759	8,590
18	2015							169	169	8,759	8,590
19	2016							169	169	8,759	8,590
20	2017							169	169	8,759	8,590
21	2018							169	169	8,759	8,590
22	2019							169	169	8,759	8,590
23	2020						1,000	169	1,169	8,759	7,590
24	2021							169	169	8,759	8,590
25	2022							169	169	8,759	8,590
26	2023						500	169	669	8,759	8,090
27	2024							169	169	8,759	8,590
28	2025						1,210	169	1,379	8,759	7,380
29	2026							169	169	8,759	8,590
30	2027							169	169	8,759	8,590
31	2028						500	169	669	8,759	8,090
32	2029							169	169	8,759	8,590
33	2030						500	169	669	8,759	8,090
34	2031							169	169	8,759	8,590
35	2032							169	169	8,759	8,590
36	2033						500	169	669	8,759	8,090
37	2034							169	169	8,759	8,590
38	2035							169	169	8,759	8,590
39	2036							169	169	8,759	8,590
40	2037							169	169	8,759	8,590
41	2038							169	169	8,759	8,590
42	2039							169	169	8,759	8,590
43	2040						500	169	669	8,759	8,090
44	2041							168	168	8,759	8,591
45	2042							169	169	8,759	8,590
46	2043						500	169	669	8,759	8,090
47	2044							169	169	8,759	8,590
48	2045						500	169	669	8,759	8,090
49	2046							169	169	8,759	8,590
50	2047							169	169	8,759	8,590
	Total	33,559	1,000	1,020	5,500	4,108					

Economic Internal Rate of Return : 15.5%

Table P.2.7 Economic Cost and Benefit Stream with Hydropwer Development Plan (2/3)

Case-3: Existing Lower Moshi Project Area (2,150ha)

(Unit: US$1,000)

Year in Order	Year	Cost Stream								Benefit Stream	Net Cash Flow
		Capital	O & M Equipment	Administration	Engineering Service	Physical Contingency	Replacement	O & M	Total		
1	1998	0		93	503	60			656		-656
2	1999	5,553		94	503	615			6,765		-6,765
3	2000	5,131	500	94	501	623			6,852		-6,852
4	2001	671		93	503	127		99	1,493	3,018	1,525
5	2002	330		93	503	92		99	1,117	3,018	1,901
6	2003							99	99	3,770	3,671
7	2004							99	99	3,708	3,609
8	2005							99	99	3,635	3,536
9	2006							77	77	3,702	3,625
10	2007							77	77	3,702	3,625
11	2008							77	77	3,702	3,625
12	2009							77	77	3,702	3,625
13	2010						500	77	577	3,702	3,125
14	2011							77	77	3,702	3,625
15	2012							77	77	3,702	3,625
16	2013							77	77	3,702	3,625
17	2014							77	77	3,702	3,625
18	2015							77	77	3,702	3,625
19	2016							77	77	3,702	3,625
20	2017							77	77	3,702	3,625
21	2018							77	77	3,702	3,625
22	2019							77	77	3,702	3,625
23	2020						1,000	77	1,077	3,702	2,625
24	2021							77	77	3,702	3,625
25	2022							77	77	3,702	3,625
26	2023							77	77	3,702	3,625
27	2024							77	77	3,702	3,625
28	2025						554	77	631	3,702	3,071
29	2026							77	77	3,702	3,625
30	2027							77	77	3,702	3,625
31	2028							77	77	3,702	3,625
32	2029							77	77	3,702	3,625
33	2030						500	77	577	3,702	3,125
34	2031							77	77	3,702	3,625
35	2032							77	77	3,702	3,625
36	2033							77	77	3,702	3,625
37	2034							77	77	3,702	3,625
38	2035							77	77	3,702	3,625
39	2036							77	77	3,702	3,625
40	2037							77	77	3,702	3,625
41	2038							77	77	3,702	3,625
42	2039							77	77	3,702	3,625
43	2040						500	77	577	3,702	3,125
44	2041							77	77	3,702	3,625
45	2042							77	77	3,702	3,625
46	2043							77	77	3,702	3,625
47	2044							77	77	3,702	3,625
48	2045						500	77	577	3,702	3,125
49	2046							77	77	3,702	3,625
50	2047							77	77	3,702	3,625
	Total	11,685	500	467	2,516	1,517					

Economic Internal Rate of Return : 19.1%

Table P.2.7 Economic Cost and Benefit Stream with Hydropower Development Plan (3/3)

Case-3: New Extension Area (2,090ha) and Expanded Area (460 ha)

(Unit: US$1,000)

