

Annex D

Extensive Work Plan for Irrigation Development

The Master Plan for Promotion of Irrigated Agriculture for Smallholders
in the Peri-Urban Areas in the Republic of Zambia
Final Report
Annex D. Extensive Work Plan for Irrigation Development

Table of Contents

	page
Annex D. Extensive Work Plan for Irrigation Development	
Chapter 1 Practicable Investment	
1.1 Practicable Investment	D-1
1.2 Work Items in the Master Plan.....	D-1
1.3 Structural Design (Reference).....	D-3
 Chapter 2 Work Items	
2.1 Work Items for the Rehabilitation of the Existing Irrigation Schemes	D-9
2.2 Work Items for the Construction of the Proposed Irrigation Schemes	D-9
2.3 Extension of the Works.....	D-9
 Chapter 3 Cost Estimates of Irrigation Facilities	
3.1 Assumptions.....	D-10
3.2 Project Cost.....	D-10
3.3 Cost Estimates.....	D-11

List of Table

Table T2.1.1 Rehabilitation Plan of Existing Irrigation Schemes (Proposed Works)	D-9
Table T2.2.1 Construction Plan of Potential Irrigation Schemes (Tentative plan).....	D-12
Table T3.3.1 Cost Estimates.....	D-16
Table T3.3.2 Direct Cost of the Rehabilitation Works.....	D-17
Table T3.3.3 Direct Cost of the New Construction Works.....	D-21
Table T3.3.4 Direct Cost of the Dam Rehabilitation Works	D-25

Annex D. Extensive Work Plan for Irrigation Development

Chapter 1 Practicable Investment

1.1 Practicable Investment

The field survey indicates a necessity of several rehabilitation and construction work to attain 1) effective and efficient water use, 2) proper on-farm water management, 3) dam safety, as well as appropriate watershed management of the dam catchment area. Work items of the rehabilitation and new construction works are broadly composed of construction of irrigation/drainage canals, intake facilities such as weirs, dams with appurtenant structures of spillway, intake, as well.

Amongst these interventions aiming at irrigation development, it is essential to make a plan, design and implementation of the rehabilitation and new construction works on the basis of a participatory approach to attain sustainable project operation. For this purpose, promotion of farmers' ownership is indispensable to improve farmer's income. The farmers should notify an importance of operation and maintenance of irrigation systems and water management. Dam rehabilitation work is also promptly carried out to minimize future damages of spillway and dam embankment. Rehabilitation of intake weirs is also necessary to ensure intake capacity for irrigation. The Government shall undertake the rehabilitation work of these dams and intake weirs because it is recognized that the farmers, who are practically responsible for these facilities at present, have no technical and also financial ability to undertake these works. In terms of irrigation development in the Master plan, staged implementation plan is proposed, comprising of 1) irrigation canal construction, 2) small scale intake weir construction and 3) major facilities like to impounding dams in the order of a priority.

1.2 Work Items in the Master Plan

During the investigation of the small scale irrigation schemes in the Study area, 13 existing schemes and 12 potential schemes were selected from the point of their viability of the system operation by the farmers. In the Master plan, the first priority shall be put on canal rehabilitation and new construction works for the reason that proper maintenance of these on-farm irrigation systems by the beneficiaries led to sustainable irrigated agriculture. It is of course necessary to commence rehabilitation work of the dam facilities and watershed management aiming to prolong a life span of the dam, however as indicated above first priority shall be put on the irrigation system rehabilitation to directly and promptly improve farmers' income and livelihood. The following are remarkable points to implement the small scale investment plans, especially for gravity system:

Table 1.1.1 Remarkable Points on the Rehabilitation Work for Gravity Irrigation Schemes

	Remarkable points	Explanations
1)	Irrigation system functions as required.	Emphasis shall be put on enhancement of the farmers' activities realize sustainable agriculture, thus rehabilitation work shall be competent to the farmers ability of the operation and maintenance, water management, etc. For this purpose, the MACO staff should be capable of investigation and planning. In addition, the MACO staff should recognize an importance of farmers participation from the planning period.

	Remarkable points	Explanations
2)	Irrigation water is properly distributed.	Water distribution system should be maintained with farmers' ability and demands. It is expected to growing in capacity of the irrigation staff of the MACO to instruct the farmers of self planning of the irrigation system.
3)	Water users association, agricultural cooperatives work well for operation and maintenance.	The farmers themselves recognize a validity of WUA and decide operational rules of the WUA. The MACO shall assist establishment of the WUA and further process to strengthen their activities.
4)	Investment cost and benefit take a balance.	It is essential to make rehabilitation and new construction works economically vital between investment (rehabilitation) cost and incremental benefit by increase of farm production as well as market price improvement with market cultivation.
5)	Irrigation management system is disseminated to surrounding area.	A rehabilitation work is expanded to surrounding area as a model. A model project should be composed of taking regional characteristics in terms of water resource availability, run-off pattern of surface water, similarity of farming practice.

The following are major components of the rehabilitation works:

- Construction of canal : Earth lined canal for impervious foundation, or concrete/ brick with mortar plastering canal is proposed.
- Reshape of canal : Widening of canal section improves flow capacity, thus improves irrigation efficiency. Minimizing flow time of the irrigation water can reduce water conveyance loss.
- Installation of intake : Siphon or conduits type intake is installed on the dam embankment for irrigation water use.
- Division pit : Water control by soil material at division point is sometimes a laborious work, especially women. Prefabricated concrete plate is recommended to lighten manpower.



Prefabricated concrete plate



Assembly at site

- Small storage pit : Water conveyance to the farm land located at upper portion of the canal is by manpower by means of buckets or treadle pumps. In general, irrigation time is limited, so it is difficult to draw water to the farm land. Small storage pit is helpful to tentatively storage irrigation water.
- Rehabilitation of spillway : It is necessary to take appropriate measures to ensure the dam safety during food. Spillway canal bed, side wall protection is employed.
- Installation of intake weir : Intake weir is constructed to divert surface water to the beneficial areas. Simple weir made of wood thinned from forests and earth

materials, masonry weir are available from an economical efficiency and also ease of maintenance by the farmers.

From a point of water management, the following are improved:

- Control of irrigation water: It is necessary to control irrigation water according to growth period of the crops, especially irrigation water is limited like a dam facilities.
- Irrigation time : It is preferable to estimate irrigation time corresponding to a farm land area.
- Secondary canal : Reshape of a secondary canal contributes to shortening of flow time, reduction of a seepage loss from a canal.

With regard to a groundwater use such as dambo, following points are indicated to accelerate water use for irrigation purpose:

- Land use : Land use in and around a dambo area has not been developed due to a traditional land ownership system. It is recommended to ease traditional system by the Government initiative.
- Groundwater use : Environmental issue of a dambo use related to soil and water contamination shall be cleared to come up with a means of groundwater use.
- Improving work conditions: Rural development in such a method of standardizing of living condition, rural road construction is encouraged to accelerate collective farming in and around the dambo areas.
- Initial investment : A financial support system of an initial investment for such as protect fencing, water place for livestock.
- Hydro-geological investigation: Yield of groundwater varies by geological characteristics of the ground even in the dambo area. Hydro-geological investigation of aquifers is inevitable to estimate development potential in the development site.

Following points are indicated from an environmental issues:

- Soil erosion : “Sabo dam” (sand trap dam) is effective to eliminate soil development in the reservoir of the dam. (Sabo dam aims at not sediment trap but control erosion along the stream by means of declining stream slope that reduces river erosion and soil movement). Dredging of sediment in the reservoir is also effective to enlarge impounding capacity of the dam. Machinery selection is important to effectively remove the soil.
- Watershed management : Contour bund with vetiver grass is effective way to mitigate surface erosion.
- Pollution in depressed area: Sewage contained water flows into a dambo area in a few irrigation schemes without sufficient treatment. Further investigation of

natural depuration effect by plant and soil in the swampy area, dewatering to downstream area is required.

The above rehabilitation plan shall be verified and its effectiveness is monitored and quantitatively evaluated so as to ensure expansion to the similar area as a model scheme. Detailed investigation of a dambo condition, water surface fluctuation, water quality shall be carried out to collect necessary assessment data for a dambo development.

1.3 Structural Design (Reference)

The following are basic design concept for the structural planning and design:

(1) Intake weir (River)

In general, intake weir has firm structure comprising of concrete, masonry, etc. to secure stability of the structure against floods. In addition, more simplified structure using thin wood, earth materials and plastic sheet as an impervious material materials to minimize construction cost. The structure and material depends on a length of the intake weir, elevation of water level from the foundation, bearing capacity of the foundation, as well.

(2) Installation of intake devices (Dam)

Either siphon type intake or conduit type intake is selected to introduce dam water to the beneficial farm lands. Siphon type was applied to the existing dam due to an economical advantage of the siphon type intake. Characteristic points of both intake types are listed below.

Table 1.3.1 Characteristics of Intake Type

	Siphon type	Conduits type
Intake capacity	Two parallel polyethylene pipes with its diameter of maximum 60 mm are applied to intake storage water in the reservoir. The capacity of siphon with two pipes are roughly estimated at maximum 5 lit/sec, thus siphon type intake is recommende to supply irrigation water to relatively small farm area. When pipe diameter becomes large, it takes a lot of time and labor force to fill up the pipe with water.	Any pipe diameter is allowed for conduits type. When water requirement is large, conduits type is selected.
Operability	When pipe diameter becomes large, it takes a lot of time and labor force to fill up the pipe with water.	It requires simple valve opening.
Construction cost	Material cost for PVC and polyethylene pipe is minimal. Earth work also small.	Excavation work to the dam foundation and pipe protection work need relatively high construction cost. Dewatering also necessary to secure dry work condition.
Maintenance cost	Water tightness shall be secured especially joint portion. PVC and polyethylene pipe are not deteriorated when they are buried in the ground.	Maintenance cost is null. Intake valve shall be replaced every 10 to 20 year after the installation.

There are two types in the siphon type intake, 1) installing siphon pipe along the dam crest, and 2) siphon pipe is embedded in the dam crest.

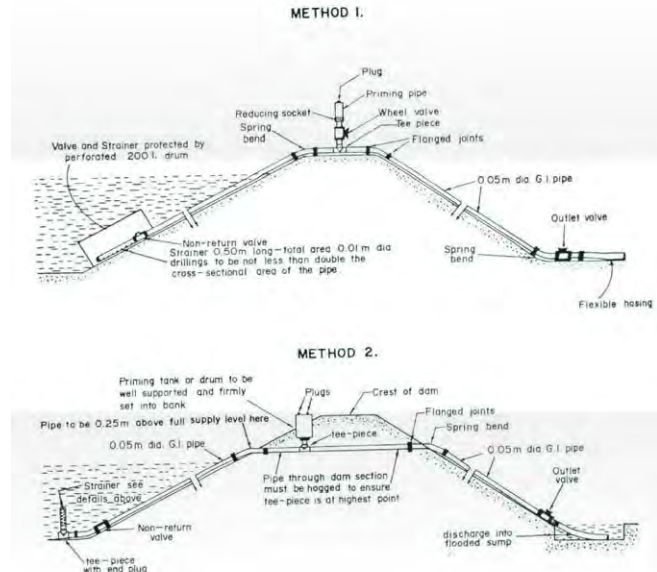


Fig. Siphon Type Structure
A Guide to Agricultural Planning, 1977

Conduits shall be embedded in the firm dam foundation to prevent uneven settlement of the dam embankment, which caused pipe damage.

Cut-off walls are installed along the conduits. A wider cut-off wall is installed to secure longer seepage length, especially in the core section of the dam embankment. Imperrmeable earth material such as clayey soil is refilled along the conduits.

In general, steel pipe and concrete pipe is used for the conduits with a reinforced concrete protection along the pipe.

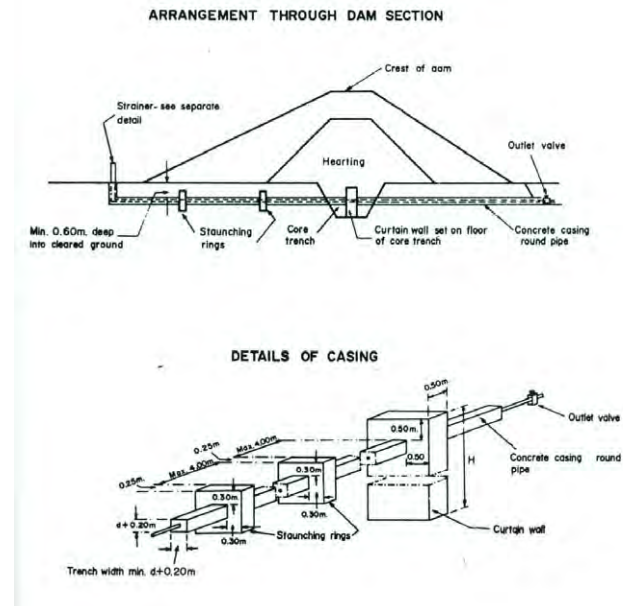


Fig. Conduits Type Structure
A Guide to Agricultural Planning, 1977

1) Siphon type intake

It is notable points for the design of the siphon type intake:

(a) Water head

It is crucial to secure water head between water surface and farm land. Since the farm lands are located immediately downstream of the dam, sufficient water head is not secured especially in the dry season. It is proposed to install prural siphons in different elevation at the outlet of the siphon to intake water as much as possible when impounding water level becomes low in the dry season.

(b) Number of siphon

The intake capacity is determined by pipe diameter and the number of siphon. Several combinations of pipe diameter and number of the siphon shall be examined in consideration of operation method, material availability, etc. At least two siphons are installed in case of malfunction of the either siphon. Use of extremely smaller pipe diameter causes small flow capacity due to a friction loss of the pipe. Besides from this, large pipe requires laborious work to fulfill the siphon pipe with water. Pipe diameter shall be not smaller than 60 mm according to the site investigation. PVC pipe and polyethylene pipe is selected for outlet side. Polyethylene pipe is applicable to inlet side pipe because of its flexibility.

(c) Valve selection

Flap valve and sluice (stop) valve are applied to the inlet and outlet end, respectively. Flap bane type valve is recommended for inlet valve to avoid mechanical failure like a spring type flap valve. Screen or slotted filter is installed to avoid foreign materials clogging the inlet pipe. Stop valve is applied to the outlet valve.

2) Conduit type intake

Conduit type intake is recommended because of its adequate flow capacity and operational and maintenance easiness, except following problems:

(a) Water leakage through conduits

Pipe installation through the dam embankment is susceptible to induce water flow along the conduits. Cutoff wall installation mitigates water flow and proper compaction of impervious earth material can reduce seepage flow. Conduits shall be installed in the dam foundation to neglect affect to the dam embankment in principle.

(b) Dewatering of impounding water

It is necessary to drain impounding water during the construction, otherwise temporary embankment or sheet pile is necessary to maintain construction site in dry condition. It sometimes needs higher construction cost.

(c) It is important to install two valves at the outlet of the intake pipe.

(3) Rehabilitation of dam and appurtenant structure

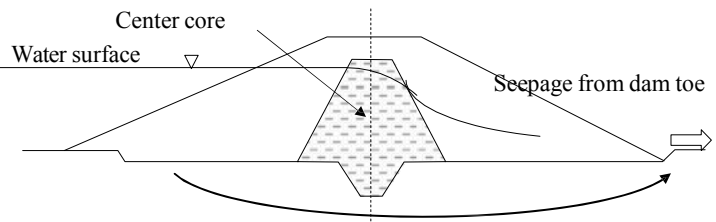
1) Dam

(a) Leakage of water

The leakage through dam embankment and foundation is caused by several reasons as follow:

i) High permeability of the dam foundation (Grouting wall is not installed.)

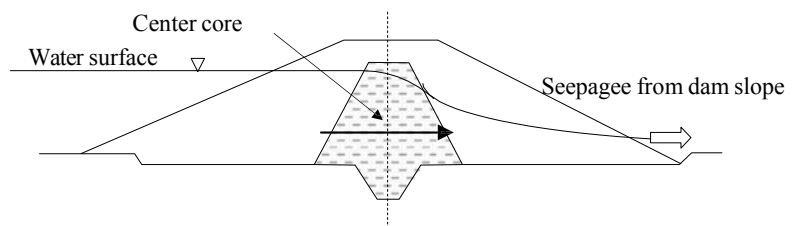
When dam foundation is composed of high permeable layers, seepage water spouts out from downstream of the dam embankment.



ii) High permeability of dam embankment

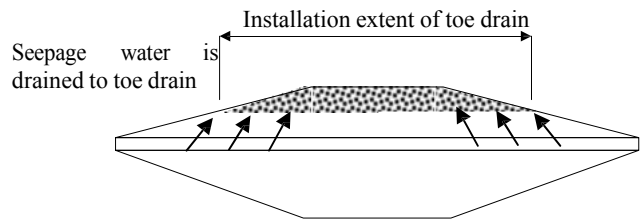
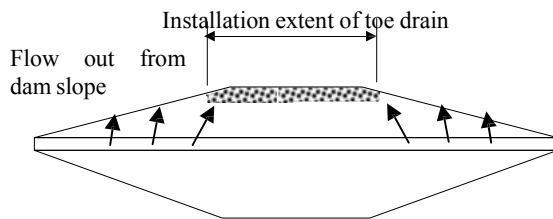
In the case a dam embankment, especially core zone is not sufficiently compacted due to poor construction method or improper material selection.

When core materials were not sufficiently compacted, or compacted surface of each layer was not raked, seepage flows along the boundary of compacted layer, and flow out from downstream slope.



iii) Toe drain is not installed to the abutment

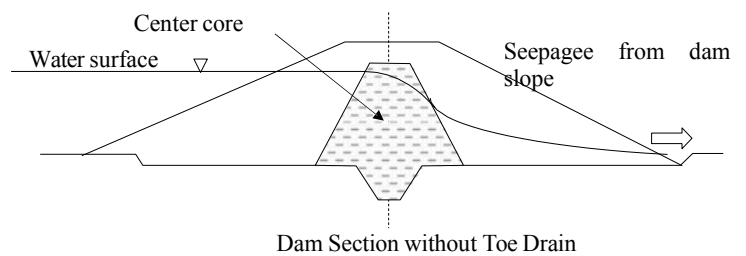
Downstream



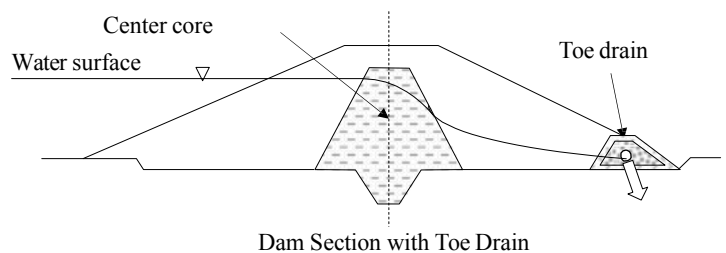
Upstream

iv) Drain was not constructed

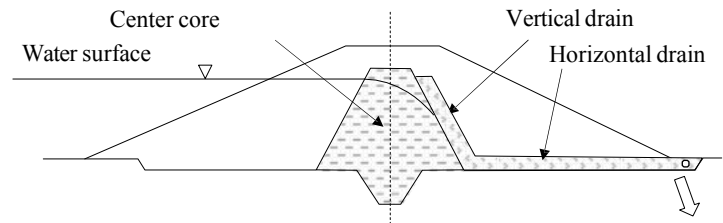
When drain was not installed, seepage water spouts out on the downstream slope of the embankment.



As a countermeasures, toe drain shall be installed along the embankment. Seepage water is drained along the pipe in the toe drain and drained to the stream.



In the case of center core zone type dam, a vertical drain is appropriate method to safely drain the seepage water and sustain embankment stability in general.



Dam Section with Vertical Drain

2) Rehabilitation of the spillway

Almost all dam spillway canal bed and side walls are not protected with firm materials such as concrete, masonry and stone riprap. In this situation, spillway bed and side walls have been damaged and eroded by floods. Meanwhile some dams have insufficient free board height between spillway canal bed and dam crest, accordingly dam safety is not secured especially during the floods. A few dam have an overflow crest in the spillway canal, however canal surface erosion of the spillway is destructive to a stability of crest foundation of the spillway. In addition, over exuberant weeds on the spillway canal declines flow capacity of the spillway. In this regard, protection of the spillway canal and side walls are necessary not only to secure dam safety but to minimize total rehabilitation cost of the spillway in its service period from a view point of asset management. Concrete slab apron, gabion consolidation along the spillway bed and masonry wall protection of the side walls of the spillway are recommended to protect the spillway.

Widening of the spillway canal, rising of dam crest are proposed to secure free board. Installation of overflow crest also increases flow capacity of the spillway without rising of flood water level and mitigate spillway channel erosion at the upstream of the spillway crest. Sufficiently longer apron concrete shall be installed to prevent local erosion immediately downstream of the overflow crest of the spillway.

Chapter 2 Work Items

2.1 Work Items for Rehabilitation of the Existing Irrigation Schemes

Work items for the rehabilitation work of the existing irrigation schemes are indicated in Table T2.1.1. Work items are divided into two categories, i.e., “water conveyance works for irrigation” and “dam rehabilitation works” according to funding schedule.

2.2 Work Items for Construction of the Proposed Irrigation Schemes

Work items for the proposed irrigation schemes are indicated in Table T2.2.1. As same policy as those for rehabilitation works above, work items are divided into two categories, i.e., water conveyance works for irrigation and dam rehabilitation works.

2.3 Extension of the Works

Extensive work for the rehabilitation and new construction work of the irrigation facilities shall be proposed in line with effective and efficient investment plan with following conditions:

- 1) Investment plan shall be formulated taking account of economical issue, i.e., cost - benefit relationship of the project,
- 2) The irrigation system shall be designed in conformity to technical and financial ability of the farmers to achieve sustainable project implementation by the farmers,
- 3) Rehabilitation and new construction works shall be evaluated by not individual project but overall projects proposed in the Master plan,
- 4) Effective rehabilitation plan shall be proposed for dam structures taking their long term use as a water source for the irrigation. The rehabilitation cost and investment schedule shall be examined comparing damaged cost without rehabilitation work and expected benefit originated by long term use of the impounding water.

About 1), irrigation canal rehabilitation in on-farm level is proposed from a cost-benefit perspective. About, 2), it is essential to apply gravity irrigation system, about 3), aver all project cost shall be estimated to satisfy en economical internal rate of return (EIRR) ranging from 12 to 15 % referring to other economical evaluation of the irrigation sector. About 4), rehabilitation of the spillway canal shall be promptly commenced to protect dam embankment. It is strongly recommended the Governments to allocate rehabilitation cost for the dam and its appurtenant structures as a physical input to prolong their life spans of these social assets. The rehabilitation cost was estimated for a reference, so it was excluded from the cost in the Mater plan.

Chapter 3 Cost Estimates of Irrigation Facilities

3.1 Assumptions

The following are assumptions of the cost estimates:

- 1) Material costs were surveyed in the Study period of December 2010.
- 2) The exchange rate used in the estimates is as follows:
US\$1.00=ZMK4,700 (ZMK1.00=J¥0.017) as of December 2010
- 3) Construction cost is contract basis with local contractor.
- 4) The physical contingency of ten (10) percent of the total cost of the construction cost, administration, engineering costs is included in the project cost.
- 5) Price contingency is also taken into account at an annual price escalation rate of 3.0 percent.

3.2 Project Cost

Project cost is comprised of following items:

- 1) Construction cost
Construction cost is composed of direct cost, temporary and preparatory work, contractor's expense, etc.
- 2) Engineering service cost
Engineering service cost is estimated for detailed design and construction supervisory works by the consultant. The consultants technically assist and advice the government staff during the detailed design and construction supervision period. Engineering cost is three (3) percent for the irrigation canal, intake weir rehabilitation/ construction works and ten (10) percent of dams and their appurtenant structures taking required technical level into account.
- 3) Administration
Detailed design and construction works including pre-construction works are undertaken by the government staff with assistance and advice of the consultant. Administration cost is estimated at three (3) percent of the direct construction cost for the expense of construction supervision, diffusion activities for farming, water use, organizational strengthening of the WUAs, etc.
- 4) Physical contingency
The physical contingency of ten (10) percent of the total cost of 1), 2) and 3) above is taken

into account.

5) Price contingency

The price contingency of five (5) percent is taken into account.

3.3 Cost Estimates

Project costs are summarized in Table 3.3.1 and 3.3.2. The detailed cost estimates are shown in Table T3.3.1.

Table 3.3.1 Project Cost for the Rehabilitation Works

(Unit: ZMK '000)

No	Existing schemes	Province	District	Cost for Irrigation Scheme	Cost for Dams	Total
1	Kafubu	Copperbelt	Ndola	1,649,237	0	1,649,237
2	Katuba	Central	Chibombo	223,968	1,575,215	1,799,183
3	Mulila Kazembe	Central	Kapiri Mposhi	0	680,764	680,764
4	Chunga	Lusaka	Lusaka	739,120	0	739,120
5	Funzwe	Lusaka	Kafue	216,432	549,839	766,271
6	Shantumbo	Lusaka	Chongwe	15,339	0	15,339
7	Chipapa	Lusaka	Kafue	1,553,972	944,171	2,498,143
8	Kanundwa	Southren	Monze	0	993,490	993,490
9	Siafwa-kweda	Southern	Choma	323,548	665,814	989,362
10	Ndondi	Southern	Choma	0	0	0
11	Nkandabwe	Southern	Sinazongwe	251,088	632,042	883,130
12	Nabuyani	Southern	Kalomo	0	0	0
13	Mulabalaba	Southern	Kazungula	201,657	323,668	525,325
	Total			5,174,361	6,365,002	11,539,363

Table 3.3.2 Project Cost for Proposed Irrigation Schemes

(Unit: ZMK '000)

	Potential schemes	Province	District	Cost for Irrigation Scheme	Cost for Dams	Total
1	Kakoso	Copperbelt	Chililaombwe	2,702,233	0	2,702,233
2	Bwafwano	Copperbelt	Kalulushi	2,171,918	0	2,171,918
3	Kasamba	Central	Kapiri Mposhi	1,863,382	452,955	2,316,337
4	Juda	Central	Kapiri Mposhi	1,247,449	452,955	1,700,404
5	Natuseko	Central	Kabwe	35,925	0	35,925
6	Waya Camp	Central	Kabwe	23,573	0	23,573
7	Lifwambula	Central	Chibombo	1,031,872	639,659	1,671,531
8	Munga	Central	Chibombo	1,863,382	558,340	2,421,722
9	Chikupi	Lusaka	Kafue	35,925	0	35,925
10	Nakempa	Southern	Choma	939,482	502,133	1,441,615
11	Siakasipa	Southern	Kazungula	1,555,415	501,740	2,057,155
	Total			13,470,555	3,107,782	16,578,337

Tables

Table T2.1.1 Rehabilitation Plan of Existing Irrigation Schemes (Proposed Works)

No	Irrigation Scheme District	Province	Rehabilitation	Descriptions	Effect / Benefit	Remarks
1	Kafubu block Ndola	Copperbelt	Construction of intake weir	Intake weir (Division pit with concrete) (1.5×3.0×H1.5m)	Stable water diversion from the river	Upstream dambo area is useful to storage river water by lifting river surface by weir.
			Installation of irrigation canal	Canal lining (2.74km)	Improvement of water conveyance loss from canal surface.	
			Division pit	Installation of division pits (20 nos/ 2.74km)	Reduction of labor force	
2	Katuba Chibombo	Central	Installation of intake siphon	Additional siphon 2 lines, ϕ 100mm Replacement 2 siphon from ϕ 75mm to ϕ 100mm	Increase of intake capacity	In addition to present 2 siphons, 2 siphons are installed at elevated portion.
			Rehabilitation of spillway	Installation of masonry side wall (Right: 350m, left: 220m) Installation of revetment (Gabion 50m×7 lines)	Rehabilitation of dam facilities	Mitigation of gully erosion on the spillway canal
			Extension of irrigation canal	Extension of left bank irrigation canal (L=335 m) Division pit (8 pits)	Increase of irrigable area	Land reclamation may be necessary
			Repair of division pits	Division pit 10 nos.	Increase of irrigation water through division pit	Damaged pit is repaired.
3	Mulila Kazembe Kapiri Mposhi	Central	Rehabilitation of spillway	Installation of crest Protection wall of spillway canal (Right 100m, left 100m) Installation of revetment (Gabion 20m×7 lines)	Protection of spillway	
			Countermeasures for seepage from embankment	Grouting or blanket method	Restoration of dam storage function	Detailed investigation is required. (Rehabilitation cost is excluded from cost estimates.)
4	Chunga Lusaka	Lusaka	Prevention of contaminated sewage water into river	(Ex. aeration of treatment ponds)	Improvement of water quality for irrigation	Local government is responsible for the work. (Cost is excluded from cost estimates.)
			Installation of irrigation canal	Installation of canal (0.4×0.4m×1,200m) Division pit 24 nos.	Improvement of water conveyance loss from canal surface.	
			Diversion of irrigation water from other tributaries	Installation of conduit to divert the river water	Improvement of water quality for irrigation	(Cost is excluded from cost estimates.)
5	Funzwe Kafue	Lusaka	Provision of water lifting device	Treadle pump (10 sets)	Reduction of labor force for water lifting	

No	Irrigation Scheme District	Province	Rehabilitation	Descriptions	Effect / Benefit	Remarks
6	Shantumbu Chongwe	Lusaka	Repair of intake valve (Water leakage from valve)	Replacement of intake valve, and additional sub-valve for maintenance.	Restoration of dam storage function	The rehabilitation work is scheduled during the dry season.
			Extension of main irrigation canal	430m (Inner dimension 0.3m×0.3m) Division pit (9 pits)	Increase of irrigable area	
			Rehabilitation of spillway	Installation of crest Protection wall of spillway canal (Right 75m, left 75m) Installation of revetment (Gabion 20m×7 lines)	Protection of spillway	
			Protection of farm land erosion	Construction of terrace type farm land with masonry work	Mitigation of soil erosion	(Cost is excluded from cost estimates.)
7	Chipapa Kafue	Lusaka	Rehabilitation of main irrigation canal	Additional concrete to raise wall height (H0.2m×W0.3m×400m)	Increase of canal capacity	Survey of present flow capacity and water requirement
			Reshape of secondary canals	Canal installation (0.3×0.3m) L=250m×21 canals	Improvement of water conveyance loss	WUA is responsible for the work. (Cost includes brick and mortar canal construction.)
			Rehabilitation of spillway	Protection wall of spillway canal (Right 75m, left 75m) Installation of revetment (Gabion 20m×7 lines)	Protection of spillway	Spillway bed is composed of weathered rock, thus protection of side wall is proposed.
			Installation of consolidation dam	Masonry wall (L=100m×4 rows, H=1.5m) including gabion protection (W=3.0m)	Maintenance of reservoir capacity	Consolidation dam can reduce riverbed erosion upstream of the reservoir.
			Dredging of sediment accumulated in the reservoir	Dredging of soil, preparation of soil disposal area	Maintenance of reservoir capacity	Access of heavy equipment is necessary (Cost is excluded from cost estimates.)
			Water leakage along intake pipe	Installation of cut-off all, refilling with impermeable earth materials along the intake pipe	Securing dam safety	Detailed investigation of seepage phenomena is necessary to confirm the main cause. (Cost is excluded from cost estimates.)
			Installation of sub-valve	Sub-valve is installed when main valve is replaced or repaired.	Maintenance of reservoir capacity	
			Protection of intake valve	Valve pit construction	Maintenance of reservoir capacity	
8	Kanundwa Monze	Southern	Protection of spillway	Side wall with masonry (100m×2 spillways) Bed consolidation work with gabion (20m×10 lines ×2 spillways)	Securing dam safety	Pipe joint sealing shall be examined. (Spillway canal shall be deepened to prevent inundation of farmland immediately downstream of the dam embankment.)
			Spillway rehabilitation	Installation of overflow crest	2 spillway	

No	Irrigation Scheme District	Province	Rehabilitation	Descriptions	Effect / Benefit	Remarks
9	Siafwa-kweda Choma	Southern	Installation of dam intake device	Installation of intake or siphon type intake	Increase of intake capacity	Farm land downstream of the dam should be prepared.
			Installation of irrigation canal	Installation of canal (0.4×0.4m×500m)	Increase of irrigable area	
			Rehabilitation of spillway	Repair of apron concrete and side wall (60m×2 spillways)	Securing dam safety	Spillways located at both dam abutment shall be protected.
10	Ndondi Choma	Southern	Air valves shall be installed to smoothly blow air in the siphon pipes or change to large pipe of siphon	(Available water head shall be examined. When water head is insufficient, outlet of the siphon shall be replaced to lower portion.)	Intake discharge is increased.	(Cost is excluded from cost estimates.)
11	Nkandabwe Sinazongwe	Southern	Rehabilitation of intake weir	Rehabilitation of decrepitude weir body (L=40m)	Securing stability of the weir structure	Rising of intake crest may cause increase of seepage water in the mining tunnel located close to the reservoir, so this plan is not applicable.
			Rehabilitation of irrigation canal	Rehabilitation of decrepitude irrigation canal (0.3m×0.3m, L=500m)	Increase of intake capacity	
			Installation of pit	Division pit (10 nos)	Increase of intake capacity	
			Replacement of intake gate	Installation of sluice valve including sub-valve	Effective use of dam storage water	
12	Nabuyani Kalomo	Southern	(none)			Since inlet pipe to fill up siphon pipe is made of polyethylene pipe with rubber sheet covering, air can get in easily. It is recommended to replace pipe materials with PVC cap to hermetically seal the pipe to exclude any external air.
13	Mulabalaba Kazungula	Southern	Rehabilitation of spillway apron concrete	Placing apron concrete Placing gabion downstream of spillway apron concrete	Securing dam safety	
			Drainage improvement	Drainage canal construction (L=150m, 200m, canal width of 1.0m) with wooden materials or fascine fence	Increase of irrigable area	
			Improvement of dam intake facilities	Installation of additional siphon	Increase of intake capacity	
			Improvement of main irrigation canal	Improvement of division pit (installation of adjustable stop log)	Increase of intake capacity	Device for water lifting from the canal
			Extension of irrigation canal	500m (Inner dimension 0.3m×0.3m)	Increase of irrigable area	Installation of right side canal (Cost is excluded from cost estimates.)

Table T2.2.1 Construction Plan of Potential Irrigation Schemes (Tentative plan)

No	Irrigation Scheme	Province	Rehabilitation	Descriptions	Effect / Benefit	Remarks
1	Kakoso Chililabombwe	Copperbelt	Installation of regulating tanks	Concrete tanks of 5 nos (6m×6m×H2.5m)	Reducing water loss Effective use of irrigation water in night time flow Water storage in drought year	Other farm land is located along stream for 2 to 3 km downstream of the Kakoso beneficial area. Improvement of irrigation efficiency at upstream farm land is effective to increase irrigation water for downstream use.
			Canal lining	Lining of main canal along contour line (0.4m×0.4m×3,655m)	Improvement of water conveyance loss from canal surface	Irrigation canal is extended to 1.8km downstream of the spring points.
			Division pit	Division pit (30 nos)	Diversion of irrigation water	
			- Rehabilitation of sewage ponds and tanks - Separating of sewage water by bypass canal or pipe.	Installation of PVC pipe or concrete canal	Conservation of water quality from environmental point	Sewage water shall be separated from irrigation water, especially downstream area of the sewage ponds. (Cost is excluded from cost estimates.)
2	Bwafwano Kalulushi	Copperbelt	Rehabilitation of irrigation canal	Canal lining and widening (Right canal 2.7 km), left canal 1.0 km) including culvert at road crossing section	Improvement of irrigation efficiency by reducing seepage loss from the canal.	Enlargement of canal capacity.
			Division pit	Installation of division pits(1 nos/50m)	Reduction of labor force	
3	Kasamba dam Kapiri Mposhi	Central	Rehabilitation of spillway	Protection of spillway canal bed and side walls (Right side L=60m, left side L=100m) Revetment of spillway canal (5 lines)	Securing dam safety	Overtopping of dam crest has occurred three times in 10 years after dam completion.
			Rehabilitation of spillway	Overflow crest (L=30m)	Spillway canal protection	
			Raising of dam crest	About 1.5m raising is proposed (it depends on spillway capacity)	Securing dam safety	Dam crest is raised when existing reservoir capacity is maintained. (Cost is excluded from cost estimates.)
			Installation of intake facilities	Siphon type intake is proposed at left side abutment of the dam body.	Increase of irrigable area	
			Construction of irrigation canal	Canal (0.4m×0.4m), Left side (L=1,500m), right side (L=1,500m)	Scheduled farming is realized by stable irrigation water supply.	Farm land is located along the river.
			Land preparation	Land preparation of sloped terrain along the river.	Increase of irrigable area	Since land forms relatively flat, weeding may be necessary. (Cost is excluded from cost estimates.)

No	Irrigation Scheme	Province	Rehabilitation	Descriptions	Effect / Benefit	Remarks
4	Juda dam Kapiri Mposhi	Central	Installation of intake facilities	Intake or siphon type intake device is applied.	Increase of irrigable area	
			Rehabilitation of spillway	Overflow crest (L=30m)	Spillway canal protection	
			Rehabilitation of spillway	Protection of spillway canal bed and side slope protection with masonry wall. (Right side 60m, left side 100m) Revetment (Gabion 30m×5 lines)	Securing dam sefty	
			Construction of irrigation canal	Canal (0.4m×0.4m), Left side (L=1,000m), right side (L=1,000m) Division pits (40 nos)	Scheduled farming is realized by stable irrigation water supply.	Farm land is located along the river.
			Land preparation	Land preparation of sloped terrain along the river.	Increase of irrigable area	Since land forms relatively flat, weeding may be necessary. (Cost is excluded from cost estimates.)
5	Natuseko Kabwe	Central	Enhancement of manpower watering	Treadle pumps 5 sets and movable engine pumps 5 sets for communal use of farmers	Increase of irrigable area Reduction of labor force especially for women	Beneficiaries will increase from current 30 households to 60 or more. Development of dambo area for irrigation
			Water conveyance of pipe	Polyethylene pipe (ϕ 50mm, 50m × 30 farmers)	Reduction of water conveyance loss of groundwater	Gushed (spring) water is conveyed to farm lands through pipes.
6	Waya Kabwe	Central	Enhancement of manpower watering	Treadle pumps 5 sets and movable engine pumps 2 sets for joint use of farmers	Increase of irrigable area Reduction of labor force especially for women	Project is subject to scattered farm area composed of 5 to 6 households in each area. Engine pump is used for elevated farm land.
			Road rehabilitation	Farm road (4m wide, 500m long)	Access road to transport farm inputs and outputs	(Cost is excluded from cost estimates.)
7	Lifwambora Chibombo	Central	Installation of intake facilities	Intake or siphon type intake device is applied.	Increase of intake capacity	Land preparation downstream of the dam is necessary.
			Construction of irrigation canal	Canal (0.4m×0.4m), Left side (L=1,000m), right side (L=650m) Division pits (33 nos)	Scheduled farming is realized by stable irrigation water supply.	Farm land is located along the river.
			Rehabilitation of spillway	Overflow crest (L=30m)	Spillway canal protection	
			Rehabilitation of spillway	Side wall protection (Masonry, right side 100m, left side 60m) Protection of spillway canal bed with gabion (30m wide × 5 lines)	Securing dam safety	Rehabilitation of downstream portion of the spillway (slope protection: 60m long, 2m wall height)

No	Irrigation Scheme	Province	Rehabilitation	Descriptions	Effect / Benefit	Remarks
8	Munga Chibombo	Central	Installation of intake facilities	Intake or siphon type intake device is applied.	Increase of intake capacity	Land preparation downstream of the dam is necessary.
			Construction of irrigation canal	Canal (0.4m×0.4m), Left side (L=1,500m), right side (L=1,500m) Division pits (60 nos)	Scheduled farming is realized by stable irrigation water supply.	Farm land is located along the river. Farm land shall be gathered to minimize irrigation canal length, otherwise, 3,000m canal is required.
			Raising of dam crest	Raising of dam crest to secure free board of the embankment (at least 1.0m)	Securing dam safety	(Cost is excluded from cost estimates.)
			Rehabilitation of spillway	Overflow crest (L=30m)	Spillway canal protection	
			Rehabilitation of spillway	Side wall protection (Masonry, right side 100m, left side 100m) Protection of spillway canal bed with gabion (30m wide×5 lines)	Securing dam safety	
9	Chikupi Kafue	Lusaka	Enhancement of manpower watering	Treadle pumps 5 sets and movable engine pumps 5 sets for joint use of farmers	Increase of irrigable area Reduction of labor force	Farm area is scattered in the wide dambo area. Estate area of 250 ha is located in the Chikupi area.
			Road construction	Road of 4m wide, 1km long	Access to the site in the beginning of the wet and dry season	(Cost is excluded from cost estimates.)
10	Nakempa Choma	Southern	Installation of intake facilities	Intake or siphon type intake device is applied.	Increase of intake water	Land preparation downstream of the dam is required.
			Construction of irrigation canal	Canal (0.4m×0.4m), Left side (L=750m), right side (L=750m) Division pits (30 nos)	Scheduled farming is realized by stable irrigation water supply.	
			Rehabilitation of spillway	Side wall protection (Masonry, right side 75m, left side 75m) Protection of spillway canal 20m wide ×5 lines	Securing dam safety	
			Rehabilitation of spillway	Overflow crest (L=20m)	Spillway canal protection	
11	Siakasipa Kazungula	Southern	Rehabilitation of spillway	Side slope protection with masonry wall. (Right side 60m, left side 75m) Protection of spillway canal bed (20m×5 lines)	Securing dam safety	
			Rehabilitation of spillway	Overflow crest (L=20m)	Spillway canal protection	
			Installation of intake facilities	Siphon type intake at left side of the dam embankment	Increase of irrigable area	
			Construction of irrigation canal	Canal (0.4m×0.4m), left side L=1,500m, right side L=1,500m	Scheduled farming is realized by stable irrigation water supply.	Land preparation downstream of the dam is required.
			Construction of road drainage ditch	Installation of drainage ditch along the dam crest road (50m long×2lines×both sides=200m)	Securing reservoir capacity	Mitigate sediment inflow into the reservoir. (Cost is excluded from cost estimates.)

No	Irrigation Scheme	Province	Rehabilitation	Descriptions	Effect / Benefit	Remarks
12	Mandia Kazungula	Southern	Either gravity irrigation by 15km canal or motorized pump system is proposed.			Pre-F/S shall be conducted especially water conveyance system.

Table T3.3.1 Cost Estimates

(Unit: ZMK'000)

I. Rehabilitation Cost																
Scheme	Irrigation cost							Dam, spillway cost								
	Direct cost	Indirect cost	Total	Consulting	Administration	Contingency	Total 1.	Dam	Indirect cost	Total	Consulting	Administration	Contingency	Total 2.	Total 1+2	
1 Kafubu	1,021,452	306,436	1,327,888	66,394	39,837	215,118	1,649,237	0	0	0	0	0	0	0	1,649,237	
2 Katuba	138,714	41,614	180,329	9,016	5,410	29,213	223,968	975,607	292,682	1,268,289	63,414	38,049	205,463	1,575,215	1,799,183	
3 Mulila Kazembe	0	0	0	0	0	0	0	421,630	126,489	548,119	27,406	16,444	88,795	680,764	680,764	
4 Chunga	457,773	137,332	595,105	29,755	17,853	96,407	739,120	0	0	0	0	0	0	0	739,120	
5 Sahntumbu	134,047	40,214	174,261	8,713	5,228	28,230	216,432	340,542	102,163	442,704	22,135	13,281	71,718	549,839	766,271	
6 Funzwe	9,500	2,850	12,350	618	371	2,001	15,339	0	0	0	0	0	0	0	15,339	
7 Chipapa	962,450	288,735	1,251,185	62,559	37,536	202,692	1,553,972	584,771	175,431	760,202	38,010	22,806	123,153	944,171	2,498,143	
8 Kanundwa	0	0	0	0	0	0	0	615,316	184,595	799,911	39,996	23,997	129,586	993,490	993,490	
9 Siafwa-kweda	200,389	60,117	260,506	13,025	7,815	42,202	323,548	412,371	123,711	536,082	26,804	16,082	86,845	665,814	989,362	
10 Ndoni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11 Nkandabwe	155,511	46,653	202,164	10,108	6,065	32,751	251,088	391,454	117,436	508,891	25,445	15,267	82,440	632,042	883,130	
12 Nabuyani	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13 Mulabalaba	124,896	37,469	162,365	8,118	4,871	26,303	201,657	200,463	60,139	260,602	13,030	7,818	42,218	323,668	525,325	
Total I.	3,204,732	961,420	4,166,152	208,308	124,985	674,917	5,174,361	3,942,154	1,182,646	5,124,801	256,240	153,744	830,218	6,365,002	11,539,363	
II. Construction Cost																
Scheme	Irrigation cost							Dam, spillway cost								
	Direct cost	Indirect cost	Total	Consulting	Administration	Contingency	Total 1.	Dam	Indirect cost	Total	Consulting	Administration	Contingency	Total 2.	Total 1+2	
1 Kakoso	1,673,624	502,087	2,175,711	108,786	65,271	352,465	2,702,233	0	0	0	0	0	0	0	2,702,233	
2 Bwafwano	1,345,174	403,552	1,748,726	87,436	52,462	283,294	2,171,918	0	0	0	0	0	0	0	2,171,918	
3 Kasamba	1,154,083	346,225	1,500,308	75,015	45,009	243,050	1,863,382	280,537	84,161	364,698	18,235	10,941	59,081	452,955	2,316,337	
4 Juda	772,605	231,782	1,004,387	50,219	30,132	162,711	1,247,449	280,537	84,161	364,698	18,235	10,941	59,081	452,955	1,700,404	
5 Natuseko	22,250	6,675	28,925	1,446	868	4,686	35,925	0	0	0	0	0	0	0	35,925	
6 Waya	14,600	4,380	18,980	949	569	3,075	23,573	0	0	0	0	0	0	0	23,573	
7 Lifwambora	639,088	191,726	830,815	41,541	24,924	134,592	1,031,872	396,172	118,852	515,023	25,751	15,451	83,434	639,659	1,671,531	
8 Munga	1,154,083	346,225	1,500,308	75,015	45,009	243,050	1,863,382	345,807	103,742	449,549	22,477	13,486	72,827	558,340	2,421,722	
9 Chikupi	22,250	6,675	28,925	1,446	868	4,686	35,925	0	0	0	0	0	0	0	35,925	
10 Nakempa	581,867	174,560	756,427	37,821	22,693	122,541	939,482	310,995	93,299	404,294	20,215	12,129	65,496	502,133	1,441,615	
11 Siakasipa	963,344	289,003	1,252,347	62,617	37,570	202,880	1,555,415	310,752	93,226	403,978	20,199	12,119	65,444	501,740	2,057,155	
Total II.	8,342,967	2,502,890	10,845,858	542,293	325,376	1,757,029	13,470,555	1,924,800	577,440	2,502,240	125,112	75,067	405,363	3,107,782	16,578,337	
Total I+II	11,547,699	3,464,310	15,012,010	750,601	450,361	2,431,946	18,644,916	5,866,954	1,760,086	7,627,041	381,352	228,811	1,235,581	9,472,784	28,117,700	

Table T3.3.2 Direct Cost of the Rehabilitation Works

Direct Cost (Rehabilitation)

1. Sheme Kafubu Irrigation Scheme
2. District Ndola
3. Province Copperbelt

Work Category	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
1)	Canal (Brick)	0.4mx0.4m	m	2740	269,055	59,993	737,210,727	164,380,820	901,591,547	
2)	Miscellaneous work		%	10			73,721,073	16,438,082	90,159,155	
	Sub-Total 1.						810,931,800	180,818,902	991,750,702	
2.	Pit installation for canal									
	Concrete work									
	1) Concrete	C-18	m3	11.88	497,834	209,673	5,914,273	2,490,915	8,405,189	
	2) Form		m2	115.2	29,686	0	3,419,800	0	3,419,800	
	3) Bar		ton	0.712	2,791,000	4,639,000	1,987,192	3,302,968	5,290,160	
	4) Base gravel		m3	5.88	71,736	36,183	421,807	212,756	634,563	
	5) Miscellaneous work		%	10			1,174,307	600,664	1,774,971	
	Sub-Total 2.						12,917,379	6,607,303	19,524,682	
3.	Diversion work									
	Earth work									
	1) Excavation	by man-power	m3	5	18,720	0	93,600	0	93,600	
	2) Bachfilling	by man-power	m3	0	11,040	0	0	0	0	
	Concrete work									
	1) Concrete	C-21	m3	5.5	497,834	209,673	2,738,090	1,153,202	3,891,291	
	2) Form		m2	33	29,686	0	979,630	0	979,630	
	3) Bar		ton	0.55	2,791,000	4,639,000	1,535,050	2,551,450	4,086,500	
	4) Base gravel		m3	2	71,736	36,183	143,472	72,366	215,838	
	5) Miscellaneous work		%	10			539,624	370,465	910,089	
	Sub-Total 3.						6,029,465	4,147,483	10,176,948	
	Total 1+2+3						829,878,644	191,573,688	1,021,452,332	

1. Sheme Katuba Irrigation Scheme
2. District Chibombo
3. Province Central

Work Category	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
1)	Canal (Brick)	0.4mx0.4m	m	335	269,055	59,993	90,133,428	20,097,655	110,231,083	
2)	Miscellaneous work		%	10			9,013,343	2,009,766	11,023,108	
	Sub-Total 1.						99,146,771	22,107,421	121,254,192	
2.	Pit installation for canal									
	Concrete work									
	1) Concrete	C-18	m3	4.752	497,834	209,673	2,365,709	996,366	3,362,075	
	2) Form		m2	46.08	29,686	0	1,367,920	0	1,367,920	
	3) Bar		ton	0.2848	2,791,000	4,639,000	794,877	1,321,187	2,116,064	
	4) Base gravel		m3	2.352	71,736	36,183	168,723	85,102	253,825	
	5) Miscellaneous work		%	10			469,723	240,266	709,988	
	Sub-Total 2.						5,166,951	2,642,921	7,809,873	
3.	Siphon installation									
	Earth work									
	1) Excavation	by man-power	m3	6	18,720	0	112,320	0	112,320	
	2) Bachfilling	by man-power	m3	6	11,040	0	66,240	0	66,240	
	Plumbing work									
	1) PVC pipe	Dia 100mm×2	m	60.2	11,226	36,360	675,805	2,188,872	2,864,677	
	2) Hoot valve	Dia 100mm×2	nos	2	706,000	0	1,412,000	0	1,412,000	
	3) Stop valve	Dia 100mm×2	nos	2	1,059,000	0	2,118,000	0	2,118,000	
	4) Miscellaneous work		%	20			841,161	437,774	1,278,935	
	Valve pit construction									
	1) Concrete	C-18	m3	0.9	497,834	209,673	448,051	188,706	636,757	
	2) Form		m2	10	29,686	0	296,858	0	296,858	
	3) Bar		ton	0.09	2,791,000	4,639,000	251,190	417,510	668,700	
	4) Base gravel		m3	0.3	71,736	36,183	21,521	10,855	32,376	
	5) Miscellaneous work		%	10			101,762	61,707	163,469	
	Sub-Total 3.						6,344,908	3,305,424	9,650,332	
	Total 1+2+3						110,658,630	28,055,766	138,714,396	

1. Sheme Chunga Irrigation Scheme
 2. District Lusaka
 3. Province Lusaka

Work Category	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.4mx0.4m	m	1200	269,055	59,993	322,866,012	71,991,600	394,857,612	
	2) Miscellaneous work		%	10			32,286,601	7,199,160	39,485,761	
	Sub-Total 2.						355,152,613	79,190,760	434,343,373	
2.	Pit installation for canal									
	Concrete work			nos	24					
	1) Concrete	C-18	m3	14.256	497,834	209,673	7,097,128	2,989,098	10,086,226	
	2) Form		m2	138.24	29,686	0	4,103,759	0	4,103,759	
	3) Bar		ton	0.8544	2,791,000	4,639,000	2,384,630	3,963,562	6,348,192	
	4) Base gravel		m3	7.056	71,736	36,183	506,168	255,307	761,475	
	5) Miscellaneous work		%	10			1,409,169	720,797	2,129,965	
	Sub-Total 2.						15,500,854	7,928,764	23,429,618	
	Total 1+2+3						370,653,468	87,119,524	457,772,991	

1. Sheme Sahntumbu Irrigation Scheme
 2. District Kafwe
 3. Province Lusaka

Work Category	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.3mx0.3m	m	430	214,987	53,795	92,444,367	23,131,850	115,576,217	
	2) Miscellaneous work		%	10			9,244,437	2,313,185	11,557,622	
	Sub-Total 1.						101,688,804	25,445,035	127,133,839	
2.	Pit installation for canal									
	Concrete work			nos	9					
	1) Concrete	C-18	m3	4.203	497,834	209,673	2,092,398	881,256	2,973,654	
	2) Form		m2	40.14	29,686	0	1,191,586	0	1,191,586	
	3) Bar		ton	0.252	2,791,000	4,639,000	703,332	1,169,028	1,872,360	
	4) Base gravel		m3	2.286	71,736	36,183	163,988	82,714	246,702	
	5) Miscellaneous work		%	10			415,130	213,300	628,430	
	Sub-Total 2.						4,566,435	2,346,298	6,912,733	
	Total 1+2						106,255,239	27,791,333	134,046,572	

1. Sheme Chipapa Irrigation Scheme
 2. District Kafue
 3. Province Lusaka

Work Category	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal rehabilitation									
	Concrete work	Lifting of wall height								
	1) Concrete	C-18	m3	48	497,834	209,673	23,896,054	10,064,304	33,960,358	
	2) Form		m2	320	29,686	0	9,499,443	0	9,499,443	
	3) Miscellaneous work		%	10			3,339,550	1,006,430	4,345,980	
	Sub-Total 1.						36,735,047	11,070,734	47,805,781	
2.	Secondary canal extension									
	1) Canal (Brick)	0.3mx0.3m	m	2500	269,055	59,993	672,637,525	149,982,500	822,620,025	
	2) Miscellaneous work		%	10			67,263,753	14,998,250	82,262,003	
	Sub-Total 2.						739,901,278	164,980,750	904,882,028	
3.	Pit installation for main canal									
	Concrete work			nos	10					
	1) Concrete	C-18	m3	5.94	497,834	209,673	2,957,137	1,245,458	4,202,594	
	2) Form		m2	57.6	29,686	0	1,709,900	0	1,709,900	
	3) Bar		ton	0.356	2,791,000	4,639,000	993,596	1,651,484	2,645,080	
	4) Base gravel		m3	2.94	71,736	36,183	210,903	106,378	317,281	
	5) Miscellaneous work		%	10			587,154	300,332	887,486	
	Sub-Total 3.						6,458,689	3,303,652	9,762,341	
	Total 1+2+3						783,095,014	179,355,136	962,450,150	

1. Sheme Siafwa-kweda Irrigation Scheme
 2. District Choma
 3. Province Southern

Work Category	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.4mx0.4m	m	500	269,055	59,993	134,527,505	29,996,500	164,524,005	
	2) Miscellaneous work		%	10			13,452,751	2,999,650	16,452,401	
	Sub-Total 2.						147,980,256	32,996,150	180,976,406	
2.	Pit installation for canal									
	Concrete work			nos	10					
	1) Concrete	C-18	m3	5.94	497,834	209,673	2,957,137	1,245,458	4,202,594	
	2) Form		m2	57.6	29,686	0	1,709,900	0	1,709,900	
	3) Bar		ton	0.356	2,791,000	4,639,000	993,596	1,651,484	2,645,080	
	4) Base gravel		m3	2.94	71,736	36,183	210,903	106,378	317,281	
	5) Miscellaneous work		%	10			587,154	300,332	887,486	
	Sub-Total 2.						6,458,689	3,303,652	9,762,341	
3.	Siphon installation									
	Earth work									
	1) Excavation	by man-power	m3	6	18,720	0	112,320	0	112,320	
	2) Bachfilling	by man-power	m3	6	11,040	0	66,240	0	66,240	
	Plumbing work									
	1) PVC pipe	Dia 100mm×2	m	60.2	11,226	36,360	675,805	2,188,872	2,864,677	
	2) Hoot valve	Dia 100mm×2	nos	2	706,000	0	1,412,000	0	1,412,000	
	3) Stop valve	Dia 100mm×2	nos	2	1,059,000	0	2,118,000	0	2,118,000	
	4) Miscellaneous work		%	20			841,161	437,774	1,278,935	
	Valve pit construction									
	1) Concrete	C-18	m3	0.9	497,834	209,673	448,051	188,706	636,757	
	2) Form		m2	10	29,686	0	296,858	0	296,858	
	3) Bar		ton	0.09	2,791,000	4,639,000	251,190	417,510	668,700	
	4) Base gravel		m3	0.3	71,736	36,183	21,521	10,855	32,376	
	5) Miscellaneous work		%	10			101,762	61,707	163,469	
	Sub-Total 3.						6,344,908	3,305,424	9,650,332	
	Total 1+2+3						160,783,852	39,605,226	200,389,078	

1. Sheme Nkandabwe Irrigation Scheme
 2. District Sinazongwe
 3. Province Southern

Work Category	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.3mx0.3m	m	500	214,987	53,795	107,493,450	26,897,500	134,390,950	
	2) Miscellaneous work		%	10			10,749,345	2,689,750	13,439,095	
	Sub-Total 2.						118,242,795	29,587,250	147,830,045	
	2. Pit installation for canal			nos	10					
	Concrete work									
	1) Concrete	C-18	m3	4.67	497,834		209,673	2,324,887	979,173	3,304,060
	2) Form		m2	44.6	29,686		0	1,323,985	0	1,323,985
	3) Bar		ton	0.28	2,791,000	4,639,000	781,480	1,298,920	2,080,400	
	4) Base gravel		m3	2.54	71,736		36,183	182,209	91,905	274,114
	5) Miscellaneous work		%	10				461,256	237,000	698,256
	Sub-Total 2.						5,073,817	2,606,998	7,680,814	
	Total 1+2+3						123,316,612	32,194,248	155,510,859	

1. Sheme Mulabalaba Irrigation Scheme
 2. District Kazungula
 3. Province Southern

Work Category	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Storage pit installation			nos	15					
	Concrete work									
	1) Concrete	C-18	m3	43.5	497,834	209,673	21,655,799	9,120,776	30,776,575	
	2) Form		m2	300	29,686	0	8,905,728	0	8,905,728	
	3) Bar		ton	4.35	2,791,000	4,639,000	12,140,850	20,179,650	32,320,500	
	4) Base gravel		m3	15	71,736	36,183	1,076,037	542,745	1,618,782	
	5) Miscellaneous work		%	10			4,377,841	2,984,317	7,362,158	
	Sub-Total 1.						48,156,255	32,827,488	80,983,743	
2.	Siphon installation									
	Earth work									
	1) Excavation	by man-power	m3	6	18,720	0	112,320	0	112,320	
	2) Bachfilling	by man-power	m3	6	11,040	0	66,240	0	66,240	
	Plumbing work									
	1) PVC pipe	Dia 100mm×2	m	60.2	11,226	36,360	675,805	2,188,872	2,864,677	
	2) Hoot valve	Dia 100mm×2	nos	2	706,000	0	1,412,000	0	1,412,000	
	3) Stop valve	Dia 100mm×2	nos	2	1,059,000	0	2,118,000	0	2,118,000	
	4) Miscellaneous work		%	20			841,161	437,774	1,278,935	
	Valve pit construction									
	1) Concrete	C-18	m3	0.9	497,834	209,673	448,051	188,706	636,757	
	2) Form		m2	10	29,686	0	296,858	0	296,858	
	3) Bar		ton	0.09	2,791,000	4,639,000	251,190	417,510	668,700	
	4) Base gravel		m3	0.3	71,736	36,183	21,521	10,855	32,376	
	5) Miscellaneous work		%	10			101,762	61,707	163,469	
	Sub-Total 2.						6,344,908	3,305,424	9,650,332	
3.	Conduits pipe installation									
	1) PVC pipe	Dia 100mm	m	400	11,226	36,360	4,490,400	14,544,000	19,034,400	
	2) Other materials	Outlet, elbow, etc.	%	50			2,245,200	7,272,000	9,517,200	
	3) Installation of pipe		%	20			1,347,120	4,363,200	5,710,320	
	Sub-Total 3.						8,082,720	26,179,200	34,261,920	
	Total 1+2+3						62,583,883	62,312,112	124,895,995	

Table T3.3.3 Direct Cost of the New Construction Works

Direct Cost (New Construction)

1. Sheme Kakoso Irrigation Scheme
 2. District Chillilabombwe
 3. Province Copperbelt

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.4mx0.4m	m	3655	269,055	59,993	983,396,062	219,274,415	1,202,670,477	
	3) Miscellaneous work		%	10			98,339,606	21,927,442	120,267,048	
	Sub-Total 1.						1,081,735,668	241,201,857	1,322,937,524	
2.	Pit installation for canal		nos	30						
	Concrete work									
	1) Concrete	C-18	m3	17.82	497,834	209,673	8,871,410	3,736,373	12,607,783	
	2) Form		m2	172.8	29,686	0	5,129,699	0	5,129,699	
	3) Bar		ton	1.068	2,791,000	4,639,000	2,980,788	4,954,452	7,935,240	
	4) Base gravel		m3	8.82	71,736	36,183	632,710	319,134	951,844	
	5) Miscellaneous work		%	10			1,761,461	900,996	2,662,457	
	Sub-Total 2.						19,376,068	9,910,955	29,287,023	
3.	Storage tank		nos	5						
	Earth work									
	1) Excavation	by man-power	m3	124	18,720	0	2,321,280	0	2,321,280	
	2) Backfilling	by man-power	m3	23	11,040	0	253,920	0	253,920	
	Concrete work									
	1) Concrete	C-21	m3	178.5	497,834	209,673	88,863,451	37,426,631	126,290,082	
	2) Form		m2	795	29,686	0	23,600,179	0	23,600,179	
	3) Bar		ton	17.85	2,791,000	4,639,000	49,819,350	82,806,150	132,625,500	
	4) Base gravel		m3	70	71,736	36,183	5,021,506	2,532,810	7,554,316	
	5) Miscellaneous work		%	10			16,730,449	12,023,278	28,753,727	
	Sub-Total 3.						186,610,135	134,788,869	321,399,003	
	Total 1+2+3						1,287,721,871	385,901,680	1,673,623,550	

1. Sheme Bwafwano Irrigation Scheme
 2. District Kalulushi
 3. Province Copperbelt

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Right canal (Brick)	0.4mx0.4m	m	2700	269,055	59,993	726,448,527	161,981,100	888,429,627	
	2) Left canal (Brick)	0.3mx0.3m	m	1000	214,987	53,795	214,986,900	53,795,000	268,781,900	
	2) Miscellaneous work		%	10			94,143,543	21,577,610	115,721,153	
	Sub-Total 1.						1,035,578,970	237,353,710	1,272,932,680	
2.	Pit installation for canal		nos	74						
	Concrete work									
	1) Concrete	C-18	m3	43.956	497,834	209,673	21,882,812	9,216,386	31,099,198	
	2) Form		m2	426.24	29,686	0	12,653,258	0	12,653,258	
	3) Bar		ton	2.6344	2,791,000	4,639,000	7,352,610	12,220,982	19,573,592	
	4) Base gravel		m3	21.756	71,736	36,183	1,560,684	787,197	2,347,881	
	5) Miscellaneous work		%	10			4,344,936	2,222,457	6,567,393	
	Sub-Total 2.						47,794,301	24,447,022	72,241,323	
	Total 1+2						1,083,373,270	261,800,732	1,345,174,002	

1. Scheme Kasamba Irrigation Scheme
 2. District Kapiri Mposhi
 3. Province Central

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.4mx0.4m	m	3000	269,055	59,993	807,165,030	179,979,000	987,144,030	
	2) Miscellaneous work		%	10			80,716,503	17,997,900	98,714,403	
	Sub-Total 2.						887,881,533	197,976,900	1,085,858,433	
2.	Pit installation for canal		nos	60						
	Concrete work									
	1) Concrete	C-18	m3	35.64	497,834	209,673	17,742,820	7,472,746	25,215,566	
	2) Form		m2	345.6	29,686	0	10,259,399	0	10,259,399	
	3) Bar		ton	2.136	2,791,000	4,639,000	5,961,576	9,908,904	15,870,480	
	4) Base gravel		m3	17.64	71,736	36,183	1,265,420	638,268	1,903,688	
	5) Miscellaneous work		%	10			3,522,921	1,801,992	5,324,913	
	Sub-Total 2.						38,752,136	19,821,910	58,574,045	
3.	Siphon installation									
	Earth work									
	1) Excavation	by man-power	m3	6	18,720	0	112,320	0	112,320	
	2) Bachfilling	by man-power	m3	6	11,040	0	66,240	0	66,240	
	Plumbing work									
	1) PVC pipe	Dia 100mm×2	m	60.2	11,226	36,360	675,805	2,188,872	2,864,677	
	2) Hoot valve	Dia 100mm×2	nos	2	706,000	0	1,412,000	0	1,412,000	
	3) Stop valve	Dia 100mm×2	nos	2	1,059,000	0	2,118,000	0	2,118,000	
	4) Miscellaneous work		%	20			841,161	437,774	1,278,935	
	Valve pit construction									
	1) Concrete	C-18	m3	0.9	497,834	209,673	448,051	188,706	636,757	
	2) Form		m2	10	29,686	0	296,858	0	296,858	
	3) Bar		ton	0.09	2,791,000	4,639,000	251,190	417,510	668,700	
	4) Base gravel		m3	0.3	71,736	36,183	21,521	10,855	32,376	
	5) Miscellaneous work		%	10			101,762	61,707	163,469	
	Sub-Total 3.						6,344,908	3,305,424	9,650,332	
	Total 1+2+3						932,978,576	221,104,234	1,154,082,810	

k Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.4mx0.4m	m	2000	269,055	59,993	538,110,020	119,986,000	658,096,020	
	2) Miscellaneous work		%	10			53,811,002	11,998,600	65,809,602	
	Sub-Total 2.						591,921,022	131,984,600	723,905,622	
2.	Pit installation for canal		nos	40						
	Concrete work									
	1) Concrete	C-18	m3	23.76	497,834	209,673	11,828,547	4,981,830	16,810,377	
	2) Form		m2	230.4	29,686	0	6,839,599	0	6,839,599	
	3) Bar		ton	1.424	2,791,000	4,639,000	3,974,384	6,605,936	10,580,320	
	4) Base gravel		m3	11.76	71,736	36,183	843,613	425,512	1,269,125	
	5) Miscellaneous work		%	10			2,348,614	1,201,328	3,549,942	
	Sub-Total 2.						25,834,757	13,214,606	39,049,364	
3.	Siphon installation									
	Earth work									
	1) Excavation	by man-power	m3	6	18,720	0	112,320	0	112,320	
	2) Bachfilling	by man-power	m3	6	11,040	0	66,240	0	66,240	
	Plumbing work									
	1) PVC pipe	Dia 100mm×2	m	60.2	11,226	36,360	675,805	2,188,872	2,864,677	
	2) Hoot valve	Dia 100mm×2	nos	2	706,000	0	1,412,000	0	1,412,000	
	3) Stop valve	Dia 100mm×2	nos	2	1,059,000	0	2,118,000	0	2,118,000	
	4) Miscellaneous work		%	20			841,161	437,774	1,278,935	
	Valve pit construction									
	1) Concrete	C-18	m3	0.9	497,834	209,673	448,051	188,706	636,757	
	2) Form		m2	10	29,686	0	296,858	0	296,858	
	3) Bar		ton	0.09	2,791,000	4,639,000	251,190	417,510	668,700	
	4) Base gravel		m3	0.3	71,736	36,183	21,521	10,855	32,376	
	5) Miscellaneous work		%	10			101,762	61,707	163,469	
	Sub-Total 3.						6,344,908	3,305,424	9,650,332	
	Total 1+2+3						624,100,687	148,504,630	772,605,317	

1. Sheme Lifwambora Irrigation Scheme
 2. District Chibombo
 3. Province Central

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.4mx0.4m	m	1650	269,055	59,993	443,940,767	98,988,450	542,929,217	
	2) Miscellaneous work		%	10			44,394,077	9,898,845	54,292,922	
	Sub-Total 2.						488,334,843	108,887,295	597,222,138	
2.	Pit installation for canal		nos	33						
	Concrete work									
	1) Concrete	C-18	m3	19.602	497,834	209,673	9,758,551	4,110,010	13,868,561	
	2) Form		m2	190.08	29,686	0	5,642,669	0	5,642,669	
	3) Bar		ton	1.1748	2,791,000	4,639,000	3,278,867	5,449,897	8,728,764	
	4) Base gravel		m3	9.702	71,736	36,183	695,981	351,047	1,047,028	
	5) Miscellaneous work		%	10			1,937,607	991,095	2,928,702	
	Sub-Total 2.						21,313,675	10,902,050	32,215,725	
3.	Siphon installation									
	Earth work									
	1) Excavation	by man-power	m3	6	18,720	0	112,320	0	112,320	
	2) Bachfilling	by man-power	m3	6	11,040	0	66,240	0	66,240	
	Plumbing work									
	1) PVC pipe	Dia 100mm×2	m	60.2	11,226	36,360	675,805	2,188,872	2,864,677	
	2) Hoot valve	Dia 100mm×2	nos	2	706,000	0	1,412,000	0	1,412,000	
	3) Stop valve	Dia 100mm×2	nos	2	1,059,000	0	2,118,000	0	2,118,000	
	4) Miscellaneous work		%	20			841,161	437,774	1,278,935	
	Valve pit construction									
	1) Concrete	C-18	m3	0.9	497,834	209,673	448,051	188,706	636,757	
	2) Form		m2	10	29,686	0	296,858	0	296,858	
	3) Bar		ton	0.09	2,791,000	4,639,000	251,190	417,510	668,700	
	4) Base gravel		m3	0.3	71,736	36,183	21,521	10,855	32,376	
	5) Miscellaneous work		%	10			101,762	61,707	163,469	
	Sub-Total 3.						6,344,908	3,305,424	9,650,332	
	Total 1+2+3						515,993,425	123,094,769	639,088,195	

1. Sheme Munga Irrigation Scheme
 2. District Chibombo
 3. Province Central

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.4mx0.4m	m	3000	269,055	59,993	807,165,030	179,979,000	987,144,030	
	2) Miscellaneous work		%	10			80,716,503	17,997,900	98,714,403	
	Sub-Total 2.						887,881,533	197,976,900	1,085,858,433	
2.	Pit installation for canal		nos	60						
	Concrete work									
	1) Concrete	C-18	m3	35.64	497,834	209,673	17,742,820	7,472,746	25,215,566	
	2) Form		m2	345.6	29,686	0	10,259,399	0	10,259,399	
	3) Bar		ton	2.136	2,791,000	4,639,000	5,961,576	9,908,904	15,870,480	
	4) Base gravel		m3	17.64	71,736	36,183	1,265,420	638,268	1,903,688	
	5) Miscellaneous work		%	10			3,522,921	1,801,992	5,324,913	
	Sub-Total 2.						38,752,136	19,821,910	58,574,045	
3.	Siphon installation									
	Earth work									
	1) Excavation	by man-power	m3	6	18,720	0	112,320	0	112,320	
	2) Bachfilling	by man-power	m3	6	11,040	0	66,240	0	66,240	
	Plumbing work									
	1) PVC pipe	Dia 100mm×2	m	60.2	11,226	36,360	675,805	2,188,872	2,864,677	
	2) Hoot valve	Dia 100mm×2	nos	2	706,000	0	1,412,000	0	1,412,000	
	3) Stop valve	Dia 100mm×2	nos	2	1,059,000	0	2,118,000	0	2,118,000	
	4) Miscellaneous work		%	20			841,161	437,774	1,278,935	
	Valve pit construction									
	1) Concrete	C-18	m3	0.9	497,834	209,673	448,051	188,706	636,757	
	2) Form		m2	10	29,686	0	296,858	0	296,858	
	3) Bar		ton	0.09	2,791,000	4,639,000	251,190	417,510	668,700	
	4) Base gravel		m3	0.3	71,736	36,183	21,521	10,855	32,376	
	5) Miscellaneous work		%	10			101,762	61,707	163,469	
	Sub-Total 3.						6,344,908	3,305,424	9,650,332	
	Total 1+2+3						932,978,576	221,104,234	1,154,082,810	

1. Scheme Nakempa Irrigation Scheme
 2. District Choma
 3. Province Southern

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.4mx0.4m	m	1500	269,055	59,993	403,582,515	89,989,500	493,572,015	
	2) Miscellaneous work		%	10			40,358,252	8,998,950	49,357,202	
	Sub-Total 1.						443,940,767	98,988,450	542,929,217	
2.	Pit installation for canal		nos	30						
	Concrete work									
	1) Concrete	C-18	m3	17.82	497,834	209,673	8,871,410	3,736,373	12,607,783	
	2) Form		m2	172.8	29,686	0	5,129,699	0	5,129,699	
	3) Bar		ton	1.068	2,791,000	4,639,000	2,980,788	4,954,452	7,935,240	
	4) Base gravel		m3	8.82	71,736	36,183	632,710	319,134	951,844	
	5) Miscellaneous work		%	10			1,761,461	900,996	2,662,457	
	Sub-Total 2.						19,376,068	9,910,955	29,287,023	
3.	Siphon installation									
	Earth work									
	1) Excavation	by man-power	m3	6	18,720	0	112,320	0	112,320	
	2) Bachfilling	by man-power	m3	6	11,040	0	66,240	0	66,240	
	Plumbing work									
	1) PVC pipe	Dia 100mm×2	m	60.2	11,226	36,360	675,805	2,188,872	2,864,677	
	2) Hoot valve	Dia 100mm×2	nos	2	706,000	0	1,412,000	0	1,412,000	
	3) Stop valve	Dia 100mm×2	nos	2	1,059,000	0	2,118,000	0	2,118,000	
	4) Miscellaneous work		%	20			841,161	437,774	1,278,935	
	Valve pit construction									
	1) Concrete	C-18	m3	0.9	497,834	209,673	448,051	188,706	636,757	
	2) Form		m2	10	29,686	0	296,858	0	296,858	
	3) Bar		ton	0.09	2,791,000	4,639,000	251,190	417,510	668,700	
	4) Base gravel		m3	0.3	71,736	36,183	21,521	10,855	32,376	
	5) Miscellaneous work		%	10			101,762	61,707	163,469	
	Sub-Total 3.						6,344,908	3,305,424	9,650,332	
	Total 1+2+3						469,661,742	112,204,829	581,866,571	

1. Scheme Siakasipa Irrigation Scheme
 2. District Kazungula
 3. Province Southern

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Canal construction									
	1) Canal (Brick)	0.4mx0.4m	m	2500	269,055	59,993	672,637,525	149,982,500	822,620,025	
	2) Miscellaneous work		%	10			67,263,753	14,998,250	82,262,003	
	Sub-Total 2.						739,901,278	164,980,750	904,882,028	
2.	Pit installation for canal		nos	50						
	Concrete work									
	1) Concrete	C-18	m3	29.7	497,834	209,673	14,785,683	6,227,288	21,012,972	
	2) Form		m2	288	29,686	0	8,549,499	0	8,549,499	
	3) Bar		ton	1.78	2,791,000	4,639,000	4,967,980	8,257,420	13,225,400	
	4) Base gravel		m3	14.7	71,736	36,183	1,054,516	531,890	1,586,406	
	5) Miscellaneous work		%	10			2,935,768	1,501,660	4,437,428	
	Sub-Total 2.						32,293,446	16,518,258	48,811,704	
3.	Siphon installation									
	Earth work									
	1) Excavation	by man-power	m3	6	18,720	0	112,320	0	112,320	
	2) Bachfilling	by man-power	m3	6	11,040	0	66,240	0	66,240	
	Plumbing work									
	1) PVC pipe	Dia 100mm×2	m	60.2	11,226	36,360	675,805	2,188,872	2,864,677	
	2) Hoot valve	Dia 100mm×2	nos	2	706,000	0	1,412,000	0	1,412,000	
	3) Stop valve	Dia 100mm×2	nos	2	1,059,000	0	2,118,000	0	2,118,000	
	4) Miscellaneous work		%	20			841,161	437,774	1,278,935	
	Valve pit construction									
	1) Concrete	C-18	m3	0.9	497,834	209,673	448,051	188,706	636,757	
	2) Form		m2	10	29,686	0	296,858	0	296,858	
	3) Bar		ton	0.09	2,791,000	4,639,000	251,190	417,510	668,700	
	4) Base gravel		m3	0.3	71,736	36,183	21,521	10,855	32,376	
	5) Miscellaneous work		%	10			101,762	61,707	163,469	
	Sub-Total 3.						6,344,908	3,305,424	9,650,332	
	Total 1+2+3						778,539,631	184,804,432	963,344,064	

Table T3.3.4 Direct Cost of the Dam Rehabilitation Works

Direct Cost (Dam Rehabilitation)

1. Scheme Katuba Irrigation Scheme
2. District Chibombo
3. Province Central

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks	
					Local	Foreign	Local	Foreign	Total		
1.	Spillway rehabilitation (Side wall protection)										
	Earth work										
	1) Excavation	by man-power	m3	485	18,720	0	9,079,200	0	9,079,200		
	Masonry work										
	1) Masonry	Wet masonry	m3	1881	403,484	41,650	758,952,464	78,343,650	837,296,114		
	2) Miscellaneous work		%	10			75,895,246	7,834,365	83,729,611		
	Sub-Total 1.							843,926,910	86,178,015	930,104,925	
2.	Rivetment of spillway canal										
	Earth work										
	1) Excavation	by man-power	m3	230	18,720	0	4,305,600	0	4,305,600		
	Gabion work										
	1) Gabion installation		m3	180	85,894	122,168	15,460,932	21,990,300	37,451,232		
	2) Miscellaneous work		%	10			1,546,093	2,199,030	3,745,123		
	Sub-Total 2.							21,312,625	24,189,330	45,501,955	
Total 1+2+3							865,239,535	110,367,345	975,606,880		

1. Scheme Mulila Kazembe Irrigation Scheme
2. District Kapri Mposhi
3. Province Central

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks	
					Local	Foreign	Local	Foreign	Total		
1.	Spillway rehabilitation (Side wall protection)										
	Earth work										
	1) Excavation	by man-power	m3	170	18,720	0	3,182,400	0	3,182,400		
	Masonry work										
	1) Masonry	Wet masonry	m3	660	403,484	41,650	266,299,110	27,489,000	293,788,110		
	2) Miscellaneous work		%	10			26,629,911	2,748,900	29,378,811		
	Sub-Total 1.							296,111,421	30,237,900	326,349,321	
2.	Rivetment of spillway canal										
	Earth work										
	1) Excavation	by man-power	m3	92	18,720	0	1,722,240	0	1,722,240		
	Gabion work										
	1) Gabion installation		m3	72	85,894	122,168	6,184,373	8,796,120	14,980,493		
	2) Miscellaneous work		%	10			618,437	879,612	1,498,049		
	Sub-Total 2.							8,525,050	9,675,732	18,200,782	
3.	Installation of overflow crest										
	Earth work										
	1) Excavation	by man-power	m3	1056	18,720	0	19,768,320	0	19,768,320		
	Concrete work										
	1) Concrete		m3	44	497,834	209,673	21,904,716	9,225,612	31,130,328		
	2) Form		m2	79	29,686	0	2,345,175	0	2,345,175		
	3) Bar		ton	2.2	2,791,000	4,639,000	6,140,200	10,205,800	16,346,000		
	Gabion work										
	1) Gabion		m3	36	85,894	122,168	3,092,186	4,398,060	7,490,246		
	Sub-Total 3.							53,250,598	23,829,472	77,080,070	
Total 1+2+3							357,887,069	63,743,104	421,630,173		

1. Sheme Shantumbu Irrigation Scheme
 2. District Kapri Mposhi
 3. Province Central

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks	
					Local	Foreign	Local	Foreign	Total		
1.	Spillway rehabilitation (Side wall protection)										
	Earth work										
	1) Excavation	by man-power	m3	128	18,720	0	2,396,160	0	2,396,160		
	Masonry work										
	1) Masonry	Wet masonry	m3	496	403,484	41,650	200,127,816	20,658,400	220,786,216		
	2) Miscellaneous work		%	10			20,012,782	2,065,840	22,078,622		
	Sub-Total 1.							222,536,758	22,724,240	245,260,998	
2.	Revetment of spillway canal										
	Earth work										
	1) Excavation	by man-power	m3	92	18,720	0	1,722,240	0	1,722,240		
	Gabion work										
	1) Gabion installation		m3	72	85,894	122,168	6,184,373	8,796,120	14,980,493		
	2) Miscellaneous work		%	10			618,437	879,612	1,498,049		
	Sub-Total 2.							8,525,050	9,675,732	18,200,782	
3.	Installation of overflow crest										
	Earth work										
	1) Excavation	by man-power	m3	1056	18,720	0	19,768,320	0	19,768,320		
	Concrete work										
	1) Concrete		m3	44	497,834	209,673	21,904,716	9,225,612	31,130,328		
	2) Form		m2	79	29,686	0	2,345,175	0	2,345,175		
	3) Bar		ton	2.2	2,791,000	4,639,000	6,140,200	10,205,800	16,346,000		
	Gabion work										
	1) Gabion		m3	36	85,894	122,168	3,092,186	4,398,060	7,490,246		
	Sub-Total 3.							53,250,598	23,829,472	77,080,070	
	Total 1+2+3							284,312,405	56,229,444	340,541,849	

1. Sheme Chipapa Irrigation Scheme
 2. District Kafue
 3. Province Lusaka

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks	
					Local	Foreign	Local	Foreign	Total		
1.	Spillway rehabilitation (Side wall protection)										
	Earth work										
	1) Excavation	by man-power	m3	98	18,720	0	1,834,560	0	1,834,560		
	Masonry work										
	1) Masonry	Wet masonry	m3	270	403,484	41,650	108,940,545	11,245,500	120,186,045		
	2) Miscellaneous work		%	10			10,894,055	1,124,550	12,018,605		
	Sub-Total 1.							121,669,160	12,370,050	134,039,210	
2.	Revetment of spillway canal										
	Earth work										
	1) Excavation	by man-power	m3	92	18,720	0	1,722,240	0	1,722,240		
	Gabion work										
	1) Gabion installation		m3	72	85,894	122,168	6,184,373	8,796,120	14,980,493		
	2) Miscellaneous work		%	10			618,437	879,612	1,498,049		
	Sub-Total 2.							8,525,050	9,675,732	18,200,782	
3.	Consolidation dam construction										
	Earth work										
	1) Excavation (Wall)	by man-power	m3	260	18,720	0	4,867,200	0	4,867,200		
	2) Excavation (Bed protection)	by man-power	m3	360	18,720	0	6,739,200	0	6,739,200		
	Masonry work										
	1) Masonry wall		m3	720	403,484	41,650	290,508,120	29,988,000	320,496,120		
	2) Gabion		m3	360	85,894	122,168	30,921,864	43,980,600	74,902,464		
	Sub-Total 3.							333,036,384	73,968,600	407,004,984	
4.	Valve installation										
	1) Main valve		no	1	0	10,000,000	0	10,000,000	10,000,000		
	2) Sub-valve		no	1	0	10,000,000	0	10,000,000	10,000,000		
	Valve pit										
	1) Concrete	C-18	m3	3	497,834	209,673	1,493,503	629,019	2,122,522		
	2) Form		m2	19	29,686	0	564,029	0	564,029		
	3) Bar		ton	0.3	2,791,000	4,639,000	837,300	1,391,700	2,229,000		
	4) Base gravel		m3	1	71,736	36,183	71,736	36,183	107,919		
	5) Miscellaneous work		%	10			296,657	205,690	502,347		
	Sub-Total 4.							3,263,225	22,262,592	25,525,818	
	Total 1+2+3							466,493,819	118,276,974	584,770,793	

1. Sheme Kanundwa Irrigation Scheme
 2. District Monze
 3. Province Southern

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Spillway rehabilitation (Side wall protection)									
	Earth work									
	1) Excavation	by man-power	m3	260	18,720	0	4,867,200	0	4,867,200	
	Masonry work									
	1) Masonry	Wet masonry	m3	720	403,484	41,650	290,508,120	29,988,000	320,496,120	
	2) Miscellaneous work		%	10			29,050,812	2,998,800	32,049,612	
	Sub-Total 1.						324,426,132	32,986,800	357,412,932	
2.	Rivetment of spillway canal									
	Earth work									
	1) Excavation	by man-power	m3	328	18,720	0	6,140,160	0	6,140,160	
	Gabion work									
	1) Gabion installation		m3	258	85,894	122,168	22,160,669	31,519,430	53,680,099	
	2) Miscellaneous work		%	10			2,216,067	3,151,943	5,368,010	
	Sub-Total 2.						30,516,896	34,671,373	65,188,269	
3.	Installation of overflow crest									
	Earth work									
	1) Excavation	by man-power	m3	2640	18,720	0	49,420,800	0	49,420,800	
	Concrete work									
	1) Concrete		m3	110	497,834	209,673	54,761,791	23,064,030	77,825,821	
	2) Form		m2	198	29,686	0	5,877,780	0	5,877,780	
	3) Bar		ton	5.5	2,791,000	4,639,000	15,350,500	25,514,500	40,865,000	
	Gabion work									
	1) Gabion		m3	90	85,894	122,168	7,730,466	10,995,150	18,725,616	
	Sub-Total 3.						133,141,337	59,573,680	192,715,017	
	Total 1+2+3						488,084,365	127,231,853	615,316,218	

1. Sheme Sifwa-kweda Irrigation Scheme
 2. District Choma
 3. Province Southern

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Spillway rehabilitation (Side wall protection)									
	Earth work									
	1) Excavation	by man-power	m3	204	18,720	0	3,818,880	0	3,818,880	
	Masonry work									
	1) Masonry	Wet masonry	m3	792	403,484	41,650	319,558,932	32,986,800	352,545,732	
	2) Miscellaneous work		%	10			31,955,893	3,298,680	35,254,573	
	Sub-Total 1.						355,333,705	36,285,480	391,619,185	
2.	Rivetment of spillway canal									
	Earth work									
	1) Excavation	by man-power	m3	106	18,720	0	1,984,320	0	1,984,320	
	Gabion work									
	1) Gabion installation		m3	82	85,894	122,168	7,043,313	10,017,803	17,061,117	
	2) Miscellaneous work		%	10			704,331	1,001,780	1,706,112	
	Sub-Total 2.						9,731,965	11,019,584	20,751,548	
	Total 1+2+3						365,065,670	47,305,064	412,370,734	

1. Scheme Nkandabwe Irrigation Scheme
 2. District Sinazongwe
 3. Province Southern

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Concrete work									
	1) Concrete	C-18	m3	292	497,834	209,673	145,367,662	61,224,516	206,592,178	
	2) Form		m2	349	29,686	0	10,360,330	0	10,360,330	
	3) Bar		ton	14.6	2,791,000	4,639,000	40,748,600	67,729,400	108,478,000	
	4) Base gravel		m3	0	71,736	36,183	0	0	0	
	5) Miscellaneous work		%	10			19,647,659	12,895,392	32,543,051	
	6) Main valve		no	1	0	10,000,000	0	10,000,000	10,000,000	
	7) Sub-valve		no	1	0	10,000,000	0	10,000,000	10,000,000	
	Sub-Total 1.						216,124,252	161,849,308	377,973,559	
2.	Earth work									
	Excavation	by man-power	m3	280	18,720	0	5,241,600	0	5,241,600	
	Sub-Total 2.						5,241,600	0	5,241,600	
3.	Gabion									
	1) Gabion installation		m3	36	85,894	122,168	3,092,186	4,398,060	7,490,246	
	2) Miscellaneous work		%	10			309,219	439,806	749,025	
	Sub-Total 3.						3,401,405	4,837,866	8,239,271	
	Total 1+2+3						224,767,257	166,687,174	391,454,430	

1. Scheme Mulabalaba Irrigation Scheme
 2. District Kazungula
 3. Province Southern

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks
					Local	Foreign	Local	Foreign	Total	
1.	Spillway rehabilitation (Side wall protection)									
	Earth work									
	1) Excavation	by man-power	m3	94	18,720	0	1,759,680	0	1,759,680	
	Masonry work									
	1) Masonry	Wet masonry	m3	363	403,484	41,650	146,464,511	15,118,950	161,583,461	
	2) Miscellaneous work		%	10			14,646,451	1,511,895	16,158,346	
	Sub-Total 1.						162,870,642	16,630,845	179,501,487	
2.	Rivetment of spillway canal									
	Earth work									
	1) Excavation	by man-power	m3	105	18,720	0	1,965,600	0	1,965,600	
	Gabion work									
	1) Gabion installation		m3	83	85,894	122,168	7,129,208	10,139,972	17,269,179	
	2) Miscellaneous work		%	10			712,921	1,013,997	1,726,918	
	Sub-Total 2.						9,807,728	11,153,969	20,961,697	
	Total 1+2+3						172,678,370	27,784,814	200,463,184	

1. Sheme Kasamba Irrigation Scheme
 2. District Kapiri Mposhi
 3. Province Central

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks	
					Local	Foreign	Local	Foreign	Total		
1.	Spillway rehabilitation (Side wall protection)										
	Earth work										
	1) Excavation	by man-power	m3	136	18,720	0	2,545,920	0	2,545,920		
	Masonry work										
	1) Masonry	Wet masonry	m3	528	403,484	41,650	213,039,288	21,991,200	235,030,488		
	2) Miscellaneous work		%	10			21,303,929	2,199,120	23,503,049		
	Sub-Total 1.							236,889,137	24,190,320	261,079,457	
2.	Revetment of spillway canal										
	Earth work										
	1) Excavation	by man-power	m3	98	18,720	0	1,834,560	0	1,834,560		
	Gabion work										
	1) Gabion installation		m3	77	85,894	122,168	6,613,843	9,406,962	16,020,805		
	2) Miscellaneous work		%	10			661,384	940,696	1,602,080		
	Sub-Total 2.							9,109,787	10,347,658	19,457,445	
3.	Installation of overflow crest										
	Earth work										
	1) Excavation	by man-power	m3	1584	18,720	0	29,652,480	0	29,652,480		
	Concrete work										
	1) Concrete		m3	66	497,834	209,673	32,857,074	13,838,418	46,695,492		
	2) Form		m2	119	29,686	0	3,532,605	0	3,532,605		
	3) Bar		ton	3.3	2,791,000	4,639,000	9,210,300	15,308,700	24,519,000		
	Gabion work										
	1) Gabion		m3	54	85,894	122,168	4,638,280	6,597,090	11,235,370		
	Sub-Total 3.							79,890,739	35,744,208	115,634,947	
	Total 1+2							245,998,924	34,537,978	280,536,902	

1. Sheme Juda Irrigation Scheme
 2. District Kapiri Mposhi
 3. Province Central

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks	
					Local	Foreign	Local	Foreign	Total		
1.	Spillway rehabilitation (Side wall protection)										
	Earth work										
	1) Excavation	by man-power	m3	136	18,720	0	2,545,920	0	2,545,920		
	Masonry work										
	1) Masonry	Wet masonry	m3	528	403,484	41,650	213,039,288	21,991,200	235,030,488		
	2) Miscellaneous work		%	10			21,303,929	2,199,120	23,503,049		
	Sub-Total 1.							236,889,137	24,190,320	261,079,457	
2.	Revetment of spillway canal										
	Earth work										
	1) Excavation	by man-power	m3	98	18,720	0	1,834,560	0	1,834,560		
	Gabion work										
	1) Gabion installation		m3	77	85,894	122,168	6,613,843	9,406,962	16,020,805		
	2) Miscellaneous work		%	10			661,384	940,696	1,602,080		
	Sub-Total 2.							9,109,787	10,347,658	19,457,445	
3.	Installation of overflow crest										
	Earth work										
	1) Excavation	by man-power	m3	1584	18,720	0	29,652,480	0	29,652,480		
	Concrete work										
	1) Concrete		m3	66	497,834	209,673	32,857,074	13,838,418	46,695,492		
	2) Form		m2	119	29,686	0	3,532,605	0	3,532,605		
	3) Bar		ton	3.3	2,791,000	4,639,000	9,210,300	15,308,700	24,519,000		
	Gabion work										
	1) Gabion		m3	54	85,894	122,168	4,638,280	6,597,090	11,235,370		
	Sub-Total 3.							79,890,739	35,744,208	115,634,947	
	Total 1+2+3							245,998,924	34,537,978	280,536,902	

1. Scheme Lifwambora Irrigation Scheme
 2. District Kapiri Mposhi
 3. Province Central

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks	
					Local	Foreign	Local	Foreign	Total		
1.	Spillway rehabilitation (Side wall protection)										
	Earth work										
	1) Excavation	by man-power	m3	136	18,720	0	2,545,920	0	2,545,920		
	Masonry work										
	1) Masonry	Wet masonry	m3	528	403,484	41,650	213,039,288	21,991,200	235,030,488		
	2) Miscellaneous work		%	10			21,303,929	2,199,120	23,503,049		
	Sub-Total 1.							236,889,137	24,190,320	261,079,457	
2.	Rivetment of spillway canal										
	Earth work										
	1) Excavation	by man-power	m3	98	18,720	0	1,834,560	0	1,834,560		
	Gabion work										
	1) Gabion installation		m3	77	85,894	122,168	6,613,843	9,406,962	16,020,805		
	2) Miscellaneous work		%	10			661,384	940,696	1,602,080		
	Sub-Total 2.							9,109,787	10,347,658	19,457,445	
3.	Installation of overflow crest										
	Earth work										
	1) Excavation	by man-power	m3	1584	18,720	0	29,652,480	0	29,652,480		
	Concrete work										
	1) Concrete		m3	66	497,834	209,673	32,857,074	13,838,418	46,695,492		
	2) Form		m2	119	29,686	0	3,532,605	0	3,532,605		
	3) Bar		ton	3.3	2,791,000	4,639,000	9,210,300	15,308,700	24,519,000		
	Gabion work										
	1) Gabion		m3	54	85,894	122,168	4,638,280	6,597,090	11,235,370		
	Sub-Total 3.							79,890,739	35,744,208	115,634,947	
	Total 1+2+3							325,889,664	70,282,186	396,171,849	

1. Scheme Munga Irrigation Scheme
 2. District Chibombo
 3. Province Central

Work Categ	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks	
					Local	Foreign	Local	Foreign	Total		
1.	Spillway rehabilitation (Side wall protection)										
	Earth work										
	1) Excavation	by man-power	m3	170	18,720	0	3,182,400	0	3,182,400		
	Masonry work										
	1) Masonry	Wet masonry	m3	660	403,484	41,650	266,299,110	27,489,000	293,788,110		
	2) Miscellaneous work		%	10			26,629,911	2,748,900	29,378,811		
	Sub-Total 1.							296,111,421	30,237,900	326,349,321	
2.	Rivetment of spillway canal										
	Earth work										
	1) Excavation	by man-power	m3	98	18,720	0	1,834,560	0	1,834,560		
	Gabion work										
	1) Gabion installation		m3	77	85,894	122,168	6,613,843	9,406,962	16,020,805		
	2) Miscellaneous work		%	10			661,384	940,696	1,602,080		
	Sub-Total 2.							9,109,787	10,347,658	19,457,445	
3.	Installation of overflow crest										
	Earth work										
	1) Excavation	by man-power	m3	1584	18,720	0	29,652,480	0	29,652,480		
	Concrete work										
	1) Concrete		m3	66	497,834	209,673	32,857,074	13,838,418	46,695,492		
	2) Form		m2	119	29,686	0	3,532,605	0	3,532,605		
	3) Bar		ton	3.3	2,791,000	4,639,000	9,210,300	15,308,700	24,519,000		
	Gabion work										
	1) Gabion		m3	54	85,894	122,168	4,638,280	6,597,090	11,235,370		
	Sub-Total 3.							79,890,739	35,744,208	115,634,947	
	Total 1+2+3							305,221,208	40,585,558	345,806,766	

1. Sheme Nakempa Irrigation Scheme
 2. District Choma
 3. Province Southern

Work Cate	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks	
					Local	Foreign	Local	Foreign	Total		
1.	Spillway rehabilitation (Side wall protection)										
	Earth work										
	1) Excavation	by man-power	m3	128	18,720	0	2,396,160	0	2,396,160		
	Masonry work										
	1) Masonry	Wet masonry	m3	446	403,484	41,650	179,953,641	18,575,900	198,529,541		
	2) Miscellaneous work		%	10			17,995,364	1,857,590	19,852,954		
	Sub-Total 1.							200,345,165	20,433,490	220,778,655	
2.	Rivetment of spillway canal										
	Earth work										
	1) Excavation	by man-power	m3	66	18,720	0	1,235,520	0	1,235,520		
	Gabion work										
	1) Gabion installation		m3	52	85,894	122,168	4,466,491	6,352,753	10,819,245		
	2) Miscellaneous work		%	10			446,649	635,275	1,081,924		
	Sub-Total 2.							6,148,661	6,988,029	13,136,689	
3.	Installation of overflow crest										
	Earth work										
	1) Excavation	by man-power	m3	1056	18,720	0	19,768,320	0	19,768,320		
	Concrete work										
	1) Concrete		m3	44	497,834	209,673	21,904,716	9,225,612	31,130,328		
	2) Form		m2	79	29,686	0	2,345,175	0	2,345,175		
	3) Bar		ton	2.2	2,791,000	4,639,000	6,140,200	10,205,800	16,346,000		
	Gabion work										
	1) Gabion		m3	36	85,894	122,168	3,092,186	4,398,060	7,490,246		
	Sub-Total 3.							53,250,598	23,829,472	77,080,070	
	Total 1+2+3							259,744,423	51,250,991	310,995,414	

1. Sheme Siakasipa Irrigation Scheme
 2. District Kazungula
 3. Province Southern

Work Cate	Item	Specification	Unit	Qty	Unit cost (ZMK)		Cost (ZMK)			Remarks	
					Local	Foreign	Local	Foreign	Total		
1.	Spillway rehabilitation (Side wall protection)										
	Earth work										
	1) Excavation	by man-power	m3	115	18,720	0	2,152,800	0	2,152,800		
	Masonry work										
	1) Masonry	Wet masonry	m3	446	403,484	41,650	179,953,641	18,575,900	198,529,541		
	2) Miscellaneous work		%	10			17,995,364	1,857,590	19,852,954		
	Sub-Total 1.							200,101,805	20,433,490	220,535,295	
2.	Rivetment of spillway canal										
	Earth work										
	1) Excavation	by man-power	m3	66	18,720	0	1,235,520	0	1,235,520		
	Gabion work										
	1) Gabion installation		m3	52	85,894	122,168	4,466,491	6,352,753	10,819,245		
	2) Miscellaneous work		%	10			446,649	635,275	1,081,924		
	Sub-Total 2.							6,148,661	6,988,029	13,136,689	
3.	Installation of overflow crest										
	Earth work										
	1) Excavation	by man-power	m3	1056	18,720	0	19,768,320	0	19,768,320		
	Concrete work										
	1) Concrete		m3	44	497,834	209,673	21,904,716	9,225,612	31,130,328		
	2) Form		m2	79	29,686	0	2,345,175	0	2,345,175		
	3) Bar		ton	2.2	2,791,000	4,639,000	6,140,200	10,205,800	16,346,000		
	Gabion work										
	1) Gabion		m3	36	85,894	122,168	3,092,186	4,398,060	7,490,246		
	Sub-Total 3.							53,250,598	23,829,472	77,080,070	
	Total 1+2+3							259,501,063	51,250,991	310,752,054	

Annex E

Rural Society and Farmers' Organization

The Master Plan for Promotion of Irrigated Agriculture for Smallholders
in the Peri-Urban Areas in the Republic of Zambia
Final Report
Annex E. Rural Society and Farmers’ Organization

Table of Contents

	page
Annex E. Rural Society and Farmers’ Organization	
E.1 Other Collected Information from PRA Workshop.....	E-1
E.2 Community Laws for WUA; the Case of Mulabalaba Irrigation Scheme.....	E-7
E.3 Report on the Implementation Plan Formulation Meeting for the Action Plan for the Model Sites in Kalulushi, Kabwe, Lusaka and Kazungula Districts	E-11
E.3.1 Bwafwano Action Site in Kalulushi District	E-11
E.3.2 Natuseko Action Site in Kabwe District.....	E-15
E.3.3 Chipapa Action Site in Kafue District.....	E-22
E.3.4 Mulabalaba Action Site in Kazungula District.....	E-29

Acknowledgment: “The Report on the Implementation Plan Formulation Meeting for the Action Plan for the Model Sites in Kalulushi, Kabwe, Lusaka and Kazungula Districts” was prepared and submitted by Richard K. Mfula to the JICA Study Team in January 2011. Richard Mfula (moderator) and Chiselwa Chayi (assistant moderator) are greatly acknowledged for their contribution in the Action Plan Meetings (preliminarily hold) and the post, main discussion-meetings as the Action Plan Work -Shops over 4 Action Plan model sites in Kalulushi, Kabwe, Kafue and Kazungula Destricts. .

E.1 Other Collected Information from PRA Workshop

During the first field survey, a series of PRA workshops was conducted in order to clarify characteristics of social structure and organization mechanism in rural community. PRA workshop is conducted in four selected irrigation schemes, namely Ipafu, Chunga, Chipapa, and Nkandabwe. The main activities in workshop include 1) History Hiring, 2) Success Story Hiring, 3) Rich and Poor Profiling, and 4) Problem Analysis. In this Appendix, the record of 1) History Hiring, 2) Success Story, and 3) Rich and Poor Profiling of each targeted irrigation scheme will be explained as additional information to examine the situation of rural society and group dynamics of each irrigation scheme.

(1) Chunga Irrigation Scheme

1) History of the scheme

During the PRA workshop, an activity of history hiring was conducted to collect information of history events of Chunga Irrigation Scheme. The following chart is presenting a brief history of the scheme which is made by attendant farmers of the workshop.

Table History Chart of the Chunga Irrigation Scheme

Time Period	Events
Before 1970	The University of Zambia students surveyed the area for suitable construction of the dam. They recommended for the weir construction from Chunga stream. Upon approval of the construction plan, Mr. Simon Zukas, a government officer, supervised the construction
1970	Government of the Republic of Zambia completed the construction of the dam weir and the entire irrigation canal. The First President of Zambia Dr. Kenneth Kaunda officially opened the scheme.
1970 -2002	The farmers continued utilizing the scheme under the supervision of headmen and the chief. Each family that was found in the area was allocated a piece of land in the scheme of 75m x 75m (equivalent to one lima).
1998	The weir got damaged by the floods due to heavy rains in that season
1999-2001	Government using resources from the Rural Investment Fund (RIF) reconstructed the weir which was taken off by the floods in 1998
2002	Farmers formed the Chunga Irrigation Scheme Cooperative with 34 members. These members were those that had plots in the scheme.
2002-2009	The farmers continued utilizing the scheme but with a lot of difficulties due to poor extension services

2) Success story of the scheme

Through conducting interview with farmers on the PRA workshop, the success cases or models defined by attendant farmers under the scheme were collected as below.

- Mrs. Cecilia Moyo, a 52 years old (an age she is not pretty sure of) widow, recalls she went to Chunga, with the husband in 1981, 28 years ago. She adds that she inherited the 0.25ha land within the scheme from the father. She also remembers having a number of cattle and goats which were stolen a few years after she settled there. She has a large family of 23 the majority being orphans from her children who died of HIV/AIDS. She stressed the fact that the greatest thing she has had from the time the father and the husband died was actually the land within Chunga irrigation scheme. She does not even imagine a life without such a possession, land. “My family and I actually feel empowered with the land I have”. In her own words and simply translated to mean: “With the land I have managed to generate my own income which ensures that I send my grandchildren to school and to the hospital when they are sick. In fact I cultivate my own crops

which help improve consumption in my household. With the water around, I do not worry of drought and I cultivate the crops whenever I want". A check on her irrigated plot actually indicated, though at a subsistence level, a number of crops engaged by Mrs. Cecilia Moyo. This also has been necessitated by the fact that the area is well situated in terms of market access and availability. However, in terms of farmer organization, she argues it is difficult to ascertain whether the cooperative is there as there is neither a structure nor leadership to point to. In fact, she doubts her membership and probably this explains why she has trouble to access farm inputs. She laments that she has sadly observed that the scheme is dominated by men. She therefore encourages other women to take charge and occupy such key areas.

- Mr. Andisen Banda has been in the area for a long time and has seen the scheme transformed into what it is now. He also mentions his inadequacy in terms of special training with regards irrigation and crop management. With special interest and observations in what other farmers were doing, Mr. Banda has managed to build well structured irrigation pipe lines from the main canal. Through this Andisen has managed to counter the silting of the main canal. He mentions that him being within Chunga irrigation scheme is a blessing and does not regret whatsoever. He has managed to engage a whole variety of crops which include green maize and vegetables. He mentions his diversification has made him have a steady yet sustained access to income. He also compares what he gets from the up land and the irrigated place and consents to the fact that in terms of income, the irrigated land gives him more access to finances. This is one of the strengths he mentions of being on that plot.

3) Rich and Poor Profiling

Rich and poor profiling was conducted as an activity of the workshop. Participant farmers were asked about definition of characteristics which make rich, medium, and poor and also asked the ratio of those criteria within the community.

Table Rich and Poor Profiling of Chunga Irrigation Scheme

	Characteristic	Ratio in the community
Rich	Have pigs, goats, cattle and dogs, furniture, storage for their produce. TV and cell phones. Plough on time. Wear good cloths.	15%
Medium	Have village chickens, bicycle, cell phones. Keep dogs. Live iron roofed houses.	75%
Poor	Live in poor grass thatched houses. The all family goes begging and piece work. Wear one trouser and shirt. Are mostly drunkards	0%

(2) Chipapa Irrigation Scheme

1) History of the Scheme

During the PRA workshop, an activity of history hiring was conducted to collect information of history events of Chipapa Irrigation Scheme. The following chart is presenting a brief history of the scheme which is made by attendant farmers of the workshop.

Table History Chart of Chipapa Irrigation Scheme

Time Period	Events
1952	Dam is constructed by the Northern Rhodesian Government. Irrigation starts with 10 farmers
1953	First Agriculture Extension Officer is deployed to the Irrigation Scheme. Farmers are taught Modern Farming Techniques.
1957	Farmers purchase a vehicle through contribution of scheme members.
1958	Vehicle breaks down after functioning for one year.
1970	- Mr. Kenneth Kaunda, Zambia's first president, visited the scheme. - Transport is provided by a white farmer named Mr. Temple to ferry farm produce to market (majority of buyers/Soweto market is the major selling place)
1973	Scheme members and Mr. Temple make monetary contributions to purchase a new vehicle. Scheme membership increases due to Transport provision
1982	Dam is blocked by silt and cultivation comes to a halt. Some farmers shun scheme and engage Charcoal burning to earn a living
1989	Dam is desilted by the support from DANIDA.
1997	Dam is desilted again by the support from the Rural Investment Fund.
1990	Fences are built around the scheme by members.
2003	Mr. Mundia Sikatana, Agriculture Minister, visited the scheme for the World Food Day celebration.
2004	Renovating of canals, including extension of these to unreachable farming blocks was conducted. Support Women's capacity building from Women's Irrigation and Nutrition Organization, a local NGO, was provided. Scheme members received seeds (Tomato, Rape, Green Beans, Okra, Maize), and fertilizer from Tele-Food under funding from FAO.

2) Success story of the scheme

Through conducting interview with farmers on PRA workshop, the success cases or models defined by attendant farmers under the scheme were collected as bellow.

- On individual basis, Mr. Enock Kapyanga, a 73 years old scheme member, was cited as successful. What makes Mr. Kapyanga a good model of success is that over 30 years, he has had the highest number of cattle in the community. He has 200 herds of cattle at the moment. Before the on-set of the corridor disease, he had 1,050 herds. He has a radio, TV, solar panel, cell phone, 2 bull carts, bicycle, 4 cattle ploughs, 2 crop sprayers and an iron sheet roof. He produces an average of 200 x 50kg bags of maize every crop season and is able to feed his family three meals every day. The family always has milk from the cows.
- With regard to a case of successful farmers' organization, the participants identified Land O' Lakes as a successful model. Land O' Lakes is a scheme that loans dairy cattle to farmers who in turn sale their milk to the organization. The scheme so far has 12 members with Land O' Lakes who supply milk on a daily basis and are paid every month end. Participant farmers of the programme of Land O' Lakes are seen as organized well.

3) Rich and Poor Profiling

Rich and poor profiling was conducted as an activity of the workshop. Participant farmers were asked about definition of characteristics which make rich, medium, and poor and also asked the ratio of those criteria within the community.

Table Rich and Poor Profiling of Chipapa Irrigation Scheme

	Characteristic	Ratio in the community
Rich	Have many cattle, tractor, goats, poultry, monkey, vehicle, cellular phone	5%
Medium	Have a few livestock, able to buy hybrid seed, fertilizers, pesticides	80%
Poor	A person who cannot buy fertilizer, seed, Grows more than one crop in his/her farm-bed (0.0048 lima piece of land) asks for seed from other well	15%

(3) Ipafu Irrigation Scheme

1) History of the scheme

During the PRA workshop, an activity of history hiring was conducted to collect information of history events of Ipafu Irrigation Scheme. The following chart is presenting a brief history of the scheme which is made by attendant farmers of the workshop.

Table History Chart of Ipafu Irrigation Scheme

Time Period	Events
1968	Graduates from Kalulushi Farm College managed by Mindolo Ecumenical Foundation got settled in the scheme. Farmers started stumping trees and clearing the fields
1968-1970	Small pump was installed on the Ipafu stream
1970	Construction of the reservoir commenced. There was no cooperative at that time
1971	The reservoir was opened and distribution canals started distributing water
1971-1981	Community continued utilizing the irrigation scheme with water pumped using a diesel engine. Also available were a tractor, concrete mixer, grader and two vehicles.
1981	Government withdrew from the providing support to the community. Government asked the community to form a cooperative
1982-83	The Ipafu Multi-purpose Cooperative was formed.
1984	Farmers started failing to buy diesel and members started pulling out of the Cooperative. Mr. Coaster Nkotani, a government worker, left the scheme. Following Nkotani's withdrawal, government collected all machinery from the scheme.
1984-2000	Farmers shifted to the wetlands along Ipafu River to practice farming as individuals not members of the cooperative
1984-85	Lint Company of Zambia (LINTCO) provided farmers with cotton and coffee under rain-fed farming. However, no market for produced coffee was provided
2002	Coffee Board recruited 25 members of the IISMC for the production of coffee under drip irrigation. The Board also installed two electric motor pumps by Ipafu River
2003	Coffee Board signed a three year out-grower contract with the individual farmers and provided them with irrigation equipment (drips). The board also allocated one vehicle to service the community.
2004	Coffee Board provided less inputs and chemicals and eventually withdrew from the deal.
2005	The community harvested their first coffee, the yield was low due to poor fertilization
2006	The community harvested 6 metric tons of coffee which was successfully sold and farmers paid their income. However, the Coffee Board withdrew the vehicle from the scheme.
2007	The third harvest of coffee went down because of poor support. This is the same year when ZESCO cut off power from the pump house due to none payment of 21,000,000 ZMK

2) Success story of the scheme

Through conducting interview with farmers on PRA workshop, the success cases or models defined by attendant farmers under the scheme were collected as bellow.

- Mr. Peter Kamwilo remembers how busy Ipafu was when irrigation was at its full throttle. He argued with the experience he had in the scheme, he managed to become one of the strongest farmers in Ipafu. A polygamous man with two wives and a family closer to 20, he argues he has

managed to feed the family and send the children to school. In fact, he asserts that he has been empowered with land and other assets he has acquired. With the experience, he has managed to diversify into agricultural crops such as maize, cabbages, tomatoes, rape, casaba, beans, ground nuts, and livestock rearing such as goats, pigs, and chickens. He also owns two sizeable fish ponds. He has a small engine pump which he managed to purchase after the down turn of the scheme or when water was not enough from the schemes' main pump. Mr. Kamwilo has managed to diversify and still managed to maintain stable income levels. However, he laments in his solemn voice that the Ipafu irrigation scheme, despite a whole variety machines, is not presently as functional as it used to be.

3) Rich and Poor Profiling

Rich and poor profiling was conducted as an activity of the workshop. Participant farmers were asked about definition of characteristics which make rich, medium, and poor and also asked the ratio of those criteria within the community.

Table Rich and Poor Profiling of Ipafu Irrigation Scheme

	Characteristic	Ratio in the community
Rich	Having land, pigs, cattle, vehicle, hammer mill, iron roofed brick house, water pump, fish ponds, TV and cell phone	10%
Medium	Having wheel barrows, bicycle, radio, goats, chickens, hoes and axes, wells. Eating good food.	90%
Poor	Live in grass thatched houses. The all family does piece work. Wear poor clothes. Borrow hoes. Lack food most parts of the year. Do not have land. There children do not go to school. Fail to join the cooperatives.	0%

(4) Nkandabwe Irrigation Scheme

1) History of the Scheme

During the PRA workshop, an activity of history hiring was conducted to collect information of history events of Nkandabwe Irrigation Scheme. The following chart is presenting a brief history of the scheme which is made by attendant farmers of the workshop.

Table History Chart of Nkandabwe Irrigation Scheme

Time Period	Event
1958	German nationals occupy this area and engage in cultivation of Oranges, Rice, Pineapples, cabbages, etc. Then, local people migrate to this area and find a white farmer named Mr. Becca, who is believed to have constructed the dam and the pipeline that ferries water to the farm block. However, Mr. Becca slips, falls off the dam wall and dies. Eventually, the dam is no longer functional.
Early 1960's	Five local dwellers are taught agriculture skills by the Northern Rhodesian Government. Meanwhile, the base of one coal mine is split open during excavation and water fills the mine. The water-filled mine is seriously considered for use as a dam.
1966	The Germans leave farm block to local people to continue cultivation.
1972	<ul style="list-style-type: none"> - Mr. Peter Wendy, German national, constructs an embankment on the old mine, thereby creating a new dam. The first furrow is belt, as well as the main canal. - This time, there are 43 local farmers in total at the scheme. These are mostly men; women are not given their own plots. - Farmers form a committee. This is the beginning of scheme committee. Headman Mr. Siamugande becomes the first chairperson of the committee. - No constitution is written, but Agreement Forms are used for membership. - Mr. Peter Wendy builds three more canals, and membership fee is introduced. Crops cultivated include Tomato, Beans, Onion and Maize.
1988	Farmers have difficulty irrigating the farm block as water levels fall. Committee convenes a meeting to solve the problem. A weir is made to distribute water to the scheme.

Time Period	Event
1989	A barricade is made to prevent sand from filling up the weir and dam.
1990	Silt collects in the new dam, reducing the water levels. Farmers seek Government intervention, but to no avail. Farmers begin removing silt by hand.
1995	The dam is completely silted; farmers stop cultivating crops, and resort to selling goats and chickens. Some do little gardening along the streams of dambos.
2000	- Annual general meeting is held and a decision not to hold election is made by the scheme, so as to focus only on rehabilitating the silted dam. - The abandoned coal mine is restored to utilize for the dam; furrows are cleaned for irrigation. - Government of Zambia sends block supervisors and other staff. Extension officers were already there.
2006	The Scheme becomes a Cooperative, a bank account is opened with Zambia National Commercial Bank and the committee graduates into a Board (comprising 9 members). The cooperative acquires a Certificate of Registration

2) Success story of the Scheme

Through conducting interview with farmers on PRA workshop, the success cases or models defined by attendant farmers under the scheme were collected as bellow.

- The fact that the almost every one of farmers at the scheme can access fertilizer through the scheme is seen as success enough. This has been made possible by the collecting of membership fee of K30, 000, and share capital at K10, 000 per share (a farmer can access up to a maximum of 10 shares). This money is used by the cooperative to purchase seed, fertilizer, and other necessities for the co-operators. The sustained access to fertilizer has enhanced yield levels and increased production. Thus, with the prevailing high productivity levels, Nkandabwe has the potential to commercialize successfully once farmers have been taught agriculture skill and the repeated emphasis of marketing skills which are imperative in commercial farming.
- Unity among farmers has made Nkanbabwe Cooperative a good model. This is apparent in the incorporation of women in scheme organization structure, whose vice-chairperson is a woman.
- Lessons learnt at the scheme farmer commitment to work, farmers' willingness to learn new farming methods, and savings made of profits made. Savings have enabled farmers to supplement other agro-activities like livestock rearing. Progress by some farmers within the scheme will enable them commercialize soon if they remain committed.

3) Rich and Poor Profiling

Rich and poor profiling was conducted as an activity of the workshop. Participant farmers were asked about definition of characteristics which make rich, medium, and poor and also asked the ratio of those criteria within the community.

Table Rich and Poor Profiling of Nkandabwe Irrigation Scheme

	Characteristic	Ratio in the community
Rich	Owens cattle (about 100), cars, has three meals a day, has roofed house with electricity.	6%
Medium	Owens an average of 10-15 cattle, Goats, Chicken, owns chairs, they do not borrow from fellow farmers, sends children to school, they sleep on proper beds.	60%
Poor	They have less than 3 meals a day, they cannot send their children to school, they cannot buy seed, and they pick remaining grains from other farmers' fields for seed.	34%

E.2 Community Laws for WUA; the Case of Mulabalaba Irrigation Scheme

For the irrigation schemes such as Mulabalaba irrigation scheme in Kazungula District, Chipapa irrigation scheme in Kafue District or other similar areas where communities hold water users' associations (WUA) constitute their own laws (by-laws) for water use. It makes an important rule for operation and management of areal water-use facilities and related properties by beneficiaries, i.e., farmers joining the schemes. Although these by-laws contain some site specific conditions to reflect on, it is critically valuable for the farmers to sustain their facilities as well as for collaborative administration work with the district officers (DACO). The following articles are found in the by-laws for Mulabalaba irrigation scheme and shown as a good example.

(original sentences)

1. Anybody (beneficiary) found nothing in the allocated plot shall have it repossessed after one week from the date of allocation.
2. No person shall be allowed to open the siphoning chamber and water valves except for authorized persons where if found K100,000 shall be charged.
3. Any plot beneficiary should ensure that the canal is kept clean in and out alongside the canal near his or her plot but cleaning together shall be done on parts where there are no plots violation of this by-law the charge shall be K15,000 as warning and repossession later if not adhered to.
4. Nobody shall be to collect garden fencing materials either for firewood or otherwise. Violation of this by-law is K30,000 or as shall be determined by the owner of the garden affected.
5. Nobody shall be allowed defecating, urinating or throwing debris in canal and K100,000 shall be charged to the offender.
6. No person shall be allowed to uproot or remove beacons in the demarcated plots. This charge for the violation of this by law shall be K1,000,000 or be taken to police or court of law.
7. Any beneficiary to the irrigation scheme entitled to only one plot unless a special case shall be given on either rental or temporal basis.
8. No person shall be spared found stealing vegetables in the gardens and if found guilty K200,000 shall be the charge or as would be determined by the owner according to the value of the stolen vegetables.
9. All cases arising from their irrigation scheme shall be reported to the irrigation, dam, cooperative and headmen (disciplinary) committees respectively for local solutions.
10. No person shall spare found-burning along the canal for fear of burning other people's fences and vegetables. Violation of this by-law the charge shall be K50, 000 for each affected plot or as would be determined by the owners.

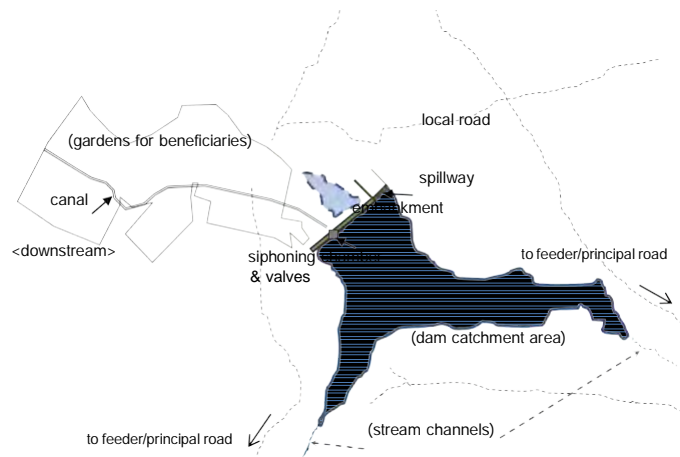


Figure Schematic of the irrigation scheme of Mulabalaba.

11. No person shall be allowed to let water flow in the canal unnecessarily except to where it is directed for fear of flooding other people's plots where it is found the charge shall be K20,000 or would be determined by the owners of the affected plots.
12. All plot beneficiaries shall fence their garden plots properly and according to demarcations using unlike fencing poles along the canal and the charge for the violation of this by-law shall be K25,000 warning and or face repossession if not adhered to.
13. Cattle owners to ensure that animals are kept in safe custody during night and day time. If they are found or seen destroying people's vegetable's payment shall be as demanded by the owner.
14. No cattle or goats shall be allowed to graze or drink water from the embankment downstream. If they are found the owner shall be required to pay K50,000.
15. No person shall be allowed to burn on the embankment or in the dam catchment area where if found K50,000 shall be the charge.
16. Anyone found cutting trees in the dam catchment area shall be charged K50,000.
17. All in direct beneficiaries to the dam shall be paying user fees of K100,000 each on annual basis or as would be determined by the community. Anyone failing to meet the charge shall be chased from using the water in the dam for his animals or for household consumption.
18. Nobody shall be allowed to establish a garden or plough near the dam stream, if found the charge shall be K100,000 or as would be determined by the committee.
19. There shall be no pathways across the embankment. The person found crossing the embankment shall be K10,000.
20. No person shall be allowed to mould bricks near the dam catchment where if found K1,000,000 shall be the charge.
21. The shall be canal maintenance fee of K12,000 to be collected from each plot owner on annual basis but subject to change when need arises.
22. The water at the canal shall be opened on the days specified by the committee and opening time shall be 06:30hrs to 11:00hrs in the morning and 14:30hrs to 18:00 hrs in the afternoon.

All stakeholders; headmen, dam committee, cooperative, irrigation committee sat and put into effect the by-laws outlined above in order to minimize or bring to an end various problems faced by the community on vegetable production and other related problems. These by-laws were agreed and signed by the headmen and other stakeholders on behalf of the community.

And the fixed charges to the above by-laws are subject to change from time to time when need arises.

(end)

E.3 Report on the Implementation Plan Formulation Meeting for the Action Plan for the Model Sites in Kalulushi, Kabwe, Kafue and Kazungula Districts

E.3.1 Meeting for the Action Plan for Bwafwano Action Site

(among Farmers' Representatives, MACO Officials and the JICA Study Team held at Kalulushi DACO Office in Kalulushi, on 9th November, 2010 from 10:00hrs to 13:00hrs)

Introduction

This report is on the meeting held among Bwafwano Irrigation Scheme Action Site Representatives, Kalulushi MACO officials and the JICA Study Team to share detailed information for inclusion in the Implementation Plan for the Action Plan for Bwafwano Action Site. The meeting took place at the Kalulushi DACO Office in Kalulushi on the 9th of November, 2010 and started at 10:00hrs with an opening prayer from one of the stakeholders and ended with a closing prayer from another stakeholder. It was moderated by Mr. Richard K. Mfula.

Stakeholders Present

-The JICA Study Team

(1) Mr. Akira Yamamoto	[Team Leader]
(2) Mr. Takahiro Kato	Water Management/Irrigation
(3) Mr. Masaya Fukumoto	Rural Society/Farmers' Organization
(4) Mr. Taisuke Onishi	Administration
(5) Mr. Massamba Gueye	Environment and Social Concern
(6) Mr. Toshio Watanabe	Marketing
(7) Mr. Richard K. Mfula	Moderator
(8) Mr. Chiselwa Chayi	Assistant to Moderator

-MACO Staff

Name:

(1) Mr. Brian Gondwe	[Title] AO
(2) Mr. Davis Kabobotu	SAO
(3) Mr. Best Chamulekwa	A/A
(4) Mr. Peter Mbaao	TO
(5) Mr. Chanda Mwenya	AO
(6) Mr. Moonga Itwala	Senior Agricultural Officer
(7) Mr. Obby Banda	AS

-Bwafwano Farmers' Group Representatives

Name:

(1) Mr. Charles Chabinga	[Position] Chairperson
(2) Mr. Lawrence Kanyembo	Treasurer
(3) Mrs. Florence Nawakwi	Treasurer
(4) Mr. Peter Musenge	Secretary

The JICA Study Team Leader's Opening Remarks

The Study Team Leader, Mr. Akira Yamamoto welcomed everyone one present and thanked them for coming to the workshop. He said that he was happy that farmers from peri-urban areas were present. Mr. Yamamoto asked everyone present to speak freely as the workshop was meant for them. He said that the Study Team would endeavor as much as possible to include the proposals from the stakeholders in the Implementation Plan for the Action Plan.

The Moderator's Remarks

In the brief introduction of the workshop, the Moderator Mr. Richard Mfula informed the workshop that the Action Plan was not only about irrigation but also about Farm Management and Cropping,

Marketing and Farmers' Organization. He said that each expert was going to explain each of these particular sectors. He urged everyone present to submit practicable proposals because the Action Plan to be formulated will be extended to other areas within the zone.

Farm Management / Cropping

This was presented by Mr. Takagi and Mr. Mfula, the Study Team's expert in Farm Management/Cropping. Under this sector, the Study Team proposed three main outputs which will be expected through proposed activities by farmers and farmer's organizations. These proposed activities will be focused on training of farmers and farmer's organization. Presently, several factors needed to be confirmed in order to make a plan while detailed activities will be set up with the beneficiaries when the project starts.

Main Expected Output No.1.

Promoting Vegetable Complex consisting of 3 to 4 Core vegetables to compete with products from other areas.

Main Proposed Activities:

The study Team proposed training of farmers and farmer's organization in:

- 1) participatory market research for improvement of market awareness
- 2) cropping calendar for improvement of planning capacity
- 3) production skills and demonstrations for improvement of productivity
- 4) business plan preparation for improvement of business solutions

Confirmation

These main proposed activities and items should be confirmed before making the plan, for instance, the presence of vegetables which are profitable; are there vegetables that farmers want to introduce as new crops?

Remarks

It is proposed that MACO District CEO's will play a trainer role for farmers and that these activities will be made with marketing and organization issues in mind.

Main Expected Output No. 2

Conducting Strategic Planting to get good business chances

Main Proposed Activities:

- 1) Based on cropping calendar, planting for high price season will be conducted
- 2) Based on contract farming with marketers, planting will be conducted
- 3) Matching meetings with marketers

Confirmation

Are there high-price seasons/months for main crops? Which vegetables are suitable for contract farming?

Remarks

These activities and trainings will be made with marketing and organization in mind

Main Expected output No.3

Introducing early maturing compost (*Bokashi*) to contribute to the cost reduction of chemical fertilizer. *Bokashi* has higher fertilizing effects than manure.

Main proposed activities:

- 1) Demonstration of making *Bokashi*
- 2) Dissemination of *Bokashi* application to farmers by District Officers and CEO's

Confirmation

-Present manure application

- 1) what raw materials are used for manure?
- 2) what is the maturing period for the manure?

-Availability of *Bokashi* materials in the area

- 1) cow dung, pig dung, chicken droppings
- 2) rice bran, maize bran, wheat bran

Remarks

-District officers and CEOs will play a trainer role for the farmers

- The activities and trainings will be made with marketing and organization issues.

Mr. Mfula referred the farmers and DACO Officers to the attached manual on the preparation of *Bokashi*. He informed them that the handout (manual) was a mere proposal meant to demonstrate how *Bokashi* is produced and applied, and that they should not despair. He assured them that if they agree to the idea, they will be trained thoroughly in the preparation and application of *Bokashi*. Mr. Mfula said there was room for them to make additions or subtractions to the proposal.

Discussion

When asked about *Bokashi*-making materials, the farmers said there are a lot of saw-mills on the Copperbelt that did not know what to do with their saw dust- meaning there is plenty of saw dust. Further, there is lots of maize bran from millers.

Both the farmers' representatives and DACO officers approved and welcomed the proposal on Farm Management/Cropping.

Marketing

Mr. Watanabe, the marketing expert on the JICA Study Team presented the proposal on marketing for inclusion in the Implementation Plan for the Action Plan for the Bwafwano Action Site. He said that the proposal on marketing was an image of what the JICA Study Team conceived but was subject to additions and possible subtraction depending on the needs. He said the proposal on marketing has two components i.e. Collective Marketing and Marketing Skill.

Component 1. Collective Marketing.

Mr. Watanabe highlighted that the JICA Study Team's proposed measure was the Construction of a Multi-Purpose Shed.

He further discussed the advantages expected from Collective Marketing which he outlined as follows:

- 1) Farmers' labor for post-harvest handling and shipment is reduced
- 2) Farmers' cost for post-harvest handling and shipment is reduced
- 3) Marketeers' cost for handling and transportation is reduced by large-lots distribution
- 4) Farmers' products are upgraded in uniformity and quality with improvement of production technology
- 5) Markets' (Consumers') confidence in the products is strengthened
- 6) Farmers' bargaining power is increased, leading to fair price formation
- 7) Linkage between farmers and marketers is established and expanded, making a win-win relationship

8) Farmers' income increases as a result of all this.

Mr. Watanabe added that under the present marketing system, individual cooperative member farmers conducted individual transactions, selling in small lots to intermediary traders, market brokers, etc, who, in turn, sold to wholesalers, exporters etc. All these, he said, worked to disadvantage the farmer. Therefore the JICA Study Team proposes a marketing system whereby JICA would construct a Multi-purpose Shed for the Cooperative which individual member farmers would come together for temporary storage; cleaning; Sorting; Preparation for shipment (Quality Assessment, Weight check, Packaging). He added that the Multi- Purpose Shed could also be used for Meetings, Training, and an Information Board for disseminating different types of data e.g. what crops are available. The cooperative will be supported by other sectors and District Officers. The Cooperative members will engage in large-lot selling as a group, utilizing the market linkage established with wholesalers, exporters etc. The large-lot selling will be supported by contract based continuous transactions.

Component 2: Marketing Skill

Proposed Measure:

Strengthening of Practical Marketing Skill of Smallholders by On-the-Job-Training (OJT)

Mr. Watanabe proposed that farmers should be able, as a group, to forecast the market trends for at least 3 to 6 months; or for 1 to 2 years. Based on that forecast, he suggested that they should then plan what to produce and how to produce it. They should also know to whom and where to sell. He said at the moment there is no farmer group doing this in Zambia. From all these activities the farmers will be able to verify factors that are at play and when it benefits them they should continue with the activities. When it does not benefit them, they should analyse the factors leading to failure. The farmers group will have an advisor (specialist) who will work with the District Officers for the benefit of the farmers group for some time. This Advisor will offer on-the-job-training to the farmers' group in conjunction with the District Officers. The farmers' group will undertake collective marketing utilizing the market linkages established with wholesalers, exporters, etc.

Potential Market Channels to be Targeted in Kalulushi Area

Potential market channels for Kalulushi: Wholesalers from major markets like Chisokone market in Kitwe and the local market; Supermarkets such as Shoprite (Freshmark), Spar; directly exporting to DRC (although JICA will not support informal cross-border trade), other exporters; Institutions, Hotels etc.

Discussion

One farmer asked whether JICA would assist with a vehicle to transport produce to markets. To this, Mr. Watanabe advised that JICA will not provide a vehicle but the farmers need to know that shipment is a farmer's cost and therefore farmers must plan for it. He said that, if, in the past, farmers have been able to hire vehicles, or use bicycles and hauling on their heads, it should not be a big problem now. He even gave an example of one successful farmers' cooperative in Southern Province where marketeers hire a vehicle and send it to the scheme to buy vegetables. Mr. Watanabe said that such an arrangement was possible because farmers do things together: they hire the vehicles together and the buyers also hire the vehicles together. In this regard, he said farmers must work together in all areas of farming.

Irrigation and Water Management

Mr. Kato, the JICA Study Team specialist in Irrigation and Water Management stated that the proposal

from the JICA Study Team with regard to irrigation and water management was mainly on how to expand the irrigation canal and how it can be made more effective. He said that due to budgetary limitations, the JICA Study Team was proposing lining the irrigation canal for a stretch of 3km. At this point, MACO officials presented their diagrammatical proposal and submitted that they also had suggested to have 3.7 km lining up of the canal with concrete (refer to **Appendix**).

Discussion

While the irrigation water from the mines tailing dam was important, it was generally agreed that it could not be relied upon because that source belonged to the mining company.

Farmers’ Organization

This was presented by Mr. Fukumoto and Mr. Mfula. Mr. Fukumoto introduced the concept of farmers organization and said that there were three areas where this could be done and these are; in training, practice and motivation. Under training Mr. Fukumoto proposed that there will be training in core capacity where farmers will be trained in organization management leadership, participatory decision making and conflict management. The second aspect of the training was technical capacity on how to manage the farm which includes water resource management marketing and book-keeping.

Under practice Mr. Fukumoto proposed that there will be activities such as matching meetings, making business plans based on market research, cropping schedule, irrigation schedule and promotion plan. After making the business plan farmers should implement the business plan while they under taken monitoring and evaluation. The information that will be obtained from monitoring and evaluation will be utilized as feedback into the next business plan. Under motivation Mr. Fukumoto proposed that farmers will undertake study tours

- (a) A study tour to visit other farmers groups
- (b) Study tour to be visited by other farm groups

After this presentation there was a PRA exercise that was conducted by the Moderator on farmers’ motivation. The farmers were requested to give characteristics of what they thought of an organized farmer group. They were also asked to rank themselves according to how they, themselves, thought they met those characteristics. The following were the characteristics and how the farmers ranked themselves:

Table Bwafwano Farmers’ perceived characteristics of an organized Farmers’ Group viz-a-viz their own ranking

Characteristic	Self Ranking (Degree of Achievement)
Meet for discussions	60%
Pay membership fees	90%
Abiding by Constitution	50%
Work together	85%
Take challenges	50%
Consider success together	85%

Study Tour to Visit

The farmers suggested that when they visit another farmer group they would like to learn

- (a) How they conduct their business plans

- (b) How they keep their records
- (c) Their farm management skills
- (d) Their marketing activities

Study tour to be visited

The farmers elicited that when they are visited by others they would:

- (a) Show them to grow carrot
- (b) Show them how to conduct business through dialogue
- (c) Teach them how to rationize irrigation water

Just before the close of the meeting, it was brought to the attention of the meeting that Tusheni Cooperative was a major beneficiary from the irrigation system and, therefore not be excluded from all the plans for scheme.

Mr. Yamamoto, thanked everyone who attended the meeting and hoped that a good Action Plan would result from the day’s discussion. The meeting ended at 13.00hrs with a closing prayer from Mr. Chabinga, the Chairperson for the Bwafwano Irrigation Scheme.

Appendix Proposed Implementation Plan for Bwafwano Irrigation Scheme drawn by Kalulushi DACO officials.

<i>BWAFWANO IRRIGATION SCHEME – PROPOSED IMPLEMENTAION PLAN AS AT 5TH NOVEMBER 2010-11-07</i>						
ITEM	STATION/ POINT	CHARACTERISTICS	RECOMMENDATION	DISTANCE	ELEVATION (M)	CO-CORDINATES
1	a- A	Natural Perennial Stream *Clogged with reeds	* Regular dredging (Community)	4.0Km (From source)	(A) 1244	0619656 8584450
2	b- B	Natural Perennial Stream *Part of the water flows through B – A – D	*Blocking or limiting the back-flow. *Regular dredging	2.5Km	(B) 1247	0619505 8584514
3	C	*Flow stops due to seepage	*Concrete lining from B – Q	700m (B – Q)	(C) 1256	0619341 8584931
4	D	*Water still flowing through D – d – H *Clogged with reeds	*Regular dredging	-	1253	0619577 8585331
5	E	*Dry (At the time of survey)	Concrete lining through E – F – G	640m (E – G)	(E) 1243	0619614 8585669
6	F	Tailings Dam overflow channel *Flow stops due to seepage	*Concrete lining	-	1247	0619812 8585944
7	G	Tailings Dam overflow channel *Water flows G - F	Concrete lining	-	1247	0619994 8586179
8	d- H	Irrigation canal *Major water loss point due to seepage and diversions.	*Concrete lining * Proposed Reservoir at (q)	425m (d-H)	(H) 1244	0619414 8585772
9	H – J	Irrigation canal *dry	*Concrete lining and division pits	530m	(d) 1238 (J) 1231	0619392 8585350 0619434 8586295

E.3.2 Meeting for the Action Plan for Natuseko Action Site

(among Farmers' Representatives, MACO Officials and the JICA Study Team held at Kabwe DACO Office in Kabwe , on 12th November, 2010 from 10:00hrs to 13:00hrs)

Introduction

This report is on the meeting held among Natuseko site Representatives, MACO officials and the JICA Study Team to share detailed information for inclusion in the Implementation Plan for the Action Plan for Natuseko site. The meeting took place at Kabwe DACO Office in Kabwe on 12th November, 2010 and started at 10:00hrs with an opening prayer from one of the farmers. It was moderated by Mr. Richard K. Mfula.

Stakeholders Present

-The JICA Study Team

(1) Mr. Akira Yamamoto	Team Leader
(2) Mr. Takahiro Kato	Water Management/Irrigation
(3) Mr. Masaya Fukumoto	Rural Society/Farmers' Organization
(4) Mr. Toshio Watanabe	Marketing
(5) Mr. Taisuke Onishi	Administrator
(6) Mr. Shigen Takagi	Farm Management/Cropping
(7) Mr. Massamba Gueye	Environment/Social Concerns
(8) Mr. Richard K. Mfula	Moderator
(9) Mr. Chiselwa Chayi	Assistant to Moderator

-MACO Staff

Name:

(1) Ms Beatrice Banda	[Title] Agriculture Assistant (Extension Officer)
(2) Mr. Sungani Phiri	CJO/TSB-AMS
(3) Ms. Chola Bwalya	JT
(4) Mr. Whiteson Simbeye	Irrigation Engineer
(5) Ms. Mary Mungabo	Crop Husbandry Officer

-Natuseko Model Site Farmers' group representatives

Name:

(1) Ms Lovely Musonda	[Position] Chairperson
(2) Mr. Bennie Mwila	Committee Member
(3) Mr. Geoffrey Mumba	Secretary
(4) Mr. Aaron Mulenga	Vice Chairman

The JICA Study Team Leader's Opening Remarks

Mr. Akira Yamamoto, the JICA Study Team Leader opened the meeting and thanked the Farmers' representatives and DACO officers for coming to the workshop. He said that the team came earlier in November to explain and discuss the action plan on how it can be a good model for other areas. Mr. Yamamoto urged everyone involved to make a good action plan that would in future be able to be replicated in other areas within the zone. He added that the proposals into the action plan should therefore be realistic and practicable. He told everyone to speak freely.

The Moderator's Remarks

Mr. Mfula, the Moderator, informed the stakeholders that the objective of the meeting was to share detailed information and exchange opinions for the model projects among the planning stakeholders, i.e., Representatives of Moto-Moto Farmers' Group, MACO officials and the JICA Study Team. He reminded DACO Officials and Farmers' Representatives that during the previous meeting the JICA Study Team left them a task to propose inputs that would be discussed for inclusion in the draft Implementation Plan for the Action Plan. He also presented a brief description of each of the sectors of

the project model which he said include: Farm Management, Marketing, Irrigation and Water Management and, Farmers' Organization. Mr. Mfula added that there was a presentation on each of these sectors and that these presentations were proposals by the JICA Study Team for detailed discussion during the meeting.

Farm Management/Cropping

This was presented by Mr. Takagi and Mr. Mfula, the Study Team's expert in Farm Management/Cropping. Under this sector, the Study Team proposed three main outputs which will be expected through proposed activities by farmers and farmer's organizations. These proposed activities will be focused on training of farmers and farmer's organization. Presently, several activities ought to be confirmed in order to make a plan while detailed activities will be set up with the beneficiaries when the project starts.

Main Expected Output No.1.

Promoting Vegetable Complex consisting of 3 to 4 Core vegetables to compete with products from other areas.

Main Proposed Activities

The study Team proposed training of farmers and farmer's organization in:

- 1) participatory market research for improvement of market awareness
- 2) cropping calendar for improvement of planning capacity
- 3) production skills and demonstrations for improvement of productivity
- 4) business plan preparation for improvement of business solutions

Confirmation

These main proposed activities and items should be confirmed before making the plan, for instance, the presence of vegetables which are profitable; are there vegetables that farmers want to introduce as new crops?

Remarks

It is proposed that MACO District CEO's will play a trainer role for farmers and that these activities will be made with marketing and organization issues in mind.

Main Expected Output No. 2

Conducting Strategic Planting to get good business chances

Main Proposed Activities

- 1) Based on cropping calendar, planting for high price season will be conducted
- 2) Based on contract farming with marketers, planting will be conducted
- 3) Matching meetings with marketers

Confirmation

Are there high price seasons/months for main crops? Which vegetables are suitable for contract farming?

Remarks

These activities and trainings will be made with marketing and organization in mind

Main Expected output No.3

Introducing early maturing compost (*Bokashi*) go contribute to reducing of the cost of chemical fertilizer. *Bokashi* has higher fertilizing effects than manure.

Main proposed activities

- 1) Demonstration of making *Bokashi*
- 2) Dissemination of *Bokashi* application to farmers by District Officers and CEO's

Confirmation

-Present manure application

- 1) what raw materials are used for manure by the farmers?
- 2) what is the maturing period for that manure ?

-Availability of *Bokashi* materials in the area

- 1) cow dung, pig dung, chicken droppings
- 2) rice bran, maize bran, wheat bran

Remarks

-District officers and CEOs will play a trainer role for the farmers

- The activities and trainings will be made with marketing and organization issues.

Mr. Mfula referred the farmers and DACO Officers to the manual on the preparation of *Bokashi*. He informed them that they should not despair as that was just a proposal depicting how *Bokashi* is prepared and applied. He assured them that if they agree to the idea, they will be trained thoroughly in the preparation and application of *Bokashi*.

Both the farmers' representatives and DACO officers welcomed the proposal on Farm Management/Cropping, especially the use of *Bokashi*, which they said would reduce the farmers' production costs incurred from the use of chemical fertilizers.

Discussion

One of the farmer's representatives asked whether or not the *Bokashi* would not increase the soil acidity in their fields. In response, Mr. Mfula told him that in normal agricultural practice, whenever the soil became acidic, lime application was the remedy. The same farmer contended that he may not need *Bokashi* because presently his vegetable land was fertile enough as not to use any fertilizers. He was advised that he may need the skills in producing and applying *Bokashi* for other agricultural uses upland such as for maize growing.

Marketing

Mr. Watanabe, the marketing expert on the JICA Study Team presented the proposal on marketing for inclusion in the Implementation Plan for the Action Plan for Natuseko Action Site. He said that the proposal on marketing was an image of what the JICA Study Team conceived but was subject to additions and possible subtraction depending on the needs. He said the proposal on marketing has two components i.e. Collective Marketing and Marketing Skill.

Component 1. Collective Marketing.

Mr. Watanabe highlighted that the JICA Study Team's proposed measure was the Construction of a Multi-Purpose Shed.

He further discussed the advantages expected from Collective Marketing which he outlined as follows:

- 1) Farmers' labor for post-harvest handling and shipment is reduced
- 2) Farmers' cost for post-harvest handling and shipment is reduced
- 3) Marketeers' cost for handling and transportation is reduced by large-lots distribution
- 4) Farmers' products are upgraded in uniformity and quality with improvement of production

technology

- 5) Markets' (consumers') confidence in the products is strengthened
- 6) Farmers' bargaining power is increased, leading to fair price formation
- 7) Linkage between farmers and marketers is established and expanded, making a win-win relationship
- 8) Farmers' income increases as a result of all this.

Mr. Watanabe added that under the present marketing system, individual cooperative member farmers conducted individual transactions, selling in small lots to intermediary traders, market brokers, etc, who, in turn, sold to wholesalers, exporters etc. All these, he said, worked to disadvantage the farmer. Therefore the JICA Study Team proposes a marketing system whereby JICA would construct a Multi-purpose Shed for the Cooperative which individual member farmers would come together for temporary storage; cleaning; Sorting; Preparation for shipment (Quality Assessment, Weight check, Packaging). He added that the Multi- Purpose Shed could also be used for Meetings, Training, and an Information Board for disseminating different types of data e.g. what crops are available. The cooperative will be supported by other sectors and District Officers. The Cooperative members will engage in large-lot selling as a group, utilizing the market linkage established with wholesalers, exporters etc. The large-lot selling will be supported by contract based continuous transactions.

Component 2: Marketing Skill

Proposed Measure:

Strengthening of Practical Marketing Skill of Smallholders by On-the-Job-Training (OJT)

Mr. Watanabe proposed that farmers should be able, as a group, to forecast the market trends for at least 3 to 6 months; or for 1 to 2 years. Based on that forecast, he suggested that they should then plan what to produce and how to produce it. They should also know to whom and where to sell. From all these activities the farmers will be able to verify factors that are at play and when it benefits them they should continue with the activities. When it does not benefit them, they should analyse the factors leading to failure. The farmers group will have an advisor (specialist) who will work with the District Officers for the benefit of the farmers group for some time. This Advisor will offer on-the-job-training to the farmers' group in conjunction with the District Officers. The farmers' group will undertake collective marketing utilizing the market linkages established with wholesalers, exporters, etc.

Potential Market Channels to be Targeted in Kabwe area

Mr. Watanabe proposed wholesalers (on contract basis) at new Kasanda market, Kabwe town centre market, companies and exporters as the major market channels.

Discussion

The farmers complained that the buyers have better marketing skills than they do. They admitted that buyers always brought the prices down. However, they acknowledged that it was difficult to negotiate prices when the farmer worked alone. They said that working in a group would prevent farmers from being outplayed by the buyers.

Mr. Watanabe observed that the market scenario in Kabwe is such that most farmers grow locally consumable produce such as rape, cabbage, tomatoes and onions. It is unlike in Lusaka where most farmers grow exportable products such as green beans and carrots. However the farmers contended that Kabwe has few customers who could consume these exportable products and, therefore, they could incur losses if they produced such vegetables. To this Mr. Mfula advised that if the farmers improved on

the quality of their produce more consumers would be scrambling for their produce. This would enhance their goodwill and everybody would be calling their produce “Natuseko” as the Mkushi produce is generally referred to as “Mkushi”. Mr. Mumba however said that, at one time he had grown tomatoes which were better than the one produced in Mkushi. He said it was surprising though that the buyers went ahead and bought Mkushi tomato.

Mr. Watanabe advised that there was market in Kabwe for crops like carrot. All the farmers needed to do was identify these markets such as hotels and lodges. He further said that certain customers want certain varieties of crops and farmers should ensure that they grow those crop varieties demanded by the buyers. As farmers they needed to know the type of carrot to grow for specific customers.

After the discussion, Mr. Watanabe invited the farmers and DACO officers for further discussion after the meeting to facilitate further insights into the Action Plan.

Irrigation and Water Management

There were separate presentations on Irrigation and Water management. One from Mr. Kato, the JICA Study Team expert on Irrigation and Water Management and another from Mr. Simbeye, the Irrigation Engineer from DACO’s office (refer to Mr. Kato and Mr. Simbeye’s respective reports). Mr. Kato told the farmers and DACO officers to meet him after the meeting to further discuss proposals to be included in the Action Plan. Mr. Kato advised that much as the aspirations of the farmers were important, there were budgetary constraints to be considered because there was a ceiling as to how much will be allocated to irrigation.

Discussion

When Mr. Kato proposed that the JICA Study team would have preferred 5 farmers to share 1 treadle pump, several concerns were raised. One farmer suggested that they each be given a treadle pump, however Mr Kato advised that the JICA policy is to encourage group use as opposed to individual use. The farmers also suggested that they had observed that the use of tools in groups has been difficult in the past because some farmers are selfish and this could disadvantage other farmers. In addition farmers have different sizes of portions and the time they spent irrigating their portions would differ accordingly. Further the farmers suggested that it would be very difficult to maintain the group treadle pumps; therefore individual treadle pumps would be better they repeated. Mr. Kato advised that farmers should negotiate and make a plan for using the treadle pumps. He further said that the JICA plan has budgetary limitations. An officer from MACO advised that if people cannot accept group use then other suitable interventions should be devised. For instance he said the treadle pump has proved to be inadequate although it is expensive. The amount of water that it produces is very little. Mr. Kato said although it is important to get the views of the farmers regarding what they wanted, the purpose of the action site was not for Natuseko alone but rather to be replicated in other areas in the zone. The farmers suggested that if it were possible let them be provided with engine pumps even though they had never used engine pumps before as a group. The farmers said that those who used personal engine pumps irrigate wider portions because the engine pump is more efficient than the treadle pump. Farmers requested for technical assistance on how to maintain the engine pumps especially in the initial stages. Mr. Kato suggested that the cost of maintaining the pumps will be covered by the group members. The other concern raised was that there are households that have more than one farmer group members; and how will they use the equipment. Mr. Musonda suggested that it would be

appropriate that such a household be considered as one group and use one pump.

Farmers' Organization

This was presented by Mr. Fukumoto and Mr. Mfula. Mr. Fukumoto introduced the concept of farmers' organization and said that there were three areas where this could be done and these are; in training, practice and motivation. Under training Mr. Fukumoto proposed that there will be training in core capacity where farmers will be trained in organization management leadership, participatory decision making and conflict management. The second aspect of the training was technical capacity on how to manage the farm which includes water resource management marketing and book keeping.

Under practice Mr. Fukumoto proposed that there will be activities such as marching meetings, making business plans based on market research, cropping schedule, irrigation schedule and promotion plan. After making the business plan farmers should implement the business plan while they under taken monitoring and evaluation. The information that will be obtained from monitoring and evaluation will be utilized as feedback into the next business plan. Under motivation Mr. Fukumoto proposed that farmers will undertake study tours:

- (c) A study tour to visit other farmers groups
- (d) Study tour to be visited by other farm groups

After this presentation, a PRA exercise was conducted and the farmers were requested to elicit characteristics of organized farmer groups and were further asked to rank themselves according these characteristics. The following were the characteristics and how farmers ranked themselves:

Table Natuseko Farmers' perceived characteristics of an organized Farmers' Group viz-a-viz their own ranking

Characteristic	Self Ranking (Degree of Achievement)
One common interest	75%
Share experiences	85%
Unity of purpose/harmony	80%
Democratic, transparent, selfless	90%
Commitment to project	90%

The following were the responses elicited by the farmers with regard to study visits:

Study Tour to Visit

The farmers suggested that when they visit another farmer group they would like to learn:

- (e) What type of farming methods are used
- (f) How other farm groups do business and marketing
- (g) Crop management
- (h) Dambo utilization
- (i) Water management
- (j) Diversification

Study Tour to be Visited

The farmers mentioned that when they are visited by other farmer groups, they would:

- (d) Show them the importance of organized leadership
- (e) Show them quality products

- (f) Teach them time management
- (g) Show them dambo utilization

What Type of Training/Activity to improve their scheme would the farmers request from JICA:

- (a) Training in good farming methods
- (b) Training in business management and marketing
- (c) Workshops on leadership
- (d) Constitution-making and registration
- (e) Democracy; i.e. clarifying roles and responsibilities, regular meetings, financial reporting, right of expression
- (f) Commitment to project, i.e., training members on time management, record keeping and channels of communication

The meeting ended at 13.00 with a closing prayer from one of the farmers. The farmers and DACO officers remained to discuss with Mr. Watanabe and Mr. Kato.

E.3.3 Meeting for the Action Plan for Chipapa Action Site

(among Farmers' Representatives, MACO Officials and the JICA Study Team held at House of Excellence Guest House in Kafue, on 19th November, 2010 from 10:00hrs to 13:00hrs)

Introduction

This report is on the meeting held among Chipapa Irrigation Scheme Action Site Representatives, Kafue MACO officials and the JICA Study Team to share detailed information for inclusion in the Implementation Plan for the Action Plan for Chipapa Action Site. The meeting took place at the House of Excellence Guest House in Kafue on the 19th of November, 2010 and started at 10:00hr with an opening prayer from one of the stakeholders and ended with a closing prayer from another stakeholder. It was moderated by Mr. Richard K. Mfula.

Stakeholders Present

-The JICA Study Team

(1) Mr. Akira Yamamoto	Team Leader
(2) Mr. Takahiro Kato	Water Management/Irrigation
(3) Mr. Masaya Fukumoto	Rural Society/Farmers' Organization
(4) Mr. Taisuke Onishi	Administration
(5) Mr. Massamba Gueye	Environment and Social Concerns
(6) Mr. Toshio Watanabe	Marketing
(7) Mr. Richard K. Mfula	Moderator
(8) Mr. Chiselwa Chayi	Assistant to Moderator

-MACO staff

Name:

(1) Mr. John Hikanyemu	[Department] DACO
(2) Mr. Dominic M. Namanyungu	SAO
(3) Mr. Elliot S. Mwangwa	STO
(4) Mr. Isaac Kazadi	CEO
(5) Mrs. Dinah C. Phiri	DMDO
(6) Mr. Nthele M. K. A	Crops
(7) Mr. Michael Mwale	Cooperatives

-Chipapa Model Site Farmers' group representatives

Name:

(1) Mr. Sten Malambo	[Position] Chairperson
(2) Mr. Herbert Nkandu	Secretary.
(3) Mrs. Joyce Kenguluka	Treasurer
(4) Ms Prisca Mahauahau	Member

The JICA Study Team Leader's Opening Remarks

Mr. Yamamoto, the JICA Study Team Leader, thanked all the stakeholders present most sincerely for turning up for the meeting. He reminded them that during the previous meeting held on 29th October, 2010, he had introduced the concept of the Action Plan and hoped that all present understood the concept well. He further reminded everyone that there were four model sites that have been targeted over the studied provinces (Copperbelt, Central, Lusaka and Southern) for small-scale irrigated agriculture development to be included in the draft Action Plan. He said the Chipapa model site was selected because it was the most appropriate model for surrounding areas due to its good practice and other factors. He further said that the reason for the meeting was to analyze, in detail, results from the workshop. Thereafter, MACO and JICA will discuss and investigate the feasibility of the model projects, revise and finalize it. This, he said, will then be deliberated further to come up with the finalized plan of Model Projects in order to make the decision for project implementation of the project. Mr. Yamamoto

observed that although farmers from Chipapa were eager to progress and may have huge investments for their scheme in mind, it was necessary that the proposals to be included in the draft Action Plan be realistic and practicable. This is because the Chipapa model outputs should be transferable to other areas within the zone.

The Moderator's Remarks

Mr. Mfula, the workshop Moderator, informed the stakeholders that the objective of the meeting was to share detailed information and exchange opinions for the model projects among the planning stakeholders i.e. Representatives of Chipapa Farmers' Group, MACO officials and the JICA Study Team. He reminded DACO Officials and Farmers' Representatives that during the previous meeting of 29th October, 2010, the JICA Study Team left them a task to make proposals that would be discussed for possible inclusion in the draft Implementation Plan for the Action Plan, and hoped that they had written something to that effect. He also gave a brief description of each of the sectors of the project model which he said include: Farm Management, Marketing, Irrigation and Water Management and, Farmers' Organisation. Mr. Mfula said there was a presentation on each of these sectors and that these presentations were proposals by the JICA Study Team for detailed discussion during the meeting.

Farm Management / Cropping

This was presented by Mr. Mfula on behalf of Mr. Takagi, the Study Team's expert in Farm Management/Cropping. Under this sector, the Study Team proposed three main outputs which will be expected through proposed activities by farmers and farmer's organizations. These proposed activities will be focused on training of farmers and farmer's organization. Presently, several activities needed to be confirmed in order to make a plan while detailed activities will be set up with the beneficiaries when the project starts.

Main Expected Output No.1.

Promoting Vegetable Complex consisting of 3 to 4 Core vegetables to compete with products from other areas.

Main Proposed Activities:

The Study Team proposed training of farmers and farmer's organization in:

- 1) participatory market research for improvement of market awareness
- 2) cropping calendar for improvement of planning capacity
- 3) production skills and demonstrations for improvement of productivity
- 4) business plan preparation for improvement of business solutions

Confirmation

These main proposed activities and items should be confirmed before making the plan, for instance, the presence of vegetables which are profitable; are there vegetables that farmers want to introduce as new crops?

Remarks

It is proposed that MACO District CEO's will play a trainer role for farmers and that these activities will be undertaken with marketing and organization issues in mind.

Main Expected Output No. 2

Conducting Strategic Planting to get good business chances.

Main Proposed Activities:

- 1) Based on cropping calendar, planting for high price season will be conducted
- 2) Based on contract farming with marketers, planting will be conducted
- 3) Matching meetings with marketers

Confirmation

Are there high price seasons/months for main crops? Which vegetables are suitable for contract farming?

Remarks .

These activities and trainings will be made with marketing and organization in mind.

Main Expected output No.3

Introducing early maturing compost (*Bokashi*) go contribute to reducing of the cost of chemical fertilizer. *Bokashi* has higher fertilizing effects than manure.

Main proposed activities:

- 1) Demonstration of making *Bokashi*
- 2) Dissemination of *Bokashi* application to farmers by District Officers and CEO's

Confirmation

-Present manure application

- 1) what raw materials are used by farmers presently?
- 2) what is the maturing period of the manure used?

-Availability of *Bokashi* materials in the area

- 1) cow dung, pig dung, chicken droppings
- 2) rice bran, maize bran, wheat bran

Remarks

-District officers and CEOs will play a trainer role for the farmers

- The activities and trainings will be undertaken with marketing and organization issues.

Mr. Mfula referred the farmers and DACO Officers to the attached manual on the preparation of *Bokashi*. He informed them that they should not despair as that was just a proposal depicting how *Bokashi* is prepared and applied. He assured them that if they agree to the idea, they will be trained thoroughly in the preparation and application of *Bokashi*.

Both the farmers' representatives and DACO officers welcomed the proposal on Farm Management/Cropping.

Discussion

When the farmers were asked as to which month(s) tomato has the highest market price, they said that it was mainly in June and December. They complained that during low-demand months, a lot of tomatoes go to waste as they do not know how to preserve it. They said they were at one time trained in the preservation of *Bidens Pilosa* leaves, locally known as KANUNKA by Silva Catering (Kanunka is very delicious and is sold in supermarkets and exported to Botswana and Namibia). However, owing to lack of finances, they cannot afford to purchase electric, or, even, solar driers and packaging materials. They requested JICA to assist them to purchase the driers and packaging and branding materials.

Mr. Mfula reminded the farmers' representatives that not all farmers at the scheme were conducting contract farming and that not all of them were matched with marketers. At this point he asked how the matching exercise was benefiting them. They confirmed that they were in constant cell phone contact

with their matched marketeers and that it had made their selling easy and predictable. They added that there were instances when marketeers would remind them continually especially when they delayed supplying them the vegetables.

Mr. Mfula observed that although the *Bokashi* manual shows that *Bokashi* materials be covered with a tarpaulin during fermentation, empty polythene sacks like those of fertilizer could do just as well, especially when they are joined together. This is because the conventional tarpaulin may prove costly for most farmers.

The farmers said that presently the materials used for manure were cow dung, goat manure and chicken droppings. They admitted that they do not use vegetable residues for manure although they use maize residues upland.

When asked how they so far perceived the concept of *Bokashi*, farmers and DACO officials were optimistic that it could work well for the benefit of the farmers.

Marketing

Mr. Watanabe, the marketing expert on the JICA Study Team presented the proposal on marketing for inclusion in the Implementation Plan for the Action Plan for Chipapa Action Site. He said that the proposal on marketing was an image of what the JICA Study Team conceived but was subject to additions and possible subtraction depending on the needs. He reminded those present that historically, Chipapa had had some successes such as that the scheme had its own vehicles for transporting produce to markets.

He said the proposal on marketing has two components, i.e., Collective Marketing and Marketing Skill.

Component 1. Collective Marketing.

Mr. Watanabe highlighted that the JICA Study Team's proposed measure was the Construction of a Multi-Purpose Shed. He said that the type of shed to be constructed should be made from locally available, but affordable materials. He suggested for instance that the shed should have ordinary structures like concrete floor, pillars, iron sheets and that there should be a separate space for meetings and storage. Mr. Watanabe observed that Collective Marketing in Zambia was very limited and attributed this mainly to; lack of collective selling facilities such the multi-purpose shed being proposed. He then discussed the advantages expected from Collective Marketing which he outlined as follows:

- 1) Farmers' labor for post-harvest handling and shipment is reduced
- 2) Farmers' costs for post-harvest handling and shipment are reduced
- 3) Marketeers' costs for handling and transportation are reduced by large-lots distribution
- 4) Farmers' products are upgraded in uniformity and quality with improvement of production technology
- 5) Markets' (consumers') confidence in the products is strengthened
- 6) Farmers' bargaining power is increased, leading to fair price formation
- 7) Linkage between farmers and marketers is established and expanded, making a win-win relationship
- 8) Farmers' income increases as a result of all this.

Mr. Watanabe added that under the present marketing system, individual cooperative member farmers conducted individual transactions, selling in small lots to intermediary traders, market brokers, etc, who, in turn, sold to wholesalers, exporters etc. All these, he said, worked to disadvantage the farmer. Therefore the JICA Study Team proposes a marketing system whereby JICA would construct a

Multi-Purpose Shed for the Cooperative which individual member farmers would come together for temporary storage; cleaning; sorting; preparation for shipment (Quality Assessment, Weight check, Packaging, etc). He added that the Multi- Purpose Shed could also be used for Meetings, Training, and an Information Board for disseminating different types of data, e.g., what crops are available. The cooperative will be supported by other sectors and District Officers. The Cooperative members will engage in large-lot selling as a group, utilizing the market linkage established with wholesalers, exporters etc. The large-lot selling will be supported by contract based continuous transactions.

Component 2: Marketing Skill

Proposed Measure:

Strengthening of Practical Marketing Skill of Smallholders by On-the-Job-Training (OJT)

Mr. Watanabe proposed that farmers should be able, as a group, to forecast the market trends for at least 3 to 6 months; or for 1 to 2 years. Based on that forecast, he suggested that they should then plan what to produce and how to produce it. They should also know to whom and where to sell. From all these activities the farmers will be able to verify factors that are at play and when it benefits them they should continue with the activities. When it does not benefit them, they should analyze the factors leading to failure. The farmers group will have an advisor (specialist) attached to the scheme who will work with the District Officers for the benefit of the farmers group for some time. This Advisor will offer on-the-job-training to the farmers' group in conjunction with the District Officers. The farmers' group will undertake collective marketing utilizing the market linkages established with wholesalers, exporters, etc.

Potential Market Channels to be Targeted in Kafue Area

Mr. Watanabe advised that Kafue area had a very huge marketing owing to its vicinity to Lusaka. He proposed that market channels for Kafue included (a) wholesalers e.g. at Soweto market in Lusaka, other major markets within Lusaka, companies etc; (b) food processors such as Freshpikt; (c) supermarkets such as Shoprite (Freshmark), Spar, Melissa; Hotels/Lodges, Institutions, Exporters etc. He added that even if the borders were slightly far away, it was possible to export to neighboring countries such as Botswana and Namibia.

Discussion

The farmers wanted to find out if the JICA would partly fund the construction of the shed given that their incomes were inadequate. To this Mr. Watanabe advised that the JICA Study Team will consider that request.

Irrigation and Water Management

Mr. Kato, the JICA Study Team expert on Irrigation and Water Management said after studying the irrigation facility at Chipapa, he had made professional recommendations which he believed would work once implemented. Owing to time limitation, he invited the farmers and DACO officials to meet him after meet him after the meeting so as to consider his proposals.

The DACO officials also presented their proposal which was comprehensively prepared in line with the Study team's four major sectors i.e. Farm Management, Marketing, Irrigation and Water Management and, Farmers' Organization. Each one present was given a copy of the proposed Implementation Plan by the DACO officials.

Farmers' Organization

This was presented by Mr. Fukumoto and Mr. Mfula. Mr Fukumoto introduced the concept of farmers organization and said that there were three areas where this could be done that is in training, practice and motivation. Under training Mr. Fukumoto proposed that there will be training in core capacity where farmers will be trained in organization management leadership, participatory decision making and conflict management. The second aspect of the training was technical capacity on how to manage the farm which includes water resource management marketing and book keeping.

Under practice Mr. Fukumoto proposed that there will be activities such as marching meetings, making business plans based on market research, cropping schedule, irrigation schedule and promotion plan. After making the business plan farmers should implement the business plan while they under taken monitoring and evaluation. The information that will be obtained from monitoring and evaluation will be utilized as feedback into the next business plan. Under motivation Mr. Fukumoto proposed that farmers will undertake study tours:

- (e) A study tour to visit other farmers groups
- (f) Study tour to be visited by other farm groups

After this presentation there was an exercise that was conducted by farmers on motivation. The farmers were requested to elicit characteristics of organized farmer groups and were further asked to rank themselves according their responses. The following were the characteristics and how farmers ranked themselves;

Table Chipapa Farmers’ perceived characteristics of an organized Farmers’ Group viz-a-viz their own ranking

Characteristic	Self Ranking (Degree of Achievement)
Planting same type of crop	55%
Conducts Market Research for every member	60%
Keeps records (meetings, financial, etc) for activities	100%
Implements planned activities	82.5%
Regularly meets to discuss group matters	85%

The following were the responses elicited by the farmers with regard to study visits:

Study Tour to Visit

The farmers suggested that when they visit another farmer group they would like to learn:

- (k) Areas (ideas) in which they are lacking
- (l) How they manage their organization and the scheme
- (m) Factors that led to their growth/expansion

Study Tour to be Visited

The farmers mentioned that when they are visited by others they would:

- (h) Show the how they grow green beans
- (i) Show them how they utilize water
- (j) Show them how they sell vegetables
- (k) Show them how they use the planting calendar.

Chipapa Irrigation Scheme Members’ Proposals for Possible Inclusion in the Action Plan

The Chipapa Irrigation Scheme representatives tabled the proposals that scheme members proposed for

possible inclusion in the Action Plan. The following issues were proposed to be added to the Action Plan:

1. Marketing- the farmers requested for a vehicle to deliver produce to organized markets; Post-Harvest Processing of leaf vegetables (driers and packaging machines etc)
2. Irrigation- Introduction of rice growing during rainy season. It was observed that the period from November to March was long and there was loss of money/ income.
3. Capacity Development- There was a need to diversify the community to areas like Fish Farming in the dam.
4. Empowerment of women to do some other income-generating activities.
5. It was also observed that women did not have land which they would personally call their own. They proposed for expansion of the garden and acquire a loan to compensate for the fields owners who would surrender these to the project. They requested JICA to help compensate those non-scheme members willing to sell their plots to scheme members.
6. The whole area under irrigation is too small: farmers requested for assistance to expand the existing hectarage even by way of loans whose repayment would be supervised by the executive.
7. Raising of the embankment and planting of trees on the eastern side of the dam to be done. The headmen were approached and those on the eastern side of the dam were asked not to cultivate any more.

The JICA Study Team leader thanked all present, especially the DACO officials for preparing a comprehensive proposal. The meeting ended at 13.00 with a closing prayer from one of the farmers.

E.3.4 Meeting for the Action Plan for Mulabalaba Action Site

(among Farmers' Representatives, MACO Officials and the JICA Study Team held at the Livingstone Lodge in Livingstone, on 16th November, 2010 from 10:00hrs to 13:00hrs)

Introduction

This report is on the meeting held among Mulabalaba Action Site Representatives, MACO officials and the JICA Study Team to share detailed information for inclusion in the Implementation Plan for the Action Plan for Mulabalaba Action Site. The meeting took place at the Livingstone Lodge on 16th November, 2010 and started at 10hrs with an opening prayer from one of the farmers. It was moderated by Mr. Richard K. Mfula.

Stakeholders Present

The JICA Study Team

(1) Mr. Akira Yamamoto	Team Leader
(2) Mr. Takahiro Kato	Water Management/Irrigation
(3) Mr. Masaya Fukumoto	Rural Society/Farmers' Organization
(4) Mr. Toshio Watanabe	Marketing
(5) Mr. Taisuke Onishi	Administrator
(6) Mr. Shigen Takagi	Farm Management/Cropping
(7) Mr. Massamba Gueye	Environment/Social Concerns
(8) Mr. Richard K. Mfula	Moderator
(9) Mr. Chiselwa Chayi	Assistant to Moderator

MACO Staff

Name:

(1) Mr. Kasongo Chushi	[Title]
(2) Mr. Kantu Kantu	SAS FMO
(3) Ms. Betty Hakulipa	Irrigation Technical Officer
(4) Mr. Alexander Mutali	AG- FNO
(5) Mr. Somanje Novas	PTO-TSB
	Agric. Officer

Mulabalaba Model Site Farmers' group representatives

Name:

(1) Mr. Sevious Kawana	[Position]
(2) Mr. Enock Neene	Dam Chairperson
(3) Ms. Emelitas Mwiinga	Chairman
	Mulabalaba Irr. Chairperson

The JICA Study Team Leader's Opening Remarks

Mr. Akira Yamamoto, the JICA Study Team Leader opened the meeting and thanked the Farmers' representatives and DACO officers for coming to the workshop. He said that the team came earlier in November to explain and discuss the action plan on how it can be a good model for other areas. Mr. Yamamoto urged everyone involved to make a good action plan that would in future be able to be replicated in other areas within the zone. He added that the proposals into the action plan should therefore be realistic and practicable. He told everyone to speak freely.

The Moderator's Remarks

Mr. Mfula, the Moderator, informed the stakeholders that the objective of the meeting was to share detailed information and exchange opinions for the model projects among the planning stakeholders i.e. Representatives of Farmers' Group of Mulabalaba Irrigation Scheme, MACO officials and the JICA Study Team. He reminded DACO Officials and Farmers' Representatives that during the previous meeting the JICA Study Team left them a task to propose inputs, which would be discussed for inclusion in the draft Implementation Plan for the Action Plan. He also presented a brief description of each of the sectors of the project model which he said include: Farm Management, Marketing, Irrigation

and Water Management and, Farmers' Organization. Mr. Mfula added that there was a presentation on each of these sectors and that these presentations were proposals by the JICA Study Team for detailed discussion during the meeting.

Farm Management/Cropping

This was presented by Mr. Mfula on behalf of Mr. Takagi, the Study Team's expert in Farm Management/Cropping. Under this sector, the Study Team proposed three main outputs which will be expected through proposed activities by farmers and farmer's organizations. These proposed activities will be focused on training of farmers and farmer's organization. Presently, several should be confirmed in order to make a plan while detailed activities will be set up with the beneficiaries when the project starts.

Main Expected Output No.1.

Promoting Vegetable Complex consisting of 3 to 4 Core vegetables to compete with products from other areas.

Main Proposed Activities:

The study Team proposed training of farmers and farmer's organization in:

- 1) participatory market research for improvement of market awareness
- 2) cropping calendar for improvement of planning capacity
- 3) production skills and demonstrations for improvement of productivity
- 4) business plan preparation for improvement of business solutions

Confirmation

These main proposed activities and items should be confirmed before making the plan, for instance, the presence of vegetables which are profitable; are there vegetables that farmers want to introduce as new crops?

Remarks

It is proposed that MACO District CEO's will play a trainer role for farmers and that these activities will be made with marketing and organization issues in mind.

Main Expected Output No. 2

Conducting Strategic Planting to get good business chances

Main Proposed Activities:

- 1) Based on cropping calendar, planting for high price season will be conducted
- 2) Based on contract farming with marketers, planting will be conducted
- 3) Matching meetings with marketers

Confirmation

Are there high price seasons/months for main crops? Which vegetables are suitable for contract farming?

Remarks

These activities and trainings will be made with marketing and organization in mind

Main Expected output No.3

Introducing early maturing compost (*Bokashi*) that can contribute to reducing of the cost of chemical fertilizer. *Bokashi* has higher fertilizing effects than manure.

Main proposed activities:

- 1) Demonstration of making *Bokashi*
- 2) Dissemination of *Bokashi* application to farmers by District Officers and CEO's

Confirmation

-Present manure application

- 1) what raw materials are used?
- 2) what is the maturing period?

-Availability of *Bokashi* materials in the area

- 1) cow dung, pig dung, chicken droppings
- 2) rice bran, maize bran, wheat bran

Remarks

-District officers and CEOs will play a trainer role for the farmers

- The activities and trainings will be made with marketing and organization issues.

Mr. Mfula referred the farmers and DACO Officers to the attached manual on the preparation of *Bokashi*. He informed them that they should not despair as that was just a proposal depicting how *Bokashi* is prepared and applied. He assured them that if they agree to the idea, they will be trained thoroughly in the preparation and application of *Bokashi*.

Discussion

When Mr. Mfula asked about their knowledge of *Bokashi*, the farmers said they first heard about it during the previous meeting. They said there were enough *Bokashi*-making materials in Livingstone: maize bran is produced on a daily basis from millers; there is plenty of saw dust from the saw mill near Kazungula. The farmers said they normally prepare their compost using compost pits. They also use chicken droppings as manure..

The other concern one farmer raised was that of determining the actual temperature of *Bokashi* during fermentation. Mr. Watanabe observed that although thermometers could be purchased, the best and less expensive way would be the use hands by feeling the amount of heat. Mr. Mfula added that the DACO officials and farmers will be trained on how to know the right temperature.

Marketing

Mr. Watanabe, the marketing expert on the JICA Study Team presented the proposal on marketing for inclusion in the Implementation Plan for the Action Plan for Mulabalaba Action Site. He said that the proposal on marketing was an image of what the JICA Study Team conceived but was subject to additions and possible subtraction depending on the needs. He said the proposal on marketing has two components i.e. Collective Marketing and Marketing Skill.

Component 1. Collective Marketing

Mr. Watanabe highlighted that the JICA Study Team's proposed measure was the Construction of a Multi-Purpose Shed.

He further discussed the advantages expected from Collective Marketing which he outlined as follows:

- 1) Farmers' labor for post-harvest handling and shipment is reduced
- 2) Farmers' cost for post-harvest handling and shipment is reduced
- 3) Marketeers' cost for handling and transportation is reduced by large-lots distribution
- 4) Farmers' products are upgraded in uniformity and quality with improvement of production technology

- 5) Markets' (consumers') confidence in the products is strengthened
- 6) Farmers' bargaining power is increased, leading to fair price formation
- 7) Linkage between farmers and marketers is established and expanded, making a win-win relationship
- 8) Farmers' income increases as a result of all this.

Mr. Watanabe added that under the present marketing system, individual cooperative member farmers conducted individual transactions, selling in small lots to intermediary traders, market brokers, etc, who, in turn, sold to wholesalers, exporters etc. All these, he said, worked to disadvantage the farmer. Therefore the JICA Study Team proposes a marketing system whereby JICA would construct a Multi-purpose Shed for the Cooperative which individual member farmers would come together for temporary storage; cleaning; Sorting; Preparation for shipment (Quality Assessment, Weight check, Packaging). He added that the Multi- Purpose Shed could also be used for Meetings, Training, and an Information Board for disseminating different types of data, e.g., what crops are available. The cooperative will be supported by other sectors and District Officers. The Cooperative members will engage in large-lot selling as a group, utilizing the market linkage established with wholesalers, exporters etc. The large-lot selling will be supported by contract based continuous transactions.

Component 2: Marketing Skill

Proposed Measure:

Strengthening of Practical Marketing Skill of Smallholders by On-the-Job-Training (OJT)

Mr. Watanabe proposed that farmers should be able, as a group, to forecast the market trends for at least 3 to 6 months; or for 1 to 2 years. Based on that forecast, he suggested that they should then plan what to produce and how to produce it. They should also know to whom and where to sell. From all these activities the farmers will be able to verify factors that are at play and when it benefits them they should continue with the activities. When it does not benefit them, they should analyze the factors leading to failure. The farmers group will have an advisor (specialist) who will work with the District Officers for the benefit of the farmers group for some time. This Advisor will offer on-the-job-training to the farmers' group in conjunction with the District Officers. After the DACO officials in specific sectors have acquired the specific skills and knowledge from the Advisor, he/she will then "leave" all the tasks with DACO Officials to continue activities with the farmers. The farmers' group will undertake collective marketing utilizing the market linkages established with wholesalers, exporters, etc.

Potential Market Channels to be Targeted in Livingstone Area

Mr. Watanabe said that Livingstone has a lot of potential for vegetable and fruit farmers. He proposed that farmers could target wholesalers (on contract basis) at new Maramba market, hotels and lodges, institutions and exporters.

Discussion

Mr. Somanje from MACO raised a concern about the role of the Advisor whether it will be strictly with MACO official or farmers. Mr. Watanabe advised that the Advisor will play duo roles i.e. with both the farmers and MACO officials depending on the type of expertise that the Advisor will be offering. Mr. Somanje further observed that in previous projects, there has been a gap when technical advisors left. But Mr. Watanabe advised that the Advisor will have to impart skills and knowledge to MACO officials who will continue offering the particular expertise to the farmers even when the Advisor has left. This will ensure that there will not be the gap. He added that farmers should also hire experts, using profits,

if such need arises.

Irrigation and Water Management

Mr. Kato observed that one of the major problems at the scheme was that those plots which were situated on the portion that is higher than the canal had difficulties in lifting the water from the canal. He said that there were two options to that challenge: one would be to construct another canal which would go through the higher portion while the second option would be to provide those farmers on the higher portion with treadle pumps and ordinary 50 mm polythene pipes and that those pumps would be used in groups.

Mr. Kato further said that the existing canal needed attention especially where there were signs of leakages/seepage.

Discussion

It was unanimously observed and agreed that the second intake valve which had been dysfunctional for some time be repaired and revamped as this would increase the amount of water that would be going into the plots.

Farmers' Organization

This was presented by Mr. Fukumoto and Mr. Mfula. Mr. Fukumoto introduced the concept of farmers organization and said that there were three areas where this could be done that is in training, practice and motivation. Under training Mr. Fukumoto proposed that there will be training in core capacity where farmers will be trained in organization management leadership, participatory decision making and conflict management. The second aspect of the training was technical capacity on how to manage the farm which includes water resource management marketing and book keeping.

Under practice Mr. Fukumoto proposed that there will be activities such as matching meetings, making business plans based on market research, cropping schedule, irrigation schedule and promotion plan. After making the business plan farmers should implement the business plan while they undertake monitoring and evaluation. The information that will be obtained from monitoring and evaluation will be utilized as feedback into the next business plan. Under motivation Mr. Fukumoto proposed that farmers will undertake study tours:

- (g) A study tour to visit other farmer groups.
- (h) Study tour to be visited by other farmer groups.

After this presentation a PRA exercise was conducted whereby farmers were requested to elicit characteristics of what they perceived as an organized farmer group. They were further asked to rank their group according to how much they achieved regarding these characteristics. The following were the characteristics and how farmers ranked themselves;

Table Mulabalaba Farmers' perceived characteristics of an organized Farmers' Group viz-a-viz their own ranking

Characteristic	Self Ranking (Degree of Achievement)
Agree on what type of crop to grow	55%
Market research by group	80%
Group agreeing on pricing	99%
Agree on quality of produce	60%
Learn good practices from one another	75%

Study Tour to Visit

The farmers suggested that when they visit another farmer group they would like to learn:

- (n) What makes them successful
- (o) How they utilize their irrigation facility

Study tour to be visited,

The farmers mentioned that when they are visited by others they would:

- (l) Show them how they use organic manure
- (m) Show them how we are organized
- (n) Teach them how we make money even though the plots are small

The meeting ended at 13.00 with a closing prayer from one of the farmers.

Annex F

Environment and Social Considerations

The Master Plan for Promotion of Irrigated Agriculture for Smallholders
in the Peri-Urban Areas in the Republic of Zambia
Final Report
Annex F. Environment and Social Considerations

Table of Contents

	page
Annex F. Environment and Social Considerations	
F.1 Impacts and Mitigation Measures.....	F-1
F.2 Reference Environmental Objectives and their Justification	F-9
F.3 Minutes of Meeting at Nega-Nega Scheme	F-12
F.4(a) Agenda: Stakeholders Meeting on SEA Results	F-16
F.4(c) Comments and Recommendations of the Second Stakeholder Meeting.....	F-17
F.5 Term of Reference for the Initial Environmental Examination (IEE)	F-31
F.6 Costs and Schedule of Environmental Study.....	F-34
F.7 SAB (Striking a Balance) Project in Zambia and Malawi.....	F-36
F.8 Wetlands/Dambos, Environmental Concerns and Sustainable Use in Zambia....	F-39

List of Table

Table F1: Adverse Impacts and Mitigation Measures for each Scheme.....	F-50
Table F2: Impacts and Mitigation Measures for each Resource Body	F-52
Table F3: Indicators of Reference Environmental Objectives.....	F-55
Table F4: Linkages of the Main Directions of the Master Plan with Reference Environmental Objectives	F-56
Table F5: Impacts on Reference Environmental Objectives as a Result of Implication of Main Directions of the Master Plan	F-61

F.1 Potential Environmental Impacts and Mitigation Measures

A. Positive Impacts

Socio-Economic Impact

During the site preparation phase preceding construction, a lot of skilled and unskilled labour is usually required. In Nega-Nega, a lot of employment opportunities have been created and to some extent, the positive benefits for the local people are being realised. This impact is considered to be significant and positive.

During operation, the socio-economic benefits of the project include direct employment generation, business opportunities, improved access, direct ‘spin off’ effects in property development and great improvement in local infrastructure and social services. This is the case in all operational schemes. In summary positive impacts include the following:-

- Improved food security;
- Improved access to social services such as school, health for families;
- Improved agriculture skills; and
- Improved standards of living for the community due to increased flow /circulation of funds.

Benefits of belonging to a scheme: A farmer at her irrigated maize field at Clixby Scheme. The crop will be ready for sale in a month’s time, i.e., at the time schools will re open in Zambia. It is also a major component in the Local food basket and constitutes a staple food for the local community.



Another benefit: A banana farmer at Kapululira Scheme displaying ripe bananas, a major source of income for farmers and reliable food crop for the local community.



B. Negative Impacts

(1) Impact on Soil

During the pre-construction period, site preparation/clearing is carried out, and removal of the protective vegetation cover and disturbance to soil surface will inevitably bring about soil destabilisation and erosion. This impact has been identified in Nega-Nega and Kanakantapa Irrigation Schemes which are under construction.

Furthermore the site clearing and earthworks during the construction phase along with the construction of access roads and reservoir land clearing will cause soil destabilization.

In this same phase, soil contamination will also be caused by leakages from poor handling of petroleum products such as oil and fuel spillage during dispensing as well as improper disposal of used oils, hydraulic fluids, and empty oil containers.



Above: Cleared land to pave way for construction of Irrigation infrastructure at Nega-Nega Irrigation Scheme in Mazabuka.

During the operational phase, a particularly significant impact of harvesting on soil physical characteristics is compaction resulting from a loss of soil structure. Heavy in-field haulage fleet comprising tractors and heavy duty trucks is associated with severe soil compaction problems which are likely to occur. This is anticipated in Manyonyo / Nega-Nega where farmers will engage in cane growing and ferrying harvested cane from the fields, require use of tractors. This is also a probable impact at Buleya Malima where farmers own tractors used for ferrying the harvest.

However, the soils at Buleya Malima Irrigation scheme are, according to the findings of this strategic assessment, sandy –Loamy which are less vulnerable to compaction and compaction risks compared to areas with rich loamy soils like the Nega – Nega soils, Clixby and Chipapa soils.

Soil compaction increases bulk density and soil strength, restricting the rooting ability of the trees thereby affecting growth, and decreases porosity and water infiltration rate, which can negatively affect the soil mesofauna. Soil compaction may particularly affect invertebrates in the upper strata of the soil.

The impact is considered negative in a number of irrigation schemes mentioned above.

(2) Impact on Flora and fauna

Removing the existing vegetation, during construction of access roads and setting up of irrigation infrastructure will significantly reduce a broad range of terrestrial flora species and cause certain degree of disturbance or ecological imbalances. The examples are rodents and insects. The effect on bird population will be lesser as they can easily relocate to adjacent areas to set up their new residence/nests. Although on a lower intensity and severity scale, breeding grounds for birds might have truly been affected by cutting trees in areas where they have put up nests.

However the impact on the other animal species in the area will not be significantly affected by opening up the area for irrigation.

(3) Impact on water Quality

As all schemes require sanitary facilities such as pit latrines, construction of sub-standard pit latrines might contribute to groundwater contamination through seepage to groundwater.

Improper treatment of sewage could result in elevated Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD) and microbiological contents of the waterways bearing in mind that most schemes lay in ecological and hydrological sensitive areas. Most of them are along Zambia's important rivers such as the Zambezi and Kafue. The laboratory analysis undertaken during the study has revealed that COD results for samples from Chipapa Irrigation Scheme have been found to be above the ECZ set limit. Furthermore, impacts on water quality may be caused by contaminated run-off of diesel product spillages, leakages from fuel storage areas on-site and heavy vehicles, improper disposal of used oils and from hydraulic fluids and irrigation pumps.



Figure Spilled used oil at Kapululira Scheme pump

Similarly, easily eroded destabilized soils may be washed into surface water sources and cause siltation and sedimentation. Activities that have been reported to have given rise to this impact include erosion on the mountain/hilly sides of the dams/reservoirs. This impact had been identified and rated severe in Chipapa and Nkandabwe. Considering the factors at play in the two affected schemes, Kanakantapa Irrigation Scheme may be a victim of the same impact once fully operational. The impact is considered significant and negative.

(4) Impact on Air Quality

During construction, generation of biomass when clearing site in newly constructed schemes is traditionally followed by burning. Even though it is the easiest means to significantly reducing the biomass volume, management committees running the schemes will consider Windrowing method of land clearing. The windrow is a process whereby tree stands are felled and left in-situ to decompose naturally or just put/thrown on the way sides of the road in order not to abrogate the Environmental Protection and Pollution Control Act (EPPCA) of Zambia, regulations on burning. This method will enhance the soil organic matter status, thus help to restore and improve the fertility and physical status of soils in the schemes. Large quantities of plant nutrients are recycled in the soil through decomposition of tree residues.

Burning of tree remains and bushes is ruled out completely to avoid setting the entire scheme on fire. The other activity that is likely to result in air pollution is vehicular dust. This is likely to emanate from bull dozers, tractors and other machinery.

It is anticipated that the generated dust, dispersed by the wind may affect a zone of up to a radius of 150m from the polluting source/site.

Emissions to the air in form of exhaust fumes from vehicles and machines may cause nuisance to the closest environs

The impact is significant though minimal.

In the operational phase, impact on air quality is likely to come from increased vehicular traffic flows into the schemes, which proportionately discharge emissions to the air. At harvest time, e.g., banana growing schemes, there is usually a significant amount of traffic, mostly light trucks coming to buy and transport the produce to major towns. Also loose soils on cleared areas may be blown off during strong winds and raise dust particulate matter, which may affect the quality of the air in the area. This impact is again significant though minimal.

(5) Impact of Deforestation

This impact was cited as major around Chipapa. It is significant.

(6) Impact on Landscape and Aesthetics

Prior to and during construction, site clearing, mainly at access road opening, and canal construction and site setting, will comprise of activities such as under brushing and tree felling which will affect the aesthetic beauty of the site. The scenic beauty of the areas where construction of irrigation infrastructure will take place will definitely be distorted and the impact created is significant.

(7) Impact of Prevalence of Crop Diseases

In the operational phase, due to either lack of knowledge on the crops grown and/or the chemicals to prevent /treat the disease, prevalence of crop diseases was reported as one of the major challenges militating against improved crop yields and production in a number of schemes. The other probable reason is lack of funds to buy the right chemicals. The impact was reported to be quite devastating, significant and negative in Nkandabwe, Clixby and Chipapa irrigation schemes.



Above: Bean Rust, a difficult disease to control in Chipapa and the scheme extension officer showing consultants an infected field

(8) Impact of Mono-cropping

In the operational phase, one of the negative impacts identified by the district agriculture offices was that of lack of practice of crop rotation in most schemes, a practice that has affected productivity. This is commonplace in schemes like Buleya Malima, Nkandabwe, Chipapa among others that were identified.

Table The practice is negative as it also affects the nutrient status of the soils.

Impacts on Human Settlements	
<u>Construction and Operational Phases</u>	
The problem is significant, severe and negative in Kanakantapa where 94 households are within the dam reserve area and will have to be resettled.	⇒ Resettlement/full compensation according to local and international requirements
Impact of Human-Animal Conflicts	
<u>Construction and Operational Phases</u>	
Most predominant problem at Kapululira Scheme, elephants and hippos destroy banana crops, making farmers run at a loss and also endangering human life. These animals have also been responsible for damaging irrigation infrastructure. It is devastating impact and negative.	⇒ Fence off the scheme with recommended type of fencing to prevent access by elephants and Hippos; ⇒ Liaise with Zambia Wild Life Authority when coming up with mitigation
Impacts on Human Settlements	
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One of the negative impacts identified by the district agriculture offices was that the type of irrigation system /technology being used was not suitable in certain areas. Cases in point that were cited included the gravitational type currently employed at Nkandabwe. This system was attributed the uneven distribution of nutrients and water for plots located far apart; the first farm plots suffering from nutrient

deficit and the far end plots from excess of water. Other shortcomings of the system included: high levels of salinity in the soil; loss of soils nutrients in the drains when canals are flooded; and gully erosion becoming pronounced in the long run

(9) Impact of Malaria

In most areas, e.g., Nega-Nega Scheme, it was brought forward that the reservoirs may turn into breeding grounds for mosquitoes and exacerbate the public health situation in the community as currently there is only a Health Post not a clinic which is already inadequate to cater for the health needs of local people. The same was reported in Buleya Malima.

If not adequately mitigated, the impact could be severe and negative.

(10) Impact on Cultural and Historic Sites

During the construction and operational phases, the problem is significant, severe and negative in Kanakantapa as most community burial sites are within the dam reserve area. Furthermore, consultations with local traditional leaders in Kanakantapa have revealed that where the river will be dammed, is actually a traditional site for conducting rituals. Though not identified by the EIS, the site is traditionally classified as sensitive and any encroachment of any kind is equally considered negative and detrimental to the cultural set up. The site had been used for various rituals by the Mutakama leadership since inception.

(11) Impact on Human Settlements

The problem is significant, severe and negative in Kanakantapa where 94 households are within the dam reserve area and will have to be resettled.

(12) Impact on Unsustainability of Electricity Bills

Though left to sustain themselves, most schemes are unable to sustain themselves especially when it comes to footing electricity bills. At the time of this strategic assessment, some schemes were found either on the verge of stopping their operations or had long discontinued operations due to high, unsustainable ZESCO electricity bills. One case in point was Ipafu which has not been operational for the past three (3) years. The impact is negative and a defeat of the purpose for which the irrigation schemes are created.

(13) Impact of Human-Animal Conflicts

Most predominant problem at Kapululira Scheme, elephants and hippos destroy banana crops, making farmers run at a loss and also endangering human life. These animals have also been responsible for damaging irrigation infrastructure. It is devastating impact and negative.



Figure Irrigation infrastructure destroyed by hippos and elephants at Kapululira Banana Irrigation Scheme (Siavonga District).

C. Mitigation Measures

To minimize the adverse environmental impacts associated with the schemes, several mitigation measures are proposed during site preparation, construction phase and operational phase. Table 3.7.1 gives a detailed account of these proposed measures, and Table 3.7.2 shows the measures for each of the schemes. What follows summarizes the measures for the significant identified potential impacts to address concerns of the communities around the project sites.

(1) High Electricity Bills

- The irrigation schemes, through their management committees, should ensure that every farmer contributes towards the settling of bills;
- Farmers, through their district Agriculture Coordinators should be linked to lending institutions to finance them with agro inputs;
- Introduce high value crops alongside traditional vegetables;
- All irrigation schemes need trained and experienced management and administrative staff to run the schemes. A management consultant would also help put in place, a formidable administration, at a fee. This should be a management group/team of a successfully run Scheme;
- Irrigation schemes should be taken as business entities, hence farmers should take up farming as a business; and
- Promote agribusiness training.

(2) Prevalence of crop diseases

- Introduce workshops/trainings in management of diseases of crops for farmers in irrigation schemes; and
- Promote Crop diversification.

(3) Lack of understanding/knowledge of management of crops grown

- Introduce workshops/trainings in management of diseases of crops for farmers in irrigation schemes; and
- Promote crop diversification.

(4) Seepage of water in canals and furrows

- Cementing main canals as well as furrows

(5) Siltation of reservoirs

- Dredging of reservoirs.

(6) Deforestation

- Through District Forestry Departments, afforest affected areas;
- Sensitise communities on dangers of the practice and the legal implication.

(7) Water Quality

- Sides of rivers / stream /dams should have riparian reserves which will serve as natural filters for any surface runoff from the cultivated areas
- Avoid disturbance of streams, water bodies, floodplains and wetlands
- Proper siting of pit latrines at least 60m - 100m away from water bodies/logged areas;
- Good hygienic standards and proper maintenance of pit latrines
- Have in place an effective monitoring system on site during and after construction;

(8) Air Quality

- Limitation of use of fire and size of burn where possible;
- Exercise controlled and or avoid burning, e.g., Burning in wet season;
- Regular maintenance of field machinery, construction vehicles and equipment in order to reduce emission of exhaust fumes;

(9) Malaria

- Government should be quickly move in and expand and upgrade the existing Health Post to a Clinic

(10) Cultural and Historic Sites

- Liaise closely with traditional leaders on the handling and management of the impact
- Liaise closely with the Local Authorities on what the Town and Country Planning Act dictates on burial sites

(11) Human Settlements

- Resettlement/full compensation according to local and international requirements

(12) Human-Animal Conflicts

- Fence off the scheme with recommended type of fencing to prevent access by elephants and Hippos;
- Liaise with Zambia Wild Life Authority when coming up with mitigation

F2 Reference Environmental Objectives and their Justification

Reference environmental objectives for the Master Plan were selected based on the results of the scoping and the current environmental situation. The selected issues are those which will most likely have negative consequences on the environment and human health and well-being when implementing the main directions of the Master Plan.

1) Reducing air pollution

During construction, generation of biomass when clearing site in newly constructed schemes is traditionally followed by burning. The other activity that is likely to result in air pollution is vehicular dust. This is likely to emanate from bull dozers, tractors and other machinery.

It is anticipated that the generated dust, dispersed by the wind may affect a zone of up to a radius of 150m from the polluting source/site.

Emissions to the air in form of exhaust fumes from vehicles and machines may cause nuisance to the closest environs, causing atmospheric pollution, which negatively impact human health.

In the operational phase, impact on air quality is likely to come from increased vehicular traffic flows into the schemes, which proportionately discharge emissions to the air. At harvest time, e.g., banana growing schemes, there is usually a significant amount of traffic, mostly light trucks coming to buy and transport the produce to major towns. Also loose soils on cleared areas may be blown off during strong winds and raise dust particulate matter, which may affect the quality of the air in the area, which negatively impact environment and human health.

2) Reducing water pollution

As all schemes require sanitary facilities such as pit latrines, construction of sub-standard pit latrines might contribute to groundwater contamination through seepage to groundwater.

Improper treatment of sewage could result in elevated Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD) and microbiological contents of the waterways bearing in mind that most schemes lay in ecological and hydrological sensitive areas. Most of them are along Zambia's important rivers such as the Zambezi and Kafue. The laboratory analysis undertaken during the study has revealed that COD results for samples from Chipapa Irrigation Scheme have been found to be above the ECZ set limit. Furthermore, impacts on water quality may be caused by contaminated run-off of diesel product spillages, leakages from fuel storage areas on-site and heavy vehicles, improper disposal of used oils and from hydraulic fluids and irrigation pumps.

Similarly, easily eroded destabilized soils may be washed into surface water sources and cause siltation and sedimentation. Activities that have been reported to have given rise to this impact include erosion on the mountain/hilly sides of the dams/reservoirs. This impact had been identified and rated severe in Chipapa and Nkandabwe. Considering the factors at play in the two affected schemes, Kanakantapa Irrigation Scheme may be a victim of the same impact once fully operational. During agricultural production, these substances penetrate the crops, which are eventually consumed by human populations causing danger in human health.

3) Preventing deforestation and destruction of fauna and flora

Deforestation is cited as major negative environmental impact around Chipapa.

Removing the existing vegetation, during construction of access roads and setting up of irrigation infrastructure will significantly reduce a broad range of terrestrial flora species and cause certain degree of disturbance or ecological imbalances. The examples are rodents and insects. The effect on bird population will be lesser as they can easily relocate to adjacent areas to set up their new residence/nests. Although on a lower intensity and severity scale, breeding grounds for birds might have truly been affected by cutting trees in areas where they have put up nests.

4) Reducing negative impact on land and soil

During the pre-construction period, site preparation/clearing is carried out, and removal of the protective vegetation cover and disturbance to soil surface will inevitably bring about soil destabilization and erosion. This impact has been identified in Nega-Nega and Kanakantapa Irrigation Schemes which are under construction.

Furthermore the site clearing and earthworks during the construction phase along with the construction of access roads and reservoir land clearing will cause soil destabilization.

In this same phase, soil contamination will also be caused by leakages from poor handling of petroleum products such as oil and fuel spillage during dispensing as well as improper disposal of used oils, hydraulic fluids, and empty oil containers.

During the operational phase, a particularly significant impact of harvesting on soil physical characteristics is compaction resulting from a loss of soil structure. Heavy in-field haulage fleet comprising tractors and heavy duty trucks is associated with severe soil compaction problems which are likely to occur. This is anticipated in Manyonyo/Nega – Nega where farmers will engage in cane growing and ferrying harvested cane from the fields, require use of tractors. This is also a probable impact at Buleya Malima where farmers own tractors used for ferrying the harvest.

However, the soils at Buleya Malima Irrigation scheme are, according to the findings of this strategic assessment, sandy –Loamy which are less vulnerable to compaction and compaction risks compared to areas with rich loamy soils like the Nega – Nega soils, Clixby and Chipapa soils.

Soil compaction increases bulk density and soil strength, restricting the rooting ability of the trees thereby affecting growth, and decreases porosity and water infiltration rate, which can negatively affect the soil mesofauna. Soil compaction may particularly affect invertebrates in the upper strata of the soil.

The impact is considered negative in a number of irrigation schemes mentioned above.

5) Reducing negative impacts on human health (Malaria)

In most areas, e.g., Nega-Nega Scheme, it was brought forward that the reservoirs may turn into breeding grounds for mosquitoes and exacerbate the public health situation in the community as currently there is only a Health Post not a clinic which is already inadequate to cater for the health needs of local people. The same was reported in Buleya Malima.

If not adequately mitigated, the impact could be severe and negative.

6) Reducing conflicts related to resettlement

The problem is significant, severe and negative in Kanakantapa, a new development, where 94 households are within the dam reserve area and will have to be resettled.

7) Mitigating biodiversity risks (human-animal conflict)

Most predominant problem at Kapululira Scheme, elephants and hippos destroy banana crops, making farmers run at a loss and also endangering human life. These animals have also been responsible for damaging irrigation infrastructure. It is devastating impact and negative.

F3 Minutes of Meeting at Nega-Nega Scheme in Mazabuka District

Acronyms Used

DACO	District Agriculture Coordination Officer
ECZ	Environmental Council of Zambia
HQ	Head Quarters
MACO	Ministry of Agriculture and Cooperatives

Meetings and Consultations Held

As part of the legal requirement and consultative process in Zambia, a number of consultations were held with different stakeholders in Sinazongwe, Siavonga, Mazabuka, Kafue, Chingola and Chongwe districts.

Meetings Proceedings

Mazabuka Consultation

NEGA-NEGA (Munyonyo Irrigation Scheme) Date: 16/12/2009

The team of consultants was introduced by Mr. Nonde Alex, the District Irrigation Engineer from MACO that the team came from Lusaka to hold consultative meetings with beneficiaries of Munyonyo Irrigation Scheme.

Mr. Maurice Lucheni, the Vice Chairman of Manyonyo water user association

He welcomed the team. He said he was standing in for the chairman and thanked them for coming.

Mr. Kasapo Pearson, Greenfield Consult

Mr. Kasapo asked those that gathered if they could avail to the team with background information of the scheme.

Mr. Simwambana Maurice, the executive secretary of Manyonyo

He said that Manyonyo irrigation scheme is in Chikankata constituency in Mazabuka District and in Kasengo ward, in Chief Naluama's area. He also reviewed that the scheme used to have over 6,000 hectares of land but has now reduced to just about 3,000 hectares with over 164 households, out of which 32 are female headed households.

Mr. Mufaya L., Greenfield Consult

Asked the gathering if they are all indigenous inhabitants of Manyonyo if not were the indigenous inhabitants relocated?

Mr. Lucheni M., vice Chairman

All the beneficiaries are locals and indigenous to this area. He said there is an insignificant number of people who have come from other areas.

Mr. Lewis Tumbama, Greenfield Consult

Mr. Tumbama wanted to know from whether the scheme is on title or the farmers owned individual plots or indeed it was under traditional land.

Mr. Simwambana

Responded that some farmers have title Deeds for their farm plots, while others have letters of offer and some are still awaiting their letters of offer or Title Deeds. When pressed further by Mr.

Tumbama as to why some farmers have title deeds or letters of offering, Mr. Simwambana said, the process of obtaining Title deeds was cumbersome and expensive for farmers. Mr. Simwambana said the title deed itself cost over ZMK4, 000,000, a far-fetched-dream for most farmers, while transport and delays in Lusaka other costs farmers cannot afford. Mr. Nonde, the District irrigation Engineer added by saying that both the scheme and the land are still a Government property but Government will however handover everything to the farmers once the construction of the dams and laying of pipes is completed.

Mr. Kasapo Pearson, Greenfield Consult

How long is the lease?

Mr. Simwambana

Said at the moment the lease differs from one farmer to the other. Other farmers have the 99year lease, while the others have the 30 and the 14 year lease.

Mr. Kasapo Pearson, Greenfield Consult.

Do you have any water bodies and has the scheme obtained any water rights?

Mr. Lucheni, M.

In response to the above question, Mr. Lucheni said there is only one water body in the area and this is the Kafue River. He said it is from this same river where the scheme will be sourcing its water from.

Mr. Simwambana

Said everything to do with land, water rights and construction of the dam is at the moment in the hands of the Government. However every will be handed over to the farmers once everything is complete. As for fishing rights

Mr. Lucheni

Said it is difficult to tell whether people who are practicing fishing have fishing rights or not because fishing is done outside the scheme area. He said at the there are no fish ponds in the scheme area but rather fishing is done in the Kafue river and mostly illegally.

Mr. Kasapo Pearson, Greenfield Consult

He asked the beneficiaries what kind of irrigation system they will be using once the scheme is fully operational.

Mr. Nonde, The District irrigation Engineer

The irrigation system to be used at Manyonyo will be Farrow/ Surface irrigation.

Mr. Kasapo Pearson, Greenfield Consult

Mr. Kasapo wanted to know if the farmers have observed any physical changes to the Environment that have come as a result of the construction of the scheme.

Mrs. Kavota

She said she has two things;

- (1) A church was demolished to pave way for a canal.
- (2) The road network was severely damaged.

Mr. Lucheni

He added that the fauna has greatly been disturbed thereby displacing wild animals. He said despite all the good scheme comes with it, the water dams pose a great danger to humans and animals if not

fenced. The animals to pose some threat to the infrastructure too.

Mr. Simwambana

He said though they have not seen any positives at the moment, more advantages are to be seen once the scheme is fully operational. He said since they will be able to produce through out the year, production levels will increase thereby bringing more income to the beneficiaries.

Greenfield Consult

Mr. Lindunda inquired from the gathering if they have any mitigation measures in mind to counter the concerns they raised?

Mr. Simwambana.

He said, to reduce the threat of drowning posed to both animals and human beings, the reservoirs/dams should be fenced. He also said there will be a penalty fee for any farmer whose animals will be found near these infrastructures.

Mr. Kasapo Pearson, Greenfield Consult.

Mr. Tumbama wanted to know if Manyonyo water user association has any institutional structure in place.

Mr. Lucheni

He said there is an effective institutional structure in place which consists of the main committee, which is the Executive and seven sub-committees. He said the Executive committee meets twice every month. The structure is as follows;

The Executive

- (1) The Chairperson
- (2) The Vice-chairperson
- (3) The Secretary
- (4) The Vice-Secretary
- (5) The Treasurer

Sub-Committees

- (1) Livestock
- (2) Maintenance
- (3) Security
- (4) Commodity
- (5) Marketing
- (6) Health
- (7) Transport

Mr. Kasapo Pearson, Greenfield Consult

Does the Manyonyo Water User Association receive any assistance from the Government?

Mr. Simwambana

He said as a scheme, the farmers of Manyonyo have received a lot of from the Government of Zambia. In fact the entire irrigation scheme is a grant to the people of Manyonyo. He said besides donating a tractor to the farmers, the Government has been providing extension services to

Manyonyo area. He also said that the Government the only provider of social amenities such as Schools, Rural health centers, etc.

Mr. Kasapo Pearson, Greenfield Consult.

Are there any NGOs operating in and around the scheme?

Mr. Sikajaya

There about three to four NGOs working in Manyonyo at the moment and these are;

- (1) Plan-funds for a new school block and bore holes were also sunk
- (2) PAF-Bore holes drilling
- (3) Nakambala Parish-Home Based Care -Health matters.

Mr. Tumbama, Greenfield Consult

What will be the main crop to be grown once the scheme is fully functional?

Mr. Nonde, the District Irrigation Engineer.

The design crop for the scheme is cane sugar and as such only cane sugar will be allowed to be grown in large scale though farmers will be allowed to grow other crops on small scale basis for consumption as well as for selling. Mr. Nonde told the farmers to go ahead and grow their traditional crops for this farming season. Mr. Nonde also assured the farmers that construction of the of the irrigation system is likely to be complete by mid next year. He urged the farmers to put management measures in place to insure success of the scheme. He advised farmers to either learn from Kaleya small holders or indeed higher them as management consultants. On the fears of lack of room for expansion, Mr. Nonde told not worry for now because the four [4] hectares per farmer given at the moment is only the starting point. He said there might be an increment per farmer per year depending on the first three harvests.

Mr. Kasapo, Greenfield Consult.

Kindly tell the condition or the availability of amenities/infrastructures.

Cratus

There is one basic school and a rural health centre in the area and their condition is fair at the moment. He said the road is a very bad state and need urgent attention.

Mr. Lucheni

Though we have a clinic in the area, it is too small to cater for the Manyonyo community. He complained the in most cases drugs are out of stoke and patients are forced to travel long distances to Nega- Nega rural health centre.

Mr. Simwambana.

He bemoaned the lack of infrastructure and services such as;

- (1) Storage Sheds
- (2) Electricity
- (3) Cold rooms.

F.4 (a) Agenda Stakeholders Meeting on SEA Results

Stakeholders' Meeting on SEA results

AGENDA

Date: Friday 30 April 2010

Place: Board Room, Belvedere Lodge, Leopard's Hill Road, Lusaka

TIME	ITEM	FACILITATOR
08:30 – 08:40	Opening of the meeting	Representative MACO
08:40 – 08:50	Introduction of the topic	JICA Study Team
08:50 – 09:50	Presentation of the SEA results and environmental issues raised	Consultant
09: 50 – 10: 00	Snack and Tea break	-
10:00 – 12:00	Discussion on the issues raised and contributions from the floor	All Participants
12: 00 – 12: 10	Closing of the meeting	Representative MACO
12: 30 -	Lunch	-

F.4 (c) Comments and Recommendations of the Second Stakeholders Meeting

1. Introduction

Due to the limited number of wet months in Zambia which, in the past decades had been coupled by droughts, livelihood disruption from economic projects like the construction of the Kariba Dam and the general emphasis on the promotion of food security, poverty reduction and economic development had over the years prompted government and other private organizations to establish small scale irrigation schemes countrywide especially in dry regions of the country.

The Ministry of Agriculture and Cooperatives (MACO), in conjunction and cooperation with partners like JICA and other donors, through the Small-Scale Irrigation Project (SIP) is and has been implementing irrigation programmes in a number of provinces in Zambia.

The intent of the irrigation policy and strategy is to increase food security and generate household income in the schemes in order to empower traditional farmers. In order to improve the productivity of the small scale holders, it is imperative that a comprehensive master plan is put in place and this environmental strategic assessment constitutes an important part of the plan.

The workshop was attended by 29 Participants drawn from MACO Headquarters, District Agriculture Coordination Offices and Schemes that took part in the study.

2. Workshop Preceding

This section summarizes presentations that were made at the workshop. The section also summarizes issues and questions that ensued after each presentation.

2.1 Opening Remarks

Dr. Massamba, Environment and Social Considerations Expert, the Study Team

Dr Massamba welcomed all the participants and called the meeting to order at 09:00hours. He at it was because everybody was waiting for the Chief Organisers (MACO) to come.

He then called upon the Study Team Leader to give his remarks.

Mr. Yamamoto , Study Team leader

Good morning Ladies and Gentlemen, I'm the team leader of the study team and my name is Mr. Yamamoto first I would like to express my sincerest appreciation to all the participants here for attending this meeting. We would like to clarify some environmental and social impacts for formulating our master plan. This strategic environment assessment result report was done by Greenfield Consult in December 2009. So after his presentation please we will comments and advices which we will accept and appreciate to make the foundation of this master plan. I would like again to thank you.

Mr. H. Sichembe, Deputy Director, Technical Service Branch (TSB)

He acknowledged the presence of everyone thanked the participants for coming and apologized for coming late and went straight to talk about the importance of Small Scale Holders in Economic Development.

The Deputy Director said that he wanted to state that the subsector of Irrigation was one of the key

development areas in agriculture. This country's agriculture is mostly dependant on rain fed agriculture, but the government has seen the potential that is in Irrigated agriculture hence the study was thought of as one of the key driving factors that will be able to stimulate development.

He emphasized that what government wanted to see at the end of the day were actions that are practical. These actions must be practical and should be implementable. It will mean nothing if the actions in the master plan cannot relate and JICA would have spent tax payers money for nothing.

He urged all the participants to contribute as much as possible so that at the end of the day there is a good Master Plan.

He re emphasized adequate participation as it was key in the ownership of the Plan which he said was also key towards contribution to the overall development of the sector.

Lastly and behalf of the Permanent Secretary who could not be with us, Mr.Sichembe urged all present to learn and said that learning never ends.

Dr. Massamba

Before the presentation, I would like to give a brief introduction of SEA. As you know today's presentation will be on the Strategic Environmental Assessment which was done by JICA, in December, 2009.

First I would like to, on behalf of the Ministry of Agriculture and Cooperatives (MACO) and also JICA Study Team, to thank everyone here for coming and hope that today's meeting will help to contribute in the direction our study will take and in promoting irrigated agriculture for Small Holders in the country.

Dr Massamba said that he was in charge of the environmental and social considerations of the study.

To put it more clearly, environmental and social consideration means considering environment impacts on air, water, soil, flora and fauna as well as impacts including involuntary resettlement.

SEA is an assessment being implemented at the policy and planning and program level rather than at the project level. It refers to a range of approaches to strategic decision making to integrate environmental concerns into policy planning, and program and to integrate the linkage with economic development.

The purpose of the SEA study is to clarify the probable impacts in both environmental and social terms which are expected to arise in some of the activities related to the irrigated agriculture promotion in 4 provinces (Copperbelt, Lusaka, Southern and Central), through intensive Desk survey and complementary field survey, as part of the Master Plan for promotion of irrigated Agriculture for Smallholders in the Peri – Urban Areas.

He then called upon Lewis Tumbama to present the results of the SEA and urged the participants ask questions, comment and contribute regarding the presentation.

Mr. Lewis Tumbama, Greenfield Consult

The presentation mainly looked at the impacts identified, positives and negatives, their resultant mitigations, policy considerations and options proposed by the study Team. See attached slides for the complete presentation.

Dr. Sugimoto, Advisor for MACO HQ from JICA

Your impacts is mainly the ones from the project to the environmental, but is there any impacts form the environment to project, did you look at it that way, for example there might be impacts due to climate

change, change in rainfall pattern where the surface floor has changed and it is affecting the sustainability of the project did you look at it in that perspective?

Mr. Lewis

Although we didn't pick up any such impacts to do with climate change, but these are issues that we can all contribute to in this house. Climate Change impacts require specific studies into its impacts.

For instance if we look at the problem of low water levels for instance at Chipata, although of late rainfall pattern has been such that we have experienced an increase in rainfall in the last 4 years yet the scheme has problems of water. It is difficult to bring in issues of climatic changes.

Issues of flooding, we were told they are all as a result of the canals not being even because we never picked up complaints from farmers that there was too much water in the past season and as a result the whole scheme flooded.

▪ **Mr. Sichembe**

Just wanted to appreciate you for doing a recommendable job, but what I want to find out was whether we can be advantaged with a report not just the presentation most probably in electronic format and improve on the value of the project.

As it is there may not be the time for everyone's input and the other thing I considered is that of inclusion of the members of the Technical Working Group. They would need this information for comments and also other members form MACO.

▪ **Mr. Lewis**

The document is at draft stage and your reaction and input will enhance and enrich it If it is sent to the mentioned be seat to stakeholders. We will definitely bring the document.

Mr. Peter Chola, Department of Water Affair, Ministry of Energy and Water Development

Thank you for allowing me to participate also, we are here so that we can input to the good work the consultants have done. As a follow up to the observation made, apart from the PowerPoint presentation it is always good practice to give the draft in which ever form it is, which should be accompanied by the TORs. The next time you call for such a meeting, we expect that at least two weeks before to the meeting you give us the working document, TORs and draft report. You have done well to provide Power Point Print outs. I want to emphases that in your presentation, there are a number of schemes you covered and your impact analysis, however what I have seen is that in some schemes, you have indicated the positive impacts and in some just the negatives, can we balance up. Please maintain the uniformity throughout.

In some areas you have indicated the money spent and not the source e, so we expect in all the other schemes to reflect that kind of information. If you can do that the better. If you fail to get that information, the sources then indicate in the document. There was also the issue of Water Rights, some have, and some don't have, same as Title to land. Our policy recommendation to this is that let us make the schemes acquire water rights and title to land.

If they have got these two pieces of instrumentals, it would allow them to go to the bank and borrow for the development of their schemes which don't have water right and titles. So what can we do to entice them to get?

On the Issue of sustainability, water rights and titles are prerequisites, but apart from that use talk about the formation of water associations, can we go beyond them and formalize them, others have become

co-operatives and are registered as such, we can be sued and they can sue, they can be put to task.

Another issue of concern was the use of various technologies, pumps, paying of electricity bills, yes these are challenging and what I can say which is if the co-operatives can employ scheme operators. Preferably a mechanic so he can carry out some preventive maintenance.

It was observed, that you have lamped everything to Government. What are the things the farmers -themselves can do?

-What are the things MACO can do for them?

-What are the things the irrigation system can do?

The issue of animal-human conflict, elephants are very strong, ZESCO have tried to control them, they were falling pylons in the plains in western province, for those who know periperi, they say you can plant at the edge of these schemes, and also try to find a way of terming black ants. Elephants run away from them. In South Africa farmers have used these two methods.

Mr. Lewis

Yes on the issue of elephants we did propose to plant Chili but like I said we have to be careful and consult the Zambia Wildlife Authority for guidance. They can advise on the kind, varieties of chili that can be planted.

Mr. Tennyson Sikakwa, Clixbly.

Most of the issues have already been raised by Mr. Chola, but I just have one or two concerns. The first one is, are we handing back the sheets of papers.

Mr. Lewis

Yes because you have commented on them and we need these comments.

Mr. Tennyson

What is coliforms in water? The other one is it is tricky selling at Soweto market. We find difficult to do business. At Soweto, when you are from a farm, the only being you will know is your family. So when you come to Soweto, you are in a sea of people and so you get intimidated, you can mention your price which covers the cost and you expected profit, but you get intimidated by the way they do things there. So it seems better you have a middleman there. He will want 5% of what you get. But that's not very good it is better you deal with the buyer; I don't know what others think.

Mr. Peter Mwale, Environmental Engineer

Coliforms is one of the parameters we look at when analyzing the quality of water. In this case, the quality of water used for irrigation. Coliforms are bacteria formed in water. So like the one in clixby, we found high numbers of coliforms, looking at the site from where we collected the sample, its right next to the summer treatment plant.

Further research revealed that the summer plant is not operational and all the stuff from Town goes straight in the Kafue River. There might be need to revisit the site at another time of the season to see the levels of the coliforms.

Mr. Sampa, Irrigation Engineer, MACO Sinazongwe

I've observed some critical misrepresentation on Buleya Malima, I'm not sure if even Buleya Malima was visited.

Because the issue of fuel is no existent and yet it has been raised. The pumps use electricity and actually are mounted on a platform on water.

The other issue is of fuels around the pump house, and I am saying the pump house is for electricity. The other issue was to do with erosion, it is also no existent, because water is pumped directly into the reservoir and flows by gravity, so the issue is no existent in the irrigation scheme. May be the study team did not see the right people to get correct information.

Mr. Lewis

When we visited Buleya Malima, we had a meeting with the DACO, 2-3 other offices, at district level and we tried to catch the extension officer but the phone kept ringing. We also tried to consult with you; you were out in the field. True there could have been a misrepresentation of facts or even crossing with other schemes.

We however went to site and the person sited next to you who is the chairperson of the scheme was with us. Besides photos are there for you to confirm. It might be an oversight. Maybe it's for another scheme but we will confirm, thank you.

Mr. Philips Simbule, Chingola

I want to make a comment on Ipafu scheme and particularly on the mitigation measures where it says "do away with electricity propelled pumps". I was wondering if the community said that themselves because the history as we know it, is that there was a diesel propelled pump at first and water was going down to the coffee fields by gravity, under Rural Investment fund, we bought a diesel propelled pump which the farmers said was too costly to maintain, to be going into town and bring drums of diesel, so they request for an electric pump to be set and through the coffee board and LEAF, had to make available that electric propelled pump. So if they said again that they want to do away with this, I think they need to come up with, like you said on another scheme. To be able to inter crop or find a system that can allow to grow all year round crops other than just coffee, so that they can realize money and find a way in which each farmer can contribute towards the bills. The history is that under UNIP, they were pumped, just given, even a fuel pump was provided, so they never know of running costs. But slowly we are trying to impart ownership.

If an electric machine that they wanted. There is already a reservoir so maybe the water can be pumped first into the reservoir and line it with plastic to reduce seepage. The initial plan was actually coffee growing, not that the change of the system.

Mr. Nyambe, Mujabula

I want to understand the people you interview in the community because the target was to deal with extension officers, beneficiaries and so forth. I want to know if you included politicians and traditional.

You said lack of experience in farming Clixby, Kafue, these farmers have been on the ground since 1995 according to scheme construction and up to date they still lack experience in farmers in basic farming, I think to make an impact on this I propose besides extension services, farmer to farmer training, you are saying that in one scheme, there is positive farming skills. Probably introduce farmers exchange visits.

Mr. Anderson Mutinta, MACO Siavonga

Kapulurila is located in Musaya ward not Sikoongo.

On impacts and mitigations, I note that there is a recommendation for government to provide inputs; I don't know what kind of arrangements would work out? I thought we would need clarification and modalities on how that can be done.

Looking at the age of the machinery I think replacing them would be the best.

On the reducing of the use of electricity and going into dambos and wet lands, do these places have dambos? Electricity of course is a big issue these bills come as a result of using water for irrigating; maybe they should be using this water on high value crops. Dambos and wetlands will have other considerations.

Mr. John Hikanyemu, MACO Kafue

What you have put on the social aspects seems to have come only from the farmers. I don't see what has come from the technical officers;

Because we would have looked at the grassroots commitments are the farmers contributing monthly or depending what they have agreed, how is the maintenance there, but it's like what is there is for the government to do this and that, you would have taken note of what you were told at the offices. I remember you passed through my office and I made an input on these schemes but I don't see it here. So its better you balance the comments, what the farmers are complaining about, what the technical officers are saying about the farmers. In that way we would be able to come up with a balanced conclusion.

On Clixby there was a complaint of draining which was also mentioned by someone. With these farmers, the government has actually done a lot; probably it has gone out of its way to support these farmers. There are weeklong trainings two times, one two occasions the government paid for their electricity bills. So if you mention just one side, I know they have complaints but let's balance thing.

Mr. Christopher Mabvuso, MACO Lusaka

On our farmers in the schemes (Clixby) much as the farming is done collectively, at the time of selling, its like each one done market for himself. So it becomes a big problem dealing with the middle men at Soweto market because it's like each famer with his/her small quantity of produce to negotiate based on that. I think it would be more desirable of people from the schemes market together as a group. But that is the problem because even the way schemes are structured, there is no compelling the scheme to contribute or to operate in a certain manner and that brings me to the point you raised about issuing tiles to individual farmers in the scheme.

There have been instances where farmers in the scheme have become inactive and they don't even want to let go of the land in the scheme and nothing can be done to them. So they will start selling or renting that land to anyone who wants to produce on that land. The impact of that has been the users of that land have to recover the cost incurred. It's an extra cost of renting that land. Maybe we should look at a system and come up if someone is registered in a scheme; they only belong as longs as they abide to the set principles of that scheme, in the event that a member becomes inactive, the scheme will have the right to take that land and give it to another person. Unlike leaving the land to someone who is unproductive. I wanted to caution on issuing titles to individual farmers in the scheme, it might work in other instances, but it has worked against the productivity of the schemes. Then also the issue of dredging in cases where there is siltation problem. Actually most of the places I have been to is major

and when you talk of dredging you will dredge and keep on dredging. The other issue is to try and address the main cause of this.

I don't think we have a riparian management policy and if it's there then it has not been enforced. Much as we encourage replanting of trees but what about that production which is done in the edge of water reservoirs, what are we doing about it. So let's outline clearly what we can produce along these waters. Have some enforcement of some sort.

Mr. Etambuyu Anamela, MACO Chibombo

I wish to agree with the report on the fears from Chibombo District and I also want to mention that maybe fears are coming because we have not been meeting. We have had just one meeting, in that meeting; the chief didn't even want to be part of the meeting because he didn't get the whole picture or understand what is going to happen or how important the project is. So the suggestion is that let's have consultative meetings with the Chibombo administration and also the chief. Maybe through the discussions positive thing will come out and be able to convince the community and chiefdom that the project is important and very necessary.

Mr. Boris Luchine, Manyonyo Water Users Association

We are very happy to have this kind of meeting and we are learning a lot and sharing. Mr. Chola made a number of observations; I would like to comment on one or two. (i) where he talked about water users associations, as the institutions which you can't sue, or take to task, correction there, I know of our association, we are a registered body with registrar of societies. So you can sue us and take us to task. Yes we need to move beyond that as in our case definitely we can't manage as farmers a scheme of that magnitude. So of course as a result we have sort as farmers to engage management consultants. In the form of Kaleya smallholders, a draft agreement has been written. We haven't yet signed though. So we appreciate. As for water rights and I think one of the basic issues about water rights is not a cheap thing. It's expensive in that I don't think smallholders can afford. They are paid annually. In our case the government paid 17 million Kwacha. Meaning that when the scheme is handed to the farmers, to continue paying that much. We will need some mitigation from other sources. The same goes for titles for farmers. Individual titles would like to have title to my own piece of land. In the case of Manyonyo for a farmer to get title they need to spend about K5 million from the beginning of the process right to the end. Very few farmers in Manyonyo have ever handed K500,000 at once so titles are beyond their reach.

The cost of power is expensive and already Zesco is talking of increasing tariffs. These are the things that those implementing these programs should take into consideration. In southern province if you don't own cattle means you are poor. Doesn't matter what you own. So it's a mindset which needs to change. In Manyonyo we have a situation whereby infrastructure has been built, people with animals around. They came together to complain that since the scheme comes into place, there animals will have nowhere to graze from. They went as far as the DCs office, the town clerk, the DACO. They are genuine fears but we try to organize how to mitigate these fears. Two years ago we took farmers on a conducted tour of Kaleya holdings in Mazabuka and saw how farmers there fair and making a good living out of growing sugar cane. They too own cattle but have found grazing land somewhere outside the scheme.

Mr. Nkandu Herbert, Chipapa

The figures on the scheme were exchanged; it's the only other scheme with more female headed households than any other scheme, 70 females and less male headed households. On the dredging and siltation of the dam, we sat after your visit and reviewed what came up with other mitigation measures.

Mr. Martin Seshekanu, Department of Agriculture, MACO HQ

Regarding the birds migrating Manayongo, is it regarded as a bird sanctuary? Or could it be that they are looking for food at the particular time. Manyonyo the issue of title I thought the group had agreed and settled on organizing a block title that could then be utilize and could then be managed as an enterprise as one unity. That would have helped and let the farmer, those who had titles so that they surrender their titles so that it comes under one block. When we come up with these projects, there are projections and economic return injection farmers must be able to pick it up on the investment that government makes.

Every farmer business out of this investment so that the running cost can be part of what farmers could be working on. Then the situation of kapulurila and the issue of alternative crops, the report is not reflecting whether that was picked from farmers what do they think could be the alternative crop but could that have market, or have they observed a particular crop that could be more marketable than the current crop that could be more that until our farmers, despite being a group still want to do things at individual level when it comes to marketing. When it comes to the actual preparation of land they need the rest. But marketing is one of the key part and they better be organized. So they can have the bargaining power and even hiring a truck to transport their produce as a group. Finally the issue of Kanakantapa the centre had been so much of the youth, but it's a mixed grill and you may wish to know that a number of farms have been sold and now there are some new people who where not in the initial group and therefore they may not have the model that was there at the start. As for as they are concerned they have bought the land and they can do any thing they want.

Mr. Stanford Mulawa, Buleya Malima

On transport, you said the mitigation was to find a loan if you consider someone has failed to pay, electricity bills, how can they find money to buy a vehicles?

Water bills in 3 Million ZMK. So I think MACO should come in and help to find transport. Because that the main determining factor in selling price. When a buyer travels from Lusaka to Buleya Malima, he will first talk of transport of the produce from Sinazongwe. Transport is a major problem in irrigation schemes. If MACO doesn't come to help the farmers; it will be a perpetual problem.

Mr. Martin Seshekanu

Actually farmers can sequence their crops and plant in group there are times when you with these major buyers, they wouldn't like to have a season when they don't have any produce and another season when they have a bulky and big consignment coming. They have problem in dealing with that. So if they can organize themselves to sequence their produce, it becomes very easy so like when you link with big buyers like Shoprite, they would like to have consistence.

Once you have a break, they will say you are not reliable; they would therefore rather go to others who could supply them with consistence.

Mr. George Phiri, Coordinator, Small-scale Irrigation Projects (SIP)

I like the point that was raised in the presentation on the issue that management of schemes should be independent of the farmers themselves, so that when it comes to paying bills or collection of contributions there would be no sacred cows, to escape paying of the bills.

That in my view point to the issue of management. Research carried out in the past on these scheme shows that they have not performed not because the water was not flowing, the engineering has been done very well, the market may be there but the problem is the coordination which centers on the management of these schemes.

Yes the government has the responsibility, but much as it may have all the money, it wants see the schemes stand on their own. So government is pumping in the money, but is it sustainable?

Government puts in money for infrastructure in the first place , the schemes we are introducing are small companies that which the government wants to hand over to beneficiaries but the question we are asking is that is there the capacity to handle these companies on the part of the schemes? Because all these discussions hinge on when management will be able to make profit, marketing, collecting fees, water charges etc. again the blame will go to the extension services in the government? We have the DACOs here and they have capacity? We have the DACOs here and other senior people from government.

How about if they employed somebody to coordinate and manage and is paid by the scheme, so he could be able to do market surveys, plan cropping, how about not only relying on extension officer from government?.

Why can't the scheme employ one or two so that they can handle the marketing, the engineering and the accounting of the scheme. Can we consider it as a step further, are these companies sustainable?

Kenya is able to export flowers, from small scale farmers every week to Europe. How do they do it? They have employed people with offices and they are paid by the schemes to manage. South Africa can export mangoes to Europe, how have they managed? They have employed qualified people on full time to manage the schemes. So I wanted to bring this to your attention to think in these lines as managers of these schemes, beneficiaries. We are trying to do that with Nega-Nega (Manyonyo)

In Kaleya we see a success story there, because they have a qualified team to manage the scheme.

This exercise of preparing a master plan is going to end up into the establishment of successful schemes by government and co-operating partners.

May be private sector too can provide extension services , it being done by Nakambala, Kaleya and many others, why can't it be done also by our schemes like Chipapa? Employ one and say they will be paying him as a group so that he organize market, he plans when and what to plant and transport the produce to the market.

So as we look at the social and environmental concerns, let's also looks at the management as it has been identified as the major problem in the schemes in Zambia.

Mr. Sichembe

You indicated to us that this is a draft report and that you are sending a full document of more than 100 pages electronically, so that we can comment. There are other who are not here, who where not invited, whose expertise maybe necessary. I also wanted to state that, that document has an explicit analysis of the issues from the perspective of a consultant such that we are able to follow through, and eliminate

what may not be necessary. We also want to know in the document, which document you consulted, not necessarily the people you have consulted.

We would want you I think like data become very critical, we are not going to make informed decision on the bases of observations.

We must have data, raw data which you have looked at and analysed whether that data in itself, taken at that particular time is valid or should be validated.

We also need a dossier of comments, separate from that document. Now in your presentation before ending you gave what you are calling policy consideration for operational schemes. I got confused at one time; I didn't know whether we are talking about these issues which I think are not related to any policy.

We must be guided which policies as government we should be able to look at and re-examine e.g., NAP, EPPCA, NIP. Policy goes along with legislation aspects; show us the legal framework also. We have now acknowledged the problems that the schemes are going through, we will need actions from them as part of the solution for the future. In that case we want to see the legal frame too.

Also differentiate between administrative managements from actions such as strategies. The strategic means of what you are proposing as an alternative. It will be easy now as government to look at and say yes on this policy, these are the strategies that are actually requested to look at.

So that relevant authorities can look at and when we receive the actions in the master plan we will be able to agree. Our ultimate output at the end of the day is the Master Plan, therefore the actions you are proposing must be relevant to the master plan on irrigation in peri-urban focusing on environmental and social concerns.

Mr. Yamamoto

Thank you ladies and gentleman for this good meeting, you have given many good comments and opinions and advice to the formation of the Master Plan, I also want to thank you all for attending.

2.2 Written Submissions From all participants

The following are the written submissions from all participants

Written Submissions from the JICA Workshop Held on 30th April, 2010 at Belvedere Lodge, Kabulonga

No.	Name of Person Submitting	Submission
1.	N.H. Nyambe- DACO Mazabuka	Please include on the list the traditional leaders and political leaders under. Approach and methodology.
		Enhance farmer to farmer training in addition to extensions works
		Recommend that Clixby farmers do farmer exchange visits to Nkandabwe to gain more experience on farming.
		Should include marketing problems.
		The church was relocated and is to be reconstructed. (In Nega Nega).
		On utilization of agrochemicals, include integrated pest/disease control to mitigate issues of pest misuse. (policy consideration for operational schemes)
2.	Maurice Luchen- Manyonyo Water Users Association (MAWAUSA)	It is Manyonyo Irrigation Scheme NOT Nega Nega.

No.	Name of Person Submitting	Submission
		Financial constraints on acquiring titles for majority farmers in Manyonyo.
		Social economic impacts need to be addressed further. Cattle rearing vs Sugarcane growing.
		Issue of cost of power is a big concern- ZESCO may need to give subsidy to small scale irrigation farmers.
		4 Ha of irrigated land, however each household has 10 Ha of land.
		Slow implementation leads to impatience and loss of trust in the project.
		Seepage is primary.
3.	Nangogo Annie- Extension Officer Chingola	Ipafu Scheme started in 1968
		Doing away electricity propelled should not be the mitigation measure. It is better farmers start something that can help them clear the bills. (Ipafu)
4.	Peter Chola	For that scheme state both positive and negative impacts of the projects. (Chipapa) Issues recorded not reflective of the true picture on the ground. (Buleya Malima)
		Crop rotation, Use of organic fertilizers, introduce treadle pumps and Drum Drip irrigation. (Buleya Malima)
		Issues of sustainability – water users association
		Maintenance account needed
		Need to formalize position of plant operator. (nega nega)
		Crop rotation in banana schemes- Furrow
		Plant legumes in between banana rolls in Kapulurila
		Control human –animal conflict, apart from fencing, plant pigmy chili plants. (Kapuluria)
		Make a cooperative society at Ipafu in order to procure farming implements and inputs.
		Crop diversification away from coffee monoculture which is vulnerable to international market climate.
		Acquisition of water right for schemes that have not done so. (policy considerations for operational schemes)
		Introduce at least one commercial irrigation entity to support small scale holders as in outgrower schemes.
5.	Tenyson Sikakwa- chairperson Clixby farmers group	Lime application should be encouraged
		The catchment area of the scheme has no parts with dombos.
		Members too poor to raise money from other sources to pay electricity bills.
		High value crops have been identified.
		Extension services highly needed.

No.	Name of Person Submitting	Submission
		Training farmers in basics of farming needed.
		Sprinkler design not suitable for a start.
		Mitigation by group- working to connect the 200000+ litres tank to pipes taking water to plots so that farmers can drip irrigate or flood irrigate, i.e pump into tank, when full switch off pump and farmers use water in the tank. This way pump shall work for 2.5 hours per day instead of 10 hours per day.
		Economic considerations should be encouraged. Farming along slopes should even be punishable. (policy considerations)
6.	G. Phiri	Policy considerations
		Could we consider hiring professional management services? Or could PPP provide and answer?
		Apart from Soweto market, find alternative market. E.g., Lodges etc.
		Consider engaging qualified scheme manager to be paid by scheme. (Clixby)
		There is no need for water rights for international water course. (Buleya Malima)
		Sub-dividing farms in the process of construction after design had been finalized. (Nega Nega)
		Kapulurila is in Musaya ward and not Sikoogo.
Let there be consultative meetings between Chongwe and chibombo to allay fears about negative impacts to upstream stakeholders of kanakantapa Dam.		
7.	Philip Simbule- DACO Chingola Comments On Ipafu	Changing the system of irrigation is important but to do away with electricity propel pump is not the wish of the farmers. Since initially they had diesel propelled pump.
		All year round production apart from coffee will allow farmers to have income. Farmers to be encouraged to contribute towards bills.
		A reservoir exists and furrows exist, all that is required is to rehabilitate.
		The furrow was not abandoned due to coffee; the furrow irrigation was also used for coffee before the electric pump was installed.
8.	E. Anamela- DACO Chibombo	For the sake of sustainability more involvement of other stakeholders. (Ipafu)
		Need for consultative meetings for Kanakantapa with Chibombo and Chongwe administrations.
		Discussions with the Chief would be fruitful.
9.	Dominic M. Namanyungu- SAO Kafue	The scheme has 75 female headed households and 45 male headed households.
		Mitigations for Chipapa Continue canal construction to reduce underground seepage.
		Dredging silting dam periodically.
		Collaborating with farmers in raising seedling (trees).
10.	Stanford Munakacheka- From Buleya Malima. <u>Comment on Clixby</u>	Warehouse for fertilizer, inputs must be introduced. Training to farmers must be conducted. MACO must be involved in negotiating for electricity bills for farmers.

No.	Name of Person Submitting	Submission
	On Buleya Malima	The water is pumped direct to the reservoir. No fuel is being used. Canals must be revisited which were rehabilitated because they were not done well.
		On Nkandbwe Silt come from all over the hills where people were settled. Dredging can be possible because water comes from the ground. No redesign because the irrigation is landlocked scheme with traditional land around.
11.	Mr. Thomas Zackaria Nyabbepo Kapululira	Kapululira irrigation Scheme is under Musaya ward not Sikoongo. Human and animal conflict, the best solution to this is only to fence the scheme like Lusitu Irrigation Scheme. We need help by means of a loan. This can help our cooperative grow.
12.	Gibson Shachibala- Chairman kanakatapa Water users Association	483 hh only covers 3 villages out of 14 for the first phase that covers 620 Ha.(Will benefit) Additional land of 1000-1500 ha will later be put under irrigation. Users association founded on 28/09/07 including members from upstream. (Chibombo) Capacity building on farmers still going on. Association not renewed from 2008 to date due to the delay and slow pace of the project. We are worried that the association might be deregistered because the penalty fee is just too high for the association about (ZMK6 000 000). Our appeal is to lobby from well wishers to come to our aid. Motivation needed to people on the ground doing the work for most of the people holding offices, eg allowances, bicycles.
13.	Sinda Mabvuso Christopher- Senior Agricultural Specialist -irrigation Lusaka Province	Salinity in irrigation practice has a cumulative tendency, thus unless managed, may render irrigation redundant. Banana plantation loss of soil fertility and productivity, improve fertilizing regime and thinning unwanted plants to maximize water and nutrients usage. Drip efficient in terms of power however on a large scale may not be possible. Coffee is high value crop. so far the cheaper mode. In some instances mono-cropping is inevitable. Sensitization good but should be backed by laws/enforcement.
14.	Martin N. Sishekanu	Farmers to organize themselves to produce in butches, tailored towards consistent supplies of the produce.(Nega Nega) For migrating birds, is the area a bird sanctuary? How far from Siavonga and what could be the best marketable crops. Was there any suggestion from farmers on kapululira? Kanakatapa is not only for the youth but for retirees too. A number of old settlers have sold to new comers.
15.	Mr. H. Sichembe	Need Report and TORs for the study Policies –NAP,NIP Change Policy Considerations to Strategic considerations. Show Outputs, Strategic considerations in the master plan. Indicate Documents consulted. Attach a Dossier of comments.
16.	Herbert Nkandu- Chipapa Irrigation Scheme Vice Chairperson.	Chipapa is in Malundu ward. Get contracts on crops to be grown. Try seed growing as an alternative. After dredging raise embankment on the east and leave only 4 in lets
17.	Charcles N. Simulunda- DACO Chongwe Comment on kanakantapa	Back throw of water dammed will affect families upstream. What benefit for upstream displaced farmers?
18.	Christopher Mulala- DC's office Chongwe	Involve the local authorities and the District Commissioner's offices together with traditional leaders for consultative meetings to avoid the fears of the communities in chibombo District.

No.	Name of Person Submitting	Submission
19.	John Hikanyemu- DACO kafue •	This year's budget on chipapa will address some of the issues the scheme is facing. Irrigation method may have proven unsuitable for the farmers in Clixby Contributions by farmers are irregular in Clixby Grass root commitment questionable.
20.	Mwase Phiri – •	Consult Chief Irrigation Engineer for policy direction, and to make sure that the study is in line with irrigation policy and strategies and NIP. (Methodolgy) Is this flooding from the main canal? To what extent does it affect the entire 10ha scheme? (on Chipapa)
21.		There is a resident CEO in the area!! What specifically do we mean by intensify extension?(on Chipapa) Pollution from human activities on the river? (sewer system nearby) (on Clixby) Farmers were trained on how to run the irrigation system, including irrigated agriculture in Clixby
		SIP has Water Rights. International water course hence no need for water rights. on Buleya Malima Extension services is demand driven especially in irrigated agriculture on Buleya Malima
		The issues in Kanakantapa are discussed in the full EIA done under SIP. The RAP was done through transparent and consultative process involving various stakeholders in both Chongwe and Chibombo districts.
22.	Davies Mulenga Sampa -Irrigation Engineer Sinazongwe	On Buleya Malima No such environmental issue as soil erosion. No fuel leaks. Pumps use electricity. Pump house in place and need no attention. Government to deliberately consider providing inputs to irrigation scheme starting March.
23.		On Nkandabwe Dam too deep to be dredged. What can be dredged is the reservoir. Nkandabwe irrigation Scheme has no title deed- it's on customary land.

Mr. Martin Seshakanu, Department of Agriculture, MACO HQ

He wanted to know whether the birds migrating from Manyonyo as to whether the area is a bird sanctuary or they are moving out because they are looking for food.

F.5 Term of Reference for the Initial Environmental Examination (IEE)

1. Objective

The Initial Environmental Examination (IEE) is carried out for investments or projects with a low negative environmental impact, or for those projects for which the reference environmental objectives of reducing the negative impacts are easily achievable as demonstrated in the Strategic Environmental Assessment (SEA) study undertaken in the formulation of the Master Plan/Action Plan. These include all planned rehabilitation projects or model projects due to be implemented in the plan.

The IEE study will focus on the following 3 points:

- Description of the initial environmental conditions of the investment;
- Qualification and quantification of impacts depending on the nature of the rehabilitation work planned;
- Proposal for compensatory measures / mitigation measures and detailed estimate of the cost of the measures taken before, during and after the start of the work.

2. Study Area

The IEE study is required to be carried out in the following four (4) models projects.

- Chipapa Model Scheme (Kafue district)
- Bwafano Model Scheme (Kalulushi district)
- Natuseko Model Scheme (Kabwe district)
- Mulabalaba Model Scheme (Kazungura district)

3. Tasks of the Consultant

3.1 Description of initial environmental conditions

The Consultant will analyze and study the following environmental components in each project site as follows. The purpose of this study is to establish as accurately as possible a baseline of the area to be subject to rehabilitation.

It should make it possible to assess quickly and summarize the following points in that area:

- Climatic characteristics of the area and rainfall;
- Topography, geology and soils of the area and surroundings
- Susceptibility to erosion and location of erodible areas / eroded;
- Physical characteristics of streams in the area and surroundings;
- The flow of these streams during the dry and wet seasons;
- Physical characteristics of groundwater;
- Physical, chemical and biological characteristics of water quality;
- Current agricultural conditions (farm practice, yield, etc.).
- Type of and procedure for applying fertilizers and pesticides for major crops and quantities applied in the area and surroundings;
- Current and future residual toxicity of pesticides and fertilizers in the soil and air;
- Current and future agricultural practice and future condition of application of inputs
- Current land use, legal status of land, especially in the forest area
- Quality, scarcity and vulnerability of natural vegetation and plantations;

- Present condition of human health and type of water borne diseases
- Estimate or prediction of the number of patients after completion of the project
- Current control method proposed for these diseases
- Proximity and availability of health centers
- Knowledge of these diseases by the public
- Distribution and density of population (cities, districts ...);
- Water rights and fishing rights for the water source;
- Land tenure system
- Local traditions and norms;
- Current social problems and possible solutions
- Localization and quantification of sites of cultural and social uses (cemeteries, historical sites, aesthetic sites, landscapes, etc.).
- Summary description of economic activity in the area of influence of the proposed investment.

3.2 Qualification and Quantification of Direct and Indirect Impacts in the Short, Medium and Long Term

The Consultant will refine the qualitative assessment of impacts made during the SEA and quantify the most significant impacts.

The impacts will be quantified according to the particular cross-cutting themes:

- Positive or negative,
- Direct or indirect impact,
- Reversible or irreversible impact
- Impact on the short, medium or long term
- International, national, regional or local impact
- Possible, probable or certain impact.

The causes of the impacts will be clearly identified.

The Consultant will also assess the impact of the situation "without project" and to better compare the project situation.

3.3 Proposal for Compensatory Measures / Mitigation and Cost Assessment

The Consultant will analyze the environmental activities to be undertaken for each works site and make recommendations on:

- Defining the organizational arrangements for compensatory measures / mitigation;
- The arrangements for monitoring the implementation of compensatory measures / mitigation measures;
- The optimum schedule of implementation of measures;
- The responsible entity for each measure;
- Detailed assessment of costs of each measure;
- A timetable for monitoring and supervision of the work

3.4 Schedule of the IEE Study

The survey is carried out by the local consultant, one environmentalist, entrusted with the study. The term of the survey is 15 days per model project, which include the completion of a final report. The review of the report by ECZ will take approximately 35-40 days, which represents the new time frame necessary for review of one EPB.

4. Report Contents

The report is structured as follows:

- Executive summary,
- Introduction
- Brief description of the receiving environment and the basic conditions of the environment,
- Description of the work to be undertaken,
- Analysis of project impacts (identification with the methodology and tools for identification,
- Evaluation of impact importance
- Social and environmental management plan (SEMP), including:
 - Accompanying measures and strengthening the institutional framework;
 - Mitigation of negative impacts and enhancing positive impacts;
 - Responsibilities for implementation and monitoring;
 - Monitoring and supervision plan;
 - Monitoring indicators;
 - Cost of implementation of SEMP
- Conclusion
- Appendices with references, those consulted consultation reports (civil society, agencies ...), bibliography, authors of the study, specific data.

The draft report will be provided before the completion of detailed engineering studies for the investment considered and the finalization of the Tender Documents for the work.

F.6 Cost and Schedule of Environmental Study

a) Cost Estimates of the Environmental Project Brief for the Rehabilitation of an Irrigation Scheme.

No.	FEE	Description	Quantity	Unit Price (USD)	Total Cost (USD)
1.0	Professional Consulting Fees				
1.1	Fees for Professional Staff		15	200	3000
		Sub-Total			3,000
2.0	Direst Expenses				
2.1	Food and Accommodation	Food and lodging fees for the Consultant	3 nights/ days X 1 Staff	50	150
2.2	Transport Cost (Fuel)	This includes: - Fuel for 1 Vehicle (Approx.1, 200km to be covered, whole exercise. Diesel ZMK 6,999/ Litre, taking 1Litre diesel=7km for an average Land Cruiser on High Way.) + other lubricants	2 X 90litres	1.5	268
2.3	Car rental Cost	This includes: - 2 days travel back and forth from Lusaka and 3 days field survey work	5	100	500
2.4	Stationery	This includes:- - Printing of 6 Copies of the Final Report. - Binding of Reports	Lump-sum		300
		Sub-Total			1,218
3.0	Grand Total (ZMK)				4,218

Mode of Payments

1st Payment – 50% upon commencement;

2nd Payment – 30% upon submission of the Final Draft EPB Report to Environmental Council of Zambia for review;

3rd Payment – 20% Presentation of an approval letter from the Environmental Council of Zambia to the Client;

Note: Direct expenses are payable 100% upon commencement.50% is payable on professional fees.

b) Schedule

No	Activity	Description	Time Frame																						
			Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day ?	Day ?	Day ?	Day ?	Day 40			
1.0	Travel day	Driving to the district and back to Lusaka.																							
2.0	Public Consultations	Pay a courtesy call on the district commissioner in the district where the project is located.																							
		Consultation with the district department of Agriculture and Planning Unit of the District and or Municipal Council.																							
		Site visit																							
3.0	Preparation of the EPB Report and Submission to ECZ	Preparation of draft EPB Report																							
		Addressing of the comments and submission of final draft to ECZ and client pay up review fee.																							
4.0	Finalization of the process.	ECZ Field Visits to site, Presentation of the Decision Letter/most likely Approval letter from ECZ.																							

Acronyms Used:

1. ECZ = Environmental Council of Zambia;
2. EPB = Environmental Project Brief

Assumption:

1. The Review Fee to be paid to government through ECZ is approximately, ZMK 7,799,940 Million, approximately, USD equivalent USD 1,696.
2. The ECZ statutory period for approval of such projects turns now around maximum 40 days.

F. 7 SAB (Striking a Balance) Project in Zambia and Malawi

1. Taking Reference on SAB Project

The SAB (Striking a Balance) project is a demonstration of the Wetlands and Poverty Reduction Project of Wetlands International and it is carried out with financial support from Wetlands International under its Wetlands and Poverty Reduction Project financed by the Dutch Ministry of Foreign Affairs (DGIS). It is a 30-month project to explore how to manage seasonal wetlands (dambos) in Zambia and Malawi in a sustainable way.

In Malawi the local partner NGO, Malawi Enterprise Association (MALEZA), is responsible for field implementation of the project activities in the Simlemba Traditional Authority area in Kasungu District. There the SAB project adds to the overall on-going wetland activities of MALEZA's Simlemba Sustainable Rural Livelihood Project (SSRLP), which began in mid-2005, and is run by MALEZA.

In Zambia, the North Luangwa Wildlife Conservation and Community Development Programme (NLWCCDP) has been responsible for the implementation of SAB project activities in Mpika District, Northern Province. Dambo management and extension have formed part of NLWCCDP's field activities in its CHIMU project since 2002.

The SAB project has been undertaken at three sites in Mpika District (Zambia) and three in Simlemba District in Malawi (location map below).



Source: SAB Project (Wetland Action, 2008)

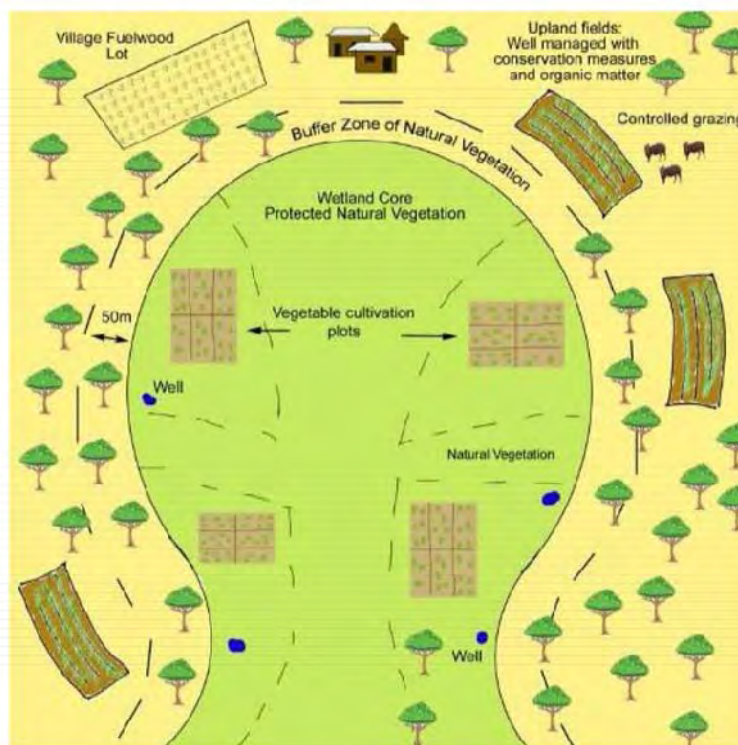
Figure Location of Mpika (Zambia) and Simlemba (Malawi)

The project aims to support sustainable wetland management through a functional landscape approach, including the development of functional institutions to ensure sustainable use.

2. SAB Functional Landscape Approach

This approach identifies the link between wetlands and catchments in terms of water storage and water utilisation, and has led to the use of the functional landscape concept which recognises how facets or different parts of the landscape or terrain are linked.

The functional landscape approach recognises the socio-economic and environmental interconnections between catchment and wetland use. For example, deforestation and the subsequent increase in catchment runoff from the uplands can have a serious impact on wetlands in terms of gully formation, erosion and water availability. Catchment rehabilitation, through afforestation initiatives, the designation of natural vegetation buffer zones, and other soil and water conservation measures, are key components of an integrated system of wetland management (Please refer to the functional landscape concept illustration below).



Source: SAB Project (Wetland Action, 2008)

Figure The Functional Landscape Concept

Developing the Local Institutions and Community Bylaws

The first stage in MALEZA's intervention has involved facilitating an election of community representatives to a village natural resources management committee (VNRMC). Following this, MALEZA has encouraged the development of wetland utilisation bylaws by the VNRMC. The bylaws were also developed with the co-operation of the village headman and approved by the local traditional authority. These bylaws were subsequently approved by the district Development Office, and the District Forestry Office.

These bylaws differ slightly between sites, but generally include:

- Designating a five metre buffer zone from the center of the wetland (stream channel), in which no cultivation is allowed.
- Ensuring livestock are always supervised in the wetland.
- Designating specific areas within the wetland for livestock grazing.
- Prohibiting the removal of indigenous trees from the wetland
- Allowing only people from the villages concerned access to the wetland

- Planting of Eucalyptus trees in the wetland is prohibited.
- Limiting the area of sugar cane when water is short for much of the year.
-

In Mpika, ten bylaws relating to dambo utilisation were identified as having been developed by representatives of the VNRMC, with the help of the NLWCCDP. These bylaws have been approved at the village and then by the area chief. Within each VNRMC there is a sub-group (which usually includes the village headman) who is responsible for enforcing the bylaws.

The bylaws include:

- Land in the uplands should not be drained within 50m of the edge of the dambo.
- Drainage and cultivation is prohibited within the dambo in the first 10m from the centre stream, or if the dambo has a steep slope, 20 m from the centre of the stream. The rationale for this is the maintenance of natural vegetation, to control erosion.
- No one should drain, plough or cut trees around water sources.
- Avoiding deforestation in the catchments within 50m of the dambo edge.
- Use of forest resources in the catchment is only permissible on one day per month
- Rehabilitation of forest areas if degraded (avoid use or burning).
- No late burning in the dambos or its upland fringes, burn only in June to reduce damage to the vegetation.
- No one should wash upstream of water collection points or near wells or sources.
- People should use the correct types of traps or nets when catching fish.
- Goats should be put in an enclosure until 14:00hrs so that they do not wander too far and destroy dambo crops.

F. 8 Wetlands / Dambos, Environmental Concerns and Sustainable Use in Zambia

1. Introduction

1.1 Background

Under the Ramsar Convention on wetlands of international importance, a wetland is an area of marsh, fen, peat land or water, whether artificial or temporary, with water that is static or flowing, fresh or brackish to a depth of not exceeding six meters, (ECZ, 1999).

1.2 Distribution of Wetlands

Zambia has extensive and diverse wetlands of considerable local and international importance. Wetlands habitats cover approximately 14% of the country's surface area and include small areas of Montana bog and wet forests, as well as extensive tracts of dambo (headwater grasslands), phragmites and papyrus swamp, and flood plain types. Dambos are most extensive covering 10% while swamps, marshes, and flood plains cover approximately 4% (ECZ, 1999). Zambia is considered the wettest country in the sub-region (Southern Africa) in terms of fresh water.

Extent of Major Wetlands in Zambia

Wetland	System	Type	Location (Province)	Coverage (km ²)
Natural				
Bangweulu System	lake	marsh and swamp	Northern	11,000
Zambezi flood Plain	riverine	flood plain	Western	9,000
Kafue flats	riverine	flood plain	Central, Southern and Lusaka	6,500
Mweru	lake	swamp and marsh	Luapula	4,500
Chambeshi plains	riverine	flood plain	Northern	3,500
Lukanga swamps	riverine	swamp and marsh	Central	2,500
Busanga Plains	riverine	flood plain	North-Western	2,000
Mweru Wa Ntipa	riverine	swamp and marsh	Northern	1,300
Dambos	palustrine	Plain	Countrywide	75,260
Tanganyika	lake		Northern	Littoral
Man-made				
Kariba	lake		Southern	Littoral
Itezhi-tezhi	lake		Southern	littoral

2. Methodology Used

2.1 Methodology

The methodology used involved:-

a) Literature Review:

This involved desk study and review of the available literature on wetlands and dambos in Zambia.

Further, information on wetlands and dambos on the internet was also consulted.

3. Use and Availability of Resources in Dambos in Zambia

3.1 Agriculture

Agricultural practice in dambos is growing as it has numerous advantages over rain fed the system. This is because water resources are available and reliable and therefore crop failure due to drought is minimal. Dambo agriculture can be irrigated or not depending on the location (in terms of ecological zone the area falls in). Although generally the country has a relatively moderate climate that is determined by the humid Congo Air Mass and the Inter-Tropical Convergence Zone (ITCZ) that brings rain from October to April. It is characterized by the following seasons, winter – cool and dry season, summer – wet and hot season. Pre-rainy season and post rain season. Winter – June to August, summer – November to March, pre-rainy season – September to October and post rainy – April and May.

The rains usually begin in September and reach their intensity between December and March. The following map helps understand the rainfall pattern in different areas.



This map is based on the 40 year period, October 1970 to September 2010

Figure Isohyetal Map for Zambia

From the map, it may be true that the wettest dambos could be concentrated Northern, Luapula, Copperbelt and North Western part of Zambia.

Crops grown include, palm, vegetables, bananas, fruit trees, rice and sugar cane. These crops are either grown on small, medium and to a lesser extent, large and commercial scale. For instance;

- Rice is grown by a number of small scale growers on Dambos that are located in Northern, Western and parts of Eastern Zambia,
- Sugar Cane is mainly grown on large scale in Southern Zambia and of late, Northern / Luapula Zambia along dambos on or off, Kafue and Kalungwishi rivers;

- Palm oil and jatropha is currently being grown by ZAMPALM, a Subsidiary of Zambeef PLC on the dambos located on the peripherals of the Bangweulu plains in Senior Chief Kopa's area, Mpika district;
- Vegetable (especially tomato, rape, onions etc) are commonplace and grown in dambos especially those near main towns.

3.2 Wildlife and Fisheries

Among the principal resources of Dambos and or wetlands in Zambia include, Wildlife and fisheries resources. Among the wild animals of commercial significance are species like the black Lechwe, Sitatunga and tsessebe for bangweulu, the kafue lechwe and Zebra are important in the kafue flats. There is further potential for exploiting large game (buffalo and elephants), particularly in the Bangweulu Basin although their abundance and occurrence are currently limited. Fish is another important resource found in dambos and communities around depend on it for their livelihood.

3.3 Traditional Economic Uses

Most dambos are used for a number of traditional economic activities. These include, cattle husbandry and rearing mainly by the people of Southern Zambia. Cattle rearing is very key to the Southern Province economy, as crop cultivation; transport is dependent on animal draft. Dambos continue to provide the much needed grass for animal survival.

3.4 Traditional /Cultural Resources

Dambos and wetlands such as the Barotse Plains in Western Zambia are an important cultural resource. The plains are used for the famous Kuomboka ceremony. The Kuomboka traditional ceremony is the relocation of the Litunga (Lozi paramount chief) from his winter Palace in Lealui to the summer headquarters in Limulunga.

4. Environmental Sustainability Issues of Dambos and Mitigations

Full exploitation of dambos and wetlands for economic use may result in the following impacts which may affect the bio-physical and socio-economic environment. See the Table F1 and F2 for summary.

4.1 Bio-Physical Impacts

4.1.1 Poor Soil and Garden Preparation

Traditional land preparation practices are still common place which practices militate against sustainable use and derivation of profits from dambo gardening and use. This involves uprooting the grass in pieces, or turfs, with quite thick "slices" taken, with a reasonable amount of soil and the grass root system. However, burning of this proves light and incomplete as the turfs are not fully dried and still moist when burning begins. This leads to low amounts of ash (potash) from the burning and hence poor yields. However, areas which receive a good burn due to the thorough drying of the grass have high concentrations of potash and can give good yields.

4.1.2 Recommended Sustainable Use / Measure

For sustainable use, increased profits, low fertilizer use and cost effective productivity, a new method of soil preparation should be adopted by small scale farmers using dambos which involves cutting thin turfs, drying them first on the ground (grass side down) and then in open and well ventilated ridges, burning these ridges and re-ridging after burning. Overall this improves nutrient availability and moisture retention.



Source: SAB Project (Wetland Action, 2008)

Figure Stripping turfs from a dambo to prepare a garden

This method means that communities progress from poverty and hunger by continuously replenishing their food stocks and selling surpluses, especially in the wet season when prices are high. So far this method is being practiced in Kabundi, Mushishe, Kaluba, Mwansabamba and Chikakala villages of Chiefs Mukungule, Chikwanda and Mpepo in Zambia.

4.1.3 Soil Fertility, Pollution and Erosion

The Effect of Dambo Use on Fertility Sustenance

In most cases, depletion of soil nutrients is a potential threat for the sustainable use of Dambos, as most Dambos are rich in organic matter and being depressions surrounded by high ground, act as nutrient depositional areas. This makes them very fertile lands for general crop cultivation. Observations indicate that farmers usually maintain soil fertility of their Dambos through regular application of manure, organic debris and fertilizer. This practice has proven sustainable and no acidification problems have been reported so far in all literature reviewed during this study. However, micronutrient deficiencies have been reported.

Some farmers burn vegetation in Dambos during cultivation (especially on virgin land) as shown below.



Source: SAB Project (Wetland Action, 2008)

Figure Mounding the dried turfs into ridges for burning in a dambo



Source: SAB Project (Wetland Action, 2008)

Figure Setting a ridge of turfs alight in a dambo

This is mainly done by small scale farmers because burning provides a number of benefits to small scale dambo users as follows:

- _ controls weeds as it destroys their seeds and roots,
- _ sterilizes the soil killing fungus spores, bacteria and nematodes,
- _ loosens the soil to improve aeration and ease root penetration, and
- _ creates potash (from burnt grass and roots) which reduces the acidity levels in the sour soils and so releases nutrients and makes them readily available to the plants.

However, on sour or acid Dambos which are deficient in basic nutrient elements, burning would further lead to loss of nitrogen taken up and stored in plant biomass such that if nutrients are not replaced, the Dambo would lose its fertility and become unproductive in the long-run.

4.1.4 Soil Pollution

Pollution of soils in dambos may be caused by application of certain fertilizers and other chemicals. These chemicals may include some insecticides and fungicides.

4.1.5 Soil Erosion

Erosion was evident in most cultivated Dambos (or parts of Dambos) that are also used for grazing livestock, although to the contrary, most extensively cultivated Dambos in Zambia have shown lower incidence of gullying. Raussen *et al* (1996)* confirm these findings by the evidence of acid Dambos remaining undisturbed as they are neither used for grazing nor gardening. Further, the main cause for gullying in Dambos appears to be deforestation of the catchment areas (refer to, NTC/JICA 2010 SEA findings on Chipapa Scheme)

Cultivation of ridges along contours of dambos can result in gully erosion if farmers are not cautioned.

*Rawssen, T., Daka, A.E. and Bangué, L. (1996) Agroecology and Use of Dambos on the Eastern Zambian Plateau. Report of a Field Study. *Journal of Applied Irrigation Science*, 31, pp.183-206.

4.1.6 Recommended Sustainable Use / Measure

- Dambos are not independent systems but are rather interconnected to the surrounding watershed and the hydrologic cycle. Communities must be made to understand this. Their sustainable utilization would thus largely depend on proper catchment management and water control.
- Conservation efforts for Dambos should therefore concentrate on the management of the whole catchment rather than focusing on Dambos alone. The hydrology and erosion processes of Dambos can only be understood and substantially influenced if the whole Dambo catchment system is considered as a unit. Conservation of the catchment is however a difficult task, since it requires a joint effort by all those farming in the watershed. Lack of social cohesion poses a serious obstacle to success. Furthermore, not all farmers cultivating within the catchment might have access to the Dambo and therefore will be less interested to participate in catchment conservation unless they derive other benefits from the catchment management, e.g. sustainable fuelwood supply. Projects for watershed management require full involvement of the communities concerned and have to share with them responsibilities from problem identification through planning and implementation of conservation effort.
- Erosion of the levees along rivers because of their mismanagement may have serious negative impacts on Dambo hydrology.
- To enhance this attribute, the Dambo watersheds and margins should be well vegetated and protected from erosion.
- Soils should be sampled at the beginning for baseline details and thereafter, timely monitored to compare any possible changes in quality, color and chemical composition across planting seasons.
- Discourage cultivation and making of ridges along the slopes or contours of dambos through education and sensitization.

4.2 Impact on Surface and Ground Water

4.2.1 Pollution due to Chemical Handling and Application

Pesticides and other vector control chemicals being used by small scale farmers can result in unsustainable use of dambos if not properly used. These can pollute water in streams and endanger human lives.

4.2.2 Pollution due to Pesticide Use in Dambos

Although there is no available literature on dambo pollution due to pesticide use in Zambia, most Dambo users traditionally use botanical pesticides such as pesticides and fungicides to spray on vegetables to control pests such as aphids, red ants and red-spidermite.

Increasing use of such methods is currently noticeable due to an increase in crop diseases. Contamination of wells and streams occurs mainly as a result of incorrect handling of application equipment (sprayers) and pesticide residues and spray drift. Some pesticides may find their way to water sources through surface run-off to streams or wells in dambos.

Accidents with pesticide use in dambo gardens are therefore possible occurrences.

4.2.3 Cultivating near the Streams

Cultivating along the streams causes pollution of the streams as most chemical fertilisers are washed into the streams during excessive irrigation. This also leads to siltation of the streams, drying up of the same streams and consequently flooding of dambos. This may further result in loss of the much needed nutrients by small scale dambo users.

4.2.4 Recommended Sustainable Use

- It is recommended that small scale farmers are made aware through sensitisation programmes, on the best and recommended way of handling and applying chemicals,
- Timely Monitoring of the quality of water in downstream to assess conformity to ECZ standards,
- Strengthen extension service provision to local small scale farmers using dambos,
- Increase awareness on the dangers of cultivating near the stream. Recommend cultivating 20 metres away from water courses such as streams to avoid burying them, causing flooding of streams, dambos and loss of plant nutrients from the dambos,
- Prevention of cultivation in the upper parts of dambos from where water originates; and
- To apply the above understanding, communities should be encouraged to develop Village Natural Resource Management Committees. These should be tasked to raise awareness of the environmental issues related to dambo cultivation and develop and enforcing by-laws which will help sustain this important contributor (dambo) to household well-being. Specific bylaws should be developed and are being enforced and approved by the village headmen and local chief.

4.2.5 Industrial Effluent

Most wetlands, especially those in or near mining towns, according to literature have a problem of

metal retention and consequently, pollution of underground and surface water as it is clear that wetlands are an very important and integral part of most river systems. Growing crops in such polluted soils may result in metal accumulation in vegetables and fruits.

The other possible cause of pollution is the uncontrolled, unguided use of chemicals for different pest and fungal control as well as fertilizers which may lead to weed growth in the nearby river.

Uncontrolled discharge of effluent from mining and other industrial houses may lead to the following:

- (i) degradation, thus endangering their important role in sustaining both local communities and ecosystems; and
- (ii) The wetlands used may become storage of pollutants that may subsequently represent an environmental liability even after active discharges through the wetlands have ceased.

4.2.6 Recommended Sustainable Use / Measure

The following measures are proposed to mitigate the impact:

- Control effluent discharge at source;
- Timely monitoring of water in affected stream, and
- Consider change of site if highly contaminated.

4.2.7 Irrigation Technology and its Influence on the Water

Without significant support from agricultural institutions, small-scale farmers have developed irrigated cropping in Dambos for several centuries. They grow different crops (different vegetables, maize, rice etc which is grown in the center of the Dambos especially in Western province of Zambia).

Traditionally in Zambia, small-scale farmers have utilized Dambos to grow both food and cash crops. Dambo gardens in Zambia are called **sishango** among the Lozi people of Western province, **dimba** among the Cewa and Fisebe among the Bisa and Lala.

Like most parts of the country, there is an excellent vegetable production by small-scale farmers in Dambos on the banks of the Zambezi River in the Senanga district in western Zambia. The gardens in which crops are grown are usually small (0.25 - 1.0 ha e.g., in Masaiti district, Copperbelt province according to a study on gardens, done by Lewis Tumbama in Chief Chiwala area ,2010) and they have had to cope with constraints such as flooding and drying of Dambos. In order to cope with flooding, in most parts, traditional technology has involved making of ridges, mounds or banks in between trenches or furrows in order to create drainage in the root zone. These structures vary widely in size depending on the prevailing groundwater levels, soils and crops grown. According to a number of experts' observation of the dambo water regimes, farmers make beds at ground level in relatively dry ambos and raise beds to more than a meter height where waterlogged conditions prevail.

Farmers' choice of suitable crops is usually related to the more general hydrological condition in the respective Dambo zone, whereas the height of beds is used to adapt to small-scale water variations in the Dambo. By doing so farmers respond remarkably well and efficiently to the variations in water levels that exist within a Dambo.



Above picture taken during the 2010 field assessment by Lewis Tumbamba for the gardens along Mwatishi stream in Chief Chiwala, Masaiti district (T. Lewis is a lead consultant of the topic study).

Along the Mwatishi stream, the dambos are quite wet and the height of beds shown above is a reflection currently being used to adapt.

Most of the irrigation systems developed by small-scale farmers are based on a combination of residual moisture, capillary rise and rope-and-bucket irrigation with water lifted from shallow wells. These methods allow for small to medium size gardens depending on the natural conditions, availability of dambo land and labor force.

In the southern parts of Zambia where relatively low annual rainfall totals are common, farmers may actively irrigate crops in the rainy season, if dry spells occur.

If residual moisture in the topsoil is sufficient, a single irrigation with watering cans may be sufficient for the seedlings to establish. Thereafter their roots will grow downwards to remain in the zone of capillary rise and no further irrigation may be required.

Similarly, directly sown crops, e.g. beans, may not require irrigation if planted early in the dry season. If groundwater and capillary rise are not within the root zone of crops, especially for those planted later in the season, they require regular watering.

In eastern Zambia about 7 mm of water was applied in a 2-day-cycle during the cooler months June-July and double that amount during the hotter part of the dry season from August to October (Raussen *et al*, 1996). During this part of the year irrigation is the most labor intensive activity in the gardens and actually limits the extent of the area under crops unless use of labour saving technologies, such as the treadle pump for water lifting and clay pots for subsurface drip irrigation, are employed.

Although most authors conclude that an extension of dambo cultivation will not have significant effects on the moisture regime of the dambo if the cultivated area is less than 10% of the dambo area or 30% of

the total catchment area, whichever is smaller, farmers who usually do not see the water tables in their gardens affected by their neighbors' irrigation activities confirm this rather conservative estimation. In Zambia it is observed, according to some authors that often much more than 10% of the dambo area is irrigated without farmers realizing any effects on the groundwater table.

A further increase of the area under irrigation in dambos may be possible without threatening its water regime through irrigation methods (such as clay pot and drip irrigation and application of mulch) that reduce evapotranspiration.

However, the introduction of mechanized pumps (whether manual, draught or engine powered) may pose a serious risk for the dambo water regime if irrigation water quantities are not limited to safe levels and small scale farmers are now very interested in such labor saving equipment.

Irrigation of areas outside the dambo with water from the dambo may pose a serious threat of groundwater depletion and should only be considered after hydrological studies have proven the sustainability of such methods for a particular area. There are fears that over-drainage of dambo soils may cause irreversible drying, leading to acidification and loss of organic matter and associated impacts.

4.2.8 Recommended Sustainable Use / Measure

The treadle pump development as a technology for irrigation in dambos is one such equipment which can be used harmoniously in dambo systems as its discharge is modest (1.5 l/s) and most of the water applied on the dambo soil either percolates back to the shallow water table or is taken up by the crop. Treadle pumps are cheaper and affordable to a small scale dambo user and available in Zambia. They are currently being supplied by the International Development Enterprise (IDE), a international NGO supporting small scale farmers involved in irrigation. It is an appropriate technology.

4.3 Socio-Economic Impacts (mainly benefits concern)

Most River basins contains extensive wetlands (or “dambos”) and are used by the local communities, with some of the main benefits accrued from doing so being: (i) a source for drinking water and water for cattle; (ii) fishing, hunting and trapping grounds, thus forming an important source of protein; (iii) dry season grazing for cattle; (iv) reed and other material used for house building; and (v) vegetable gardening and other agriculture activities.

The wetlands themselves represents rich and diverse (although as yet relatively poorly studied) ecosystems, that have an important role in maintaining the ecological and hydrological balance in the river system. The wetlands represent secluded areas, important in the reproduction of both terrestrial and aquatic species. Further, the areas' low relief, coupled with the wetlands role in trapping sediment and preventing erosion are the causes of the exceptionally clear, low turbidity water, that is carried by, e.g., the Kafue river in its natural state.

4.4 Archaeology and Heritage Protection

Some wetlands and dambos in Zambia are used for different cultural and traditional practices and therefore exploiting them for economic activities would disturb the cultural setting.

Cases in point include, the famous Barotse Plains which are used for the Kuomboka Ceremony.

5. Conclusion

The cultivation of dambos in Zambia is going to increase as Farmers, like many other Zambians realise the benefits which can be obtained and learn how their livelihoods can be enhanced. The challenge now is to manage this through training and capacity building to improve the skills of farmers to undertake these practices in ways which have minimal environmental impact. This requires the building up of community institutions as local guardians of that knowledge and also as organizations which can manage the use of land within the dambos and in their surrounding upland catchments. The future prospects are encouraging for poverty reduction through sustainable dambo cultivation and sound land management to create a functional and productive landscape.

Acknowledgement

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Table F1 : Adverse Impacts and Mitigation Measures for each Scheme

Environmental Impacts	Mitigation Measures
Chipapa (Kafue District / Lusaka Province)	
<u>Environmental</u> <ul style="list-style-type: none"> • Flooding: Main canal is not properly designed (uneven) as a result water doesn't reach other plots and overflows in some places causing flooding; • Silting: Which has reduced the capacity of the dam hence drying up in the hot dry season; • Deforestation: at the source of water hence little water to the dam <u>Socio-economic</u> <ul style="list-style-type: none"> • Transport problems; • No fence to the scheme, domestic animals damaging crops; • Prevalence of crop diseases; • Middle men causing problems at main markets. 	<ul style="list-style-type: none"> • Redesign & even the canals • Dredge silting dam • Avoid cutting down of trees • Plant trees where they ve been cut • Get a loan, buy a utility vehicle. • Fence the scheme. • Promote crop diversification • Intensify extension services
Clixby (Kafue District / Lusaka Province)	
<u>Environmental</u> <ul style="list-style-type: none"> • Soil acidity • High levels of coaliforms in water <u>Socio-economic</u> <ul style="list-style-type: none"> • High cost of electricity. • Lack of qualified personnel to run and maintain the system. • High cost of inputs - fertilizers, chemicals. • Inadequate extension services. • Lack of experience in farming by most farmers. Most of them are retirees from other professions. 	<ul style="list-style-type: none"> • Lime application; • Introduce farming in dambos • Every farmer to contribute; • Introduce high value crops alongside traditional ones • Train up people to maintain pumps • Improve extension services • Train farmers in basics of farming
Buleya Malima (Sinazongwe District / Southern Province)	
<u>Environmental</u> <ul style="list-style-type: none"> • Soil erosion caused by pressurised water from the pump and pipes; • Loss of soil nutrients caused by continuous watering; • High salinity levels brought about by the irrigation system used • Fuel from the pump station pollutes the surrounding environment. 	<ul style="list-style-type: none"> • Level affected parts • Control watering, crop rotate; • Service the pump regularly • Reconstruct pump house with impervious floors, bund wall it
<u>Socio-economic</u> <ul style="list-style-type: none"> • High electricity bills; • High running costs - repairs to machinery, pipes and pumps; • Pests and diseases unknown to the farmers affecting crops 	<ul style="list-style-type: none"> • Every farmer to contribute to settlement of bills; • Introduce high value crops along side traditional vegetables; • trainings in prevention and management of diseases ; • Intensify extension services
Nkandabwe (Sinazongwe District / Southern Province)	
<u>Environmental</u> <ul style="list-style-type: none"> • Soil erosion; • Siltation of old pit (reservoir) due to farming activities around; • Flooding for those farms in the lower land <u>Socio-economic</u> <ul style="list-style-type: none"> • Ability to meet basic needs; • Improved incomes; • Increased agriculture skills; • Increased access to farming inputs 	<ul style="list-style-type: none"> • Discourage farming along the Old Pit; • Dredge if possible & when water level is very low • Redesign irrigation system, reconstruct it in affected parts • To be enhanced
Nega-Nega (Mazabuka District / Southern Province)	
<u>Environmental</u> <ul style="list-style-type: none"> • Birds migrating from site due to construction 	<ul style="list-style-type: none"> • Avoid clear felling of trees;

Environmental Impacts	Mitigation Measures
<ul style="list-style-type: none"> activities; Tree cutting to pave way for infrastructure; Noise from construction machinery; <u>Socio-economic</u> One church was brought down to pave way for the construction of irrigation canal; The road network was disturbed during the construction of the canals; One farmer had his farm cut into by the canal. 	<ul style="list-style-type: none"> Reduce noise to acceptable levels Reconstruct the church Improve affected roads after ; Reach understanding, compensate affected farmer
Kapululira (Siavonga District / Southern Province)	
<u>Environmental</u> <ul style="list-style-type: none"> Oil leakages due to the old age of irrigation machines; Water loss/Leaking pipes cause soil erosion and washing away of nutrients; Lack of crop rotation /Mon-cropping leading to loss of soil fertility and low productivity; Seepages in the canals and furrows. 	<ul style="list-style-type: none"> Timely Service of pump Fix, Cement mend leaking canals & pipes; Rotate crops; Cement canals and furrows.
<u>Socio-economic</u> <ul style="list-style-type: none"> Low production due to lack of inputs (seedlings/suckers, fertilizers and chemicals); Long distance to market; Human-Animal conflict; Wild animals damaging crops and infrastructure; and Lack of fencing for the scheme. 	<ul style="list-style-type: none"> Through loans, GRZ to provide inputs, suckers; Improve access to Microfinance firms; In consultation with ZAWA, fence off the scheme
Ipafu (Chingola District / Copperbelt Province)	
<u>Socio-economic</u> <ul style="list-style-type: none"> Drippers eaten by rats; Size of the drippers makes it difficult to intercrop as system was meant for coffee only; High electricity costs; High transport cost to the market; Poor state of the roads; No access to loans; No farming equipment e.g. tractors 	<ul style="list-style-type: none"> Change system to one that will allow intercropping; Do away electricity propelled pumps/introduce high value crops; Improve roads; Through MACO, improve members' access to fertilizer & financial loans ; Through MACO, operationalise scheme, procure tractor on loan.
Kanakantapa (Chongwe District / Lusaka Province)	
<u>Key issues/impacts/Concerns arising from the consultative meetings</u> <u>Negative impacts</u> <ul style="list-style-type: none"> 94 hh to be resettled; No indication of alternative land for the 94 families; Impact on cultural and traditional resources; Some key stakeholders felt they needed more involvement in the project Lack of transparency in the handling of the RAP; Lack of transparency on how to mitigate affected cultural and traditional resources. Restriction of movements of people within the scheme when project is operational; Increased incidence of diseases like malaria; Drowning <u>Positive impacts</u> <ul style="list-style-type: none"> Increased incomes from irrigated crops; Improved infrastructure e.g.roads, power; Increased employment opportunities; 	<ul style="list-style-type: none"> Resettle all affected hh in light of local and international guidelines Involve all key stakeholders from Chibombo & Chongwe Districts Disclose to affected hh, contents of RAP Liaise with DHMTs on Malaria prevention/build enough clinics Enhance all positive impacts

Table F2 : Impacts and Mitigation Measures for each Resource Body

Impacts	Mitigation Measures
Impacts on Land and Soil	
<p><u>Site Preparation</u></p> <p>Exposed soil from clearing is prone to erosion by water or wind</p> <p><u>Construction Phase</u></p> <p>Soil contamination due to improper storage of fuels and poor waste effluent disposable methods</p> <p>Stripping soil during construction could lead to erosion and degradation of soil quality</p> <p>Soil compaction could result following site preparation and construction activities.</p>	<p>⇒ No clearing of steep, unstable slopes or highly erosive soils;</p> <p>⇒ Require control of storm water runoff and prompt re-vegetation on disturbed areas</p> <p>⇒ Storage of potential pollutants such as fuels, and oils shall be done on and in storage rooms with concrete and impervious surfaces with bund walls around to prevent soil contamination;</p> <p>⇒ Where possible, installation of oil traps to collect and recycle used oil and lubricants around storage areas</p> <p>⇒ Areas requiring less clearing (grasslands) should be preferred for construction of irrigation infrastructure. Clearing of trees shall be limited to the site selected for construction of such infrastructure.</p> <p>⇒ Manual site preparation preferable, depending of size of scheme;</p> <p>⇒ Heavy trucks and machine equipment shall have permanent access roads;</p> <p>⇒ Clearing and excavation of the site will be strictly limited to the actual area of development and access to the site in order to minimize undue destruction of the surrounding areas of the site;</p> <p>⇒ Whatever soils will be displaced during the digging of foundations, trenches, canals soils will be re used on site by burying holes, trenches, foundations etc</p>
Impacts on Flora/Vegetation	
<p><u>Site Preparation and Construction Phase</u></p> <p>Loss of organic matter and nutrients by removal of vegetation</p> <p>Disturbance of flora</p>	<p>⇒ Site clearing will be confined to project site.</p> <p>⇒ Tree re-planting</p> <p>⇒ Limiting the area of construction activity to site</p>
Impacts on Water Quality	
<p><u>Construction Phase</u></p> <p>Siltation of water courses due to soil erosion</p> <p>Groundwater contamination due to construction of sub-standard pit latrines</p>	<p>⇒ Sides of rivers / stream /dams should have riparian reserves which will serve as natural filters for any surface runoff from the cultivated areas</p> <p>⇒ Avoid disturbance of streams, water bodies, floodplains and wetlands</p> <p>⇒ Proper siting of pit latrines at least 60m - 100m away from water bodies/logged areas;</p> <p>⇒ Good hygienic standards and proper maintenance of pit latrines</p> <p>⇒ Have in place an effective monitoring system on site during and after construction;</p>
Impacts on Air Quality	
<p><u>All Phases</u></p> <p>Air pollution caused from burning of trees, crop remains fumes and dust from moving trucks, and bull dozers as well as site clearing may affect human, vegetation and also</p>	<p>⇒ Limitation of use of fire and size of burn where possible;</p> <p>⇒ Exercise controlled and or avoid burning , e.g., Burning in wet season;</p>

Impacts	Mitigation Measures
disturb habitats for birds and insects.	⇒ Regular maintenance of field machinery ,construction vehicles and equipment in order to reduce emission of exhaust fumes;
Impacts on Landscape and Aesthetics	
<u>Design Phase</u> Visual impact of the structures and infrastructure are not compatible with the surrounding environment	⇒ Avoid contrasting colours; ⇒ Remove all remains of construction material and where possible, re-profile area
Impact of Deforestation	
<u>Construction and Operational Phases</u> Cutting down of trees at water sources may cause soil erosion which results in siltation of reservoirs	⇒ Afforestation ⇒ Educate communities on the dangers of the practice and the legal implication if found.
Impacts of Loss of Irrigation Water	
<u>Operational Phase</u> Due to damaged irrigation infrastructure in most schemes, farmers experience tremendous loss of irrigation water which turns out to be a cost, and results in low productivity due to low pressure on farm plots furthest from the intake. The causes are manifold and include leaking irrigation pipes, damaged drippers due to rats, damaged canals and furrows hence increased seepage of water and unevenness of canals causing water to overflow. The impact is negative.	⇒ Replace leaking pipes with new ones; ⇒ Cement damaged canals and furrows; ⇒ Provide technical assistance in land use planning and control to local government.
Impact of Prevalence of Crop Diseases	
<u>Operational Phase</u> Due to either lack of knowledge of understanding of crops grown, and or chemicals to prevent /treat the disease, prevalence of crop diseases was reported as one of the major challenges militating against improved crop yields and production in a number of schemes. The other probable reason is lack of funds to buy the right chemicals. The impact was reported to be quite devastating, significant and negative in Nkandabwe, Clixby and Chipapa irrigation schemes.	⇒ Hold timely training /workshops on crop diversification, management and chemical use for farmers
Impact of Mono-Cropping	
<u>Operational Phase</u> One of the negative impacts identified by the district agriculture offices was that of lack of practice of crop rotation in most schemes, a practice that has affected productivity. This is commonplace in schemes like Buleya Malima, Nkandabwe, Chipapa among others that were identified. The practice is negative as it also affects the nutrient status of the soils.	⇒ Promote and ensure farmers practice crop diversification
Impacts on Socio-Economic Environment Benefits	
<u>Operational Phase</u> In summary positive impacts include the following:- Improved food security; Improved access to social services such as school, health for families; Improved agriculture skills; and Improved standards of living for the community due to increased flow /circulation of funds.	⇒ All should be enhanced.
Impacts of Malaria	
<u>Operational Phase</u> In most areas, e.g., Nega-Nega Scheme, it was brought forward that the reservoirs may turn into breeding grounds for mosquitoes and exacerbate the public health situation in the community as currently there is only a Health Post not a	⇒ Government should be quickly move in and expand and upgrade the existing Health Post to a Clinic

Impacts	Mitigation Measures
<p>clinic which is already inadequate to cater for the health needs of local people. The same was reported in Buleya Malima. If not adequately mitigated, the impact could be severe and negative.</p>	
Cultural and Historic Sites	
<u>Construction and Operational Phases</u>	
<p>The problem is significant, severe and negative in Kanakantapa as most community burial sites are within the dam reserve area.</p>	<p>⇒ Liaise closely with traditional leaders on the handling and management of the impact ⇒ Liaise closely with the Local Authorities on what the Town and Country Planning Act dictates on burial sites</p>
Impacts on Human Settlements	
<u>Construction and Operational Phases</u>	
<p>The problem is significant, severe and negative in Kanakantapa where 94 households are within the dam reserve area and will have to be resettled.</p>	<p>⇒ Resettlement/full compensation according to local and international requirements</p>
Impact of Human-Animal Conflicts	
<u>Construction and Operational Phases</u>	
<p>Most predominant problem at Kapululira Scheme, elephants and hippos destroy banana crops, making farmers run at a loss and also endangering human life. These animals have also been responsible for damaging irrigation infrastructure. It is devastating impact and negative.</p>	<p>⇒ Fence off the scheme with recommended type of fencing to prevent access by elephants and Hippos; ⇒ Liaise with Zambia Wild Life Authority when coming up with mitigation</p>

Table F3: Indicators of Reference Environmental Objectives

Indicator	
1. Reducing air pollution	
1.1	Decreased level of air pollution, according to MAC (Maximum Allowable Concentration) <ul style="list-style-type: none"> • Nitrogen oxides • Hydrogen oxides • Escaping organic compounds • Persistent organic pollutants • Dust
2. Reducing water pollution	
2.1	Decreased outflow levels: <ul style="list-style-type: none"> • Decrease of total level of wastewater flow (m3/year) • Decrease of amounts of out-flowing pollutants according to BOD (ton/ year)
2.2	Decreased level of water pollution according to MAC <ul style="list-style-type: none"> • BOD • Oil products • Heavy Metals
3. Preventing deforestation and destruction of fauna and flora	
3.1	Increased surface of green areas <ul style="list-style-type: none"> • Total surface of green areas, including those being restored and newly established (ha) • Surface of green areas of common use (ha, m2/men) • Surface of specially protected environmental lands (ha) • Surface of forest lands (ha)
3.2	Decreased time for accessibility of green areas (min)
4. Reducing negative impact on land and soil	
4.1	Decrease level of pollution with heavy metals according to ACI (Aggregate Concentration Index)
4.2	Decrease level of pollution with radio nuclides, according to MAL (Maximum Allowable Level)
4.3	Decreased area of highly polluted territories (ha, %)
4.4	Open soils in grassland
5. Reducing negative impacts on human health (Malaria)	
5.1	Decreased number of population living in ecologically uncomfortable zone
5.2	Decreased number of cases of population morbidity and mortality in terms of <ul style="list-style-type: none"> • Respiratory diseases (men/thousand men) • Cardio-vascular diseases (men/thousand men)
5.3	Decrease number of people subjected to epidemics of water transmitted diseases
6. Reducing conflicts related to resettlement	
6.1	Land based resettlements before development
6.2	House reconstruction before development
6.3	Restoration of community assets and services before development
6.4	Networks and community rebuilding before development
7. Mitigating biodiversity risks	
7.1	Establishment of protected areas before development

Table F4: Linkages of the main Directions of the Master Plan with Reference Environmental Objectives

For purpose of this assessment “0” will mean no linkages, “1” low link, “2” average link, “3” strong link

Priority Directions of the Master Plan	Rehabilitation of the existing irrigation facilities	Development of new irrigation facilities	Improvement of agricultural productivity	Upgrading of farm income of smallholders	Restoring and enhancing sustainability of the natural complex, mitigation of environmental risks for human health	Protecting historical and cultural heritage
Reference Environmental Objectives						
Reducing air pollution	1	3	1	0	3	0
Reducing water pollution	1	3	1	0	3	0
Preventing deforestation and destruction of fauna and flora	1	3	1	0	3	0
Reducing negative impact on land and soil	2	3	2	0	2	1
Reducing negative impacts on human health (Malaria)	0	2	0	0	1	0
Reducing conflicts related to resettlement	1	2	0	0	0	2
Mitigating biodiversity risks (human-animal conflict)	2	2	0	0	2	2

Table F5: Impacts on Reference Environmental Objectives as a result of Implementation of main Directions of the Master Plan

For purpose of this assessment “0” will mean no impact, “1” low impact, “2” high impact.
+and - will correspondingly mean positive and negative impacts.

1. Rehabilitation of the existing irrigation facilities	
<i>Reference environmental objective</i>	<i>Possible environmental impact</i>
Reducing air pollution	+1
Reducing water pollution	+1
Preventing deforestation and destruction of fauna and flora	+2
Reducing negative impact on land and soil	+1
Reducing negative impacts on human health (Malaria)	0
Reducing conflicts related to resettlement	0
Mitigating biodiversity risks (human-animal conflict)	+1
2. Development of new irrigation facilities	
Reducing air pollution	+1
Reducing water pollution	+1
Preventing deforestation and destruction of fauna and flora	-1
Reducing negative impact on land and soil	+1
Reducing negative impacts on human health (Malaria)	+1 ¹
Reducing conflicts related to resettlement	+1 ²
Mitigating biodiversity risks (human-animal conflict)	+1
3. Improvement of agricultural productivity	
Reducing air pollution	+1
Reducing water pollution	+1
Preventing deforestation and destruction of fauna and flora	+1
Reducing negative impact on land and soil	+1
Reducing negative impacts on human health (Malaria)	0
Reducing conflicts related to resettlement	0
Mitigating biodiversity risks (human-animal conflict)	0

¹This grade refers to the fact there is no large reservoir or dam planned

²This grade refers to the fact there is no dam construction anticipated in plan

Table F5 (Continued): Impacts on Reference Environmental Objectives as a result of Implementation of main Directions of the Master Plan

For purpose of this assessment “0” will mean no impact, “1” low impact, “2” high impact.

+and - will correspondingly mean positive and negative impacts.

4. Upgrading of farm income of smallholders	
<i>Reference environmental objective</i>	<i>Possible environmental impact</i>
Reducing air pollution	0
Reducing water pollution	0
Preventing deforestation and destruction of fauna and flora	0
Reducing negative impact on land and soil	0
Reducing negative impacts on human health (Malaria)	+1
Reducing conflicts related to resettlement	0
Mitigating biodiversity risks (human-animal conflict)	0
5. Restoring and enhancing sustainability of the natural complex, mitigation of environmental risks for human health	
Reducing air pollution	+1
Reducing water pollution	+1
Preventing deforestation and destruction of fauna and flora	+1
Reducing negative impact on land and soil	+1
Reducing negative impacts on human health (Malaria)	+2
Reducing conflicts related to resettlement	+1
Mitigating biodiversity risks (human-animal conflict)	+2
6. Protecting historical and cultural heritage	
Reducing air pollution	0
Reducing water pollution	0
Preventing deforestation and destruction of fauna and flora	+1
Reducing negative impact on land and soil	+1
Reducing negative impacts on human health (Malaria)	0
Reducing conflicts related to resettlement	+1
Mitigating biodiversity risks (human-animal conflict)	+2

Annex G

Implementation Plan

The Master Plan for Promotion of Irrigated Agriculture for Smallholders
in the Peri-Urban Areas in the Republic of Zambia

Final Report

Annex G. Implementation Plan

Table of Contents

	page
Annex G. Implementation Plan	
Chapter 1 Implementation Plan	
1.1 Farm Management and Cropping	G-1
1.2 Distribution and Marketing.....	G-1
1.3 Irrigation and Water Management	G-1
1.4 Farmers’ Organizations	G-2
1.5 Capacity Development.....	G-3
Chapter 2 Implementation Schedule	
2.1 Phased Development Process	G-4
2.2 Master Plan Period.....	G-4
2.3 Detailed Implementation Schedule of the Action Plan	G-5
Chapter 3 Project Cost	
3.1 Basic Assumptions	G-6
3.2 Quantitative Estimates	G-8
3.3 Project Cost.....	G-11
3.4 Cost for Dams and Appurtenant Structures.....	G-11
Chapter 4 Financial Plan	
4.1 Assistance by Donors.....	G-12
4.2.2 Assistance by the NGOs	G-12

List of Tables

Table T3.2.1 Assignment Schedule.....	G-13
Table T3.3.1 Project Cost.....	G-14
Appendix : Cost Estimate and the Basis of Multi-Purpose Shed (MPS)	(G-16)
Table T4.1.1 Outlines the Overall Objectives/ Strategy of the Donors.....	G-17
Table T4.2.1 Outlines the Overall Objectives/ Strategy of the NGOs	G-20

List of Figures

Fig.F2.2.1 Assumption of Consumer Price Index	G-27
Fig. F2.3.1 Implementation Schedule of the Action Plan	G-28
Fig. F3.1.1 Assumption of Consumer Price Index	G-29

Annex G. Implementation Plan

Chapter 1 Implementation Plan

1.1 Farm Management and Cropping

Responsible for dissemination of farm management and cropping in MACO, the Department of Agriculture cultivation in MACO is carried out by the Crop Protection Branch and the Agricultural Advisory Services Branch. MACO, as the core of the organization, is confined to provide an approval on a project and also to distribute budgets. Accordingly, a local office in nature is the center of implementation bodies. Therefore in the M/P, the front organization of the agricultural administration namely DACO (District Agricultural Coordination Officer) has an important role. Staffs allocated in the DACO, as well as BEO and CEO, are the main organizations to support the farmers/the farmer's association in a front line. Similarly, the staffs of BEO/CEO and the DACO will be the main trainers for training the farmers/the farmer's association. For an insufficient specialized field, ZARI will function as a backup.

1.2 Distribution and Marketing

Responsible for distribution and marketing in MACO H/Q is the Department of Agribusiness and Marketing, DABM). The organization is a simple and vertical division. In the Study, one (1) principal and supporting two (2) senior officers played a role as a counterpart of the Study Team. Each provincial agricultural office has one (1) PMDO (Provincial Marketing Development Officer), while each district office has one (1) DMDO (District Marketing Development Officer) and one (1) assistant DMDO. Routine work of the district officers in charge covers wide areas such as a regular collection and report of market prices; provision of market information to farmers' groups; marketing guidance for farmers; distribution of inputs; etc. MACO H/Q and provincial officers support such activities of the district officers in terms of basic planning; budget allocation; manning schedule; information transmittance; training; etc.

After the A/P period in this project, the district officers in charge, who have been transferred technology from experts during the A/P, are expected to transfer the same to other districts' officers in addition to a successive support to the model farmers' groups. Effective harmonization of this role with the said routine work of the district officers is required. This project is a comprehensive approach comprising various areas such as irrigation; farm management; farmers' organization; and marketing. Therefore, effective organizational arrangement needs to be made for much closer linkage among different departments concerned in MACO H/Q, in addition to formulation of cross-sectional supporting unit within each district office.

1.3 Irrigation and Water Management

In line with a development policy of the Master plan, four sites are selected to first implement the Action plan as a model site mainly focusing on the improvement of the farm practice, market activity, as well.

Table 1.3.1 Selection of Rehabilitation Scheme in A/P

Selected area in A/P* ¹	Present condition, constraints and development potential
<p>1) Small scale irrigation project for promoting brand crops</p> <ul style="list-style-type: none"> ○ Kafue District, Lusaka Province 	<p>Unlike a lot of dams in other provinces, where intake devices were not equipped, impounding water in the dam has been effectively utilized for irrigation purpose in the Kafue District, Lusaka Province and the vicinity area. Meanwhile, it was observed that drought occurred in three years in recent ten years since 2000, thus detailed water use plan shall be established to cope with water shortage in such a drought year. Irrigation canals have been constructing since 2000, however its coverage rate is still low for the time being.</p> <p>From the field investigation, it indicate that the Kafue and surrounding area has a high potential of irrigation development by a canal extension using impounding water in the dams as well as canal construction.</p>
<p>2) Promoting efficient use of existing small scale dam project</p> <ul style="list-style-type: none"> ○ Kazungula District ○ Choma, Kalomo Districts, in the Southern Province 	<p>Tens of the dams were constructed in the Southern Province, mainly the Districts of Choma, Kalomo and Kazungula from 1990 to 2000. However intake facilities have not equipped in most of these dams because these dams aimed at supplying domestic and livestock water. These dams should be utilized water to cope with current water shortage for irrigation. The dams constructed after 2000 have siphon type intakes, and those previously constructed have siphon type intakes.</p> <p>Canal construction has commenced after 2000, however its coverage rate is still low for the time being. It is highly recommended to promptly equip intake facilities and canal construction for expansion of the beneficial area downstream of the dams.</p>
<p>3) Promoting vegetable complex project</p> <ul style="list-style-type: none"> ○ Kabwe District, Central Province 	<p>Rich aquifers composed of permeable sandy materials lies in the shallow depth in the surrounding area of the center of the Chongwe District and the northern area of the Kabwe District. The rain water penetrates into the aquifers and slowly flows down towards lower area, that forms dambo area. The groundwater surface is locally 0.5 to 1.0 m below the ground surface even in the dry season. The farmers utilize groundwater for irrigation using buckets and treadle pumps. Thye area called dambo has high potential of irrigation development.</p> <p>In addition, gravity irrigation schem is also located in the area. As the area has high accessibility to the Kafue market, so intercropping of staple crop in the upland and high value vegetable cultivation in damob area in the both wet and dry seasons leads to high farm income.</p> <p>Since no guideline was established for the use of the dambo area, environmental assessment should be conducted to anticipate future impact by the irrigation development in the dambo area. Government should direct irrigation development policy to mitigate environmental negative impact for the dambo use, especially in the local and remoted rural areas.</p>
<p>4) Promoted vegetable complex project</p> <ul style="list-style-type: none"> ○ Kalulushi District, Copperbelt Province 	<p>The Cooperbely Provinve is located at the most upstream of the Kafue river, and is blessed with water source with sufficient rainfall, thus the Province has high irrigation potential using surface water. On contrary to the situation, few irrigation system was developed. Communal irrigation system was not developed and most of framers individually do irrigation activities with a use of buckets and treadle pumps.</p> <p>The small tributaries of the Kafue river run in the area and the fertile river desopits were developed along these small tributaries. The shallow groundwater is in the deposits and it similarly forms a dambo. Shallow groundwater is available until the middle to end of the dry season. Development of the communal irrigation systems with simple weir construction rapidly rises agricultural productobity together with enhancement of the farmers' organizations activities.</p> <p>It is also notified that agricultural land shall be properly maintained to avoid surface erosion due to a severe rainfall intensity in the area. A collective irrigated agriculture promises high profitable production with suitable farming practice and on-farm planning in the both wet and dry seasons.</p>

Note: *¹ Title of the selected area for A/P corresponds to" model plan" in the Action plan.

1.4 Farmers' Organizations

In terms of strengthening farmers' organization during the implementation of the Project, the implementing body will be CEO/BEO, DACO officers. It is expected that they will be trained as a trainer to provide farmers of the targeted area technical training for conducting commercial farming. It

is also expected that they manage information of farmers and traders and conduct activities to establish linkage between farmers and markets. Especially, officers of Department of Cooperative, such as Cooperative Inspector and District Cooperative Officer, will be a centre of the activities of the Project because appropriate management of Cooperative is a key factor to conduct successful commercial farming. The Table below shows proposed implementation body and main activities in terms of strengthening farmers' organization.

Table 1.4.1 Proposed Implementation Body and Role of Activities for Farmers' Organizations Development

Implementation Body	Main Activities
CEO/BEO, DACO officers	<ul style="list-style-type: none"> - To be a trainer for farmers' training. - To conduct monitoring and evaluation of farmers' business plan. - To manage information of farmers and markets to be used for marketing of commercial farming. - To conduct activities to link farmers and traders, such as matching meeting. - To conduct Study Tour, etc

1.5 Capacity Development

During implementation of the Project, capacity development will be done targeting DACO officers and farmers' representative through trainers' training. Implementation Body of the capacity development will be DACO/MACO officers who have knowledge and skill to be a trainer for trainers' training. Experienced NGO officers who have ability are also expected to involve the Project to be a trainer. Assumed implementation body and main activities are listed below.

Table 1.5.1 Proposed Implementation Body and Role of Activities for Capacity Building

Implementation Body	Main Activities
DACO/ MACO experts, NGO experts	<ul style="list-style-type: none"> - To be a trainer of trainers' training. - To make training curriculum and prepare training materials. - To observe farmers' training and give trainers necessary advise, etc.

Chapter 2 Implementation Schedule

2.1 Phased Development Process

As mentioned in the previous chapter, the smallholders in this study area have the potential for development, but also face many constraints. Farming in existing small-scale irrigation schemes is not necessarily managed efficiently, and for them to be used to their full development potential, they must switch from their current model of externally dependent operation of irrigation zones to sustainable irrigated agriculture on a business footing. There are issues to be dealt with, such as lack of experience in joint(or cooperative) maintenance and management of irrigation facilities, the acquisition and improvement of basic business skills for the operation and management of farmer's organizations, and reform of perceptions, and it will also be necessary to build a system to provide support in these areas. To that end the Master Plan will be drawn up as indicated in Irrigation Policy and Strategy (2004), containing the following elements in a process of phased implementation:

- 1) Building the necessary environment in the initial phase for improving market access, including empowerment of agricultural organizations, preparation of beneficiary participatory plans and the preparation, dissemination and reception of information, and the establishment of an outreach unit.
- 2) Based on the status of these improvements, implement measures to improve existing and informal irrigation zones.
- 3) Monitor and evaluate activities in existing zones and then draw on the lessons learnt to prepare and implement a plan including measures for extension to similar zones and expansion of scale etc.
- 4) Prepare and implement a project plan for new zones, based on the experience gained.

2.2 Master Plan Period

Master Plan Period (10 years): 2012-2020

- Initial phase (4 years): Action Plan phase (implementation of pilot projects)
 - ✓ Capacity building
 - ✓ Establishment of a support unit (within DACO)
 - ✓ Preparation of a participatory plan
 - ✓ Small-scale investment and implementation
 - ✓ Monitoring and evaluation of pilot projects
 - ✓ Compilation of pilot project results into a technical package
- Intermediate phase (3 years): Extension to similar zones and expansion