Year in Order	Year	Cost Stream								Benefit Stream	Net Cash Flow
		Capital	O & M Equipment	Administration	Engineering Service	Physical Contingency	Replacement	O & M	Total		
1	1998	0		92	497	59			648		-648
2	1999	4,345		92	497	493			5,427		-5,427
3	2000	3,837		92	497	443			4,869		-4,869
4	2001	6,588		93	497	718			7,896	892	-7,004
5	2002	4,260		92	498	485			5,335	1,105	-4,230
6	2003	2,844	500	92	498	393			4,327	2,070	-2,257
7	2004							117	117	3,115	2,998
8	2005							117	117	3,624	3,507
9	2006							117	117	4,113	3,996
10	2007							117	117	4,534	4,417
11	2008							117	117	4,951	4,834
12	2009							92	92	5,057	4,965
13	2010							92	92	5,057	4,965
14	2011							92	92	5,057	4,965
15	2012							92	92	5,057	4,965
16	2013						500	92	592	5,057	4,465
17	2014							92	92	5,057	4,965
18	2015							92	92	5,057	4,965
19	2016							92	92	5,057	4,965
20	2017							92	92	5,057	4,965
21	2018							92	92	5,057	4,965
22	2019							92	92	5,057	4,965
23	2020							92	92	5,057	4,965
24	2021							92	92	5,057	4,965
25	2022							92	92	5,057	4,965
26	2023						500	92	592	5,057	4,465
27	2024							92	92	5,057	4,965
28	2025						656	92	748	5,057	4,309
29	2026							92	92	5,057	4,965
30	2027							92	92	5,057	4,965
31	2028						500	92	592	5,057	4,465
32	2029							92	92	5,057	4,965
33	2030							92	92	5,057	4,965
34	2031							92	92	5,057	4,965
35	2032							92	92	5,057	4,965
36	2033						500	92	592	5,057	4,465
37	2034							92	92	5,057	4,965
38	2035							92	92	5,057	4,965
39	2036							92	92	5,057	4,965
40	2037							92	92	5,057	4,965
41	2038							92	92	5,057	4,965
42	2039							92	92	5,057	4,965
43	2040							92	92	5,057	4,965
44	2041							92	92	5,057	4,965
45	2042							92	92	5,057	4,965
46	2043						500	92	592	5,057	4,465
47	2044							92	92	5,057	4,965
48	2045							92	92	5,057	4,965
49	2046							92	92	5,057	4,965
50	2047							92	92	5,057	4,965
	Total	21,874	500	553	2,931	2,591					

Economic Internal Rate of Return : 13.2%

Table P.2.8 Cash Flow Statement of Project Implementation and Operation with Small Scale Hydropower Development Plan

Year	(1) Cash Outflow (Tsh.1,000)								(2) Cash Inflow (Tsh.1,000)							Balance	
	Capital Costs 1/			O&M Works		Tractor Hiring Services		Total Cash Outflow	Capital Investment 1/			Revenue			Total Cash Inflow	Annual (II - I)	Cummulative
	Project Works	Tractor Hiring Services	Total	Total O&M Cost	Replacement Costs	Operation Costs	Replacement Costs		Project Works	Tractor Hiring Services	Total	Water Charge 2/	Tractor Hiring Service Fees 3/	Total			
1998	616,280		616,280					616,280	616,280		616,280			0	616,280	0	0
1999	10,063,840		10,063,840					10,063,840	10,063,840		10,063,840			0	10,063,840	0	0
2000	10,236,200		10,236,200					10,236,200	10,236,200		10,236,200			0	10,236,200	0	0
2001	7,670,640	154,700	7,825,340	61,318		48,913		7,935,571	7,670,640	154,700	7,825,340	133,300	75,250	208,550	8,033,890	98,319	98,319
2002	6,093,980	136,400	6,230,380	61,318		121,996		6,413,694	6,093,980	136,400	6,230,380	133,300	187,688	320,988	6,551,368	137,674	235,993
2003	5,208,000	221,000	5,429,000	61,318		148,841		5,639,159	5,208,000	221,000	5,429,000	133,300	228,988	362,288	5,791,288	152,129	388,122
2004		66,300	66,300	134,044		163,076		363,420		66,300	66,300	291,400	250,888	542,288	608,588	245,168	633,290
2005		445,800	445,800	134,044		214,277		794,121		445,800	445,800	291,400	329,675	621,075	1,066,875	272,754	906,044
2006		154,700	154,700	120,714		226,854		502,268		154,700	154,700	278,070	349,025	627,095	781,795	279,527	1,185,571
2007		73,900	73,900	120,714		236,739	41,000	472,353		73,900	73,900	278,070	366,300	644,370	718,270	245,917	1,431,488
2008				120,714		236,739	95,000	452,453				278,070	369,000	647,070	647,070	194,617	1,626,105
2009				104,904		236,739	95,000	436,643				262,260	369,000	631,260	631,260	194,617	1,820,722
2010				104,904	310,000	236,739	95,000	746,643				262,260	369,000	631,260	631,260	-115,383	1,705,339
2011				104,904		236,739	95,000	436,643				262,260	369,000	631,260	631,260	194,617	1,899,956
2012				104,904		236,739	117,100	458,743				262,260	370,295	632,555	632,555	173,812	2,073,768
2013				104,904	310,000	236,739	153,100	804,743				262,260	371,905	634,165	634,165	-170,578	1,903,190
2014				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	2,046,697
2015				104,904		236,739	149,000	490,643				262,260	371,700	633,960	633,960	143,317	2,190,014
2016				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	2,333,521
2017				104,904		236,739	149,000	490,643				262,260	371,700	633,960	633,960	143,317	2,476,838
2018				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	2,620,345
2019				104,904		236,739	153,100	494,743				262,260	371,905	634,165	634,165	139,422	2,759,767
2020				104,904	620,000	236,739	153,100	1,114,743				262,260	371,905	634,165	634,165	-480,578	2,279,189
2021				104,904		236,739	149,000	490,643				262,260	371,700	633,960	633,960	143,317	2,422,506
2022				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	2,566,013
2023				104,904	310,000	236,739	149,000	800,643				262,260	371,700	633,960	633,960	-166,683	2,399,330
2024				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	2,542,837
2025				104,904	750,200	236,739	149,000	1,240,843				262,260	371,700	633,960	633,960	-606,883	1,935,954
2026				104,904		236,739	153,100	494,743				262,260	372,095	634,355	634,355	139,612	2,075,566
2027				104,904		236,739	153,100	494,743				262,260	371,905	634,165	634,165	139,422	2,214,988
2028				104,904	310,000	236,739	149,000	800,643				262,260	371,890	634,150	634,150	-166,493	2,048,495
2029				104,904		236,739	149,000	490,643				262,260	371,700	633,960	633,960	143,317	2,191,812
2030				104,904	310,000	236,739	149,000	800,643				262,260	371,700	633,960	633,960	-166,683	2,025,129
2031				104,904		236,739	149,000	490,643				262,260	371,700	633,960	633,960	143,317	2,168,446
2032				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	2,311,953
2033				104,904	310,000	236,739	153,100	804,743				262,260	371,905	634,165	634,165	-170,578	2,141,375
2034				104,904		236,739	153,100	494,743				262,260	372,095	634,355	634,355	139,612	2,280,987
2035				104,904		236,739	149,000	490,643				262,260	371,700	633,960	633,960	143,317	2,424,304
2036				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	2,567,811
2037				104,904		236,739	149,000	490,643				262,260	371,700	633,960	633,960	143,317	2,711,128
2038				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	2,854,635
2039				104,904		236,739	149,000	490,643				262,260	371,700	633,960	633,960	143,317	2,997,952
2040				104,904	310,000	236,739	153,100	804,743				262,260	371,905	634,165	634,165	-170,578	2,827,374
2041				104,904		236,739	153,100	494,743				262,260	371,905	634,165	634,165	139,422	2,966,796
2042				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	3,110,303
2043				104,904	310,000	236,739	149,000	800,643				262,260	371,700	633,960	633,960	-166,683	2,943,620
2044				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	3,087,127
2045				104,904	310,000	236,739	149,000	800,643				262,260	371,700	633,960	633,960	-166,683	2,920,444
2046				104,904		236,739	149,000	490,643				262,260	371,890	634,150	634,150	143,507	3,063,951
2047				104,904		236,739	153,100	494,743				262,260	371,905	634,165	634,165	139,422	3,203,373
2048				104,904		236,739	153,100	494,743				262,260	372,095	634,355	634,355	139,612	3,342,985
2049				104,904		236,739	149,000	490,643				262,260	371,700	633,960	633,960	143,317	3,486,302
2050				104,904	2,108,000	236,739	149,000	2,598,643				262,260	371,700	633,960	633,960	-1,964,683	1,521,619
2051				104,904		236,739	149,000	490,643				262,260	371,905	634,165	634,165	143,522	1,665,141
2052				104,904	1,267,900	236,739	149,000	1,758,543				262,260	372,095	634,355	634,355	-1,124,188	540,953

1/: Cpital funds of the project works and tractor hiring services are arranged by the Government of Tanzania
2/: Revenue from water charge to be collected from the beneficiaries
3/: Tractor Hiring Service fees to be collected from the beneficiaries(paddy cultivation Tsh. 50,000/ha & alfalfa cultivation Tsh. 12,500/ha) + salvage value of machinery(5%)
Note: This analysis is made until 2052 when the replacement cost for No.1 Power Station occurs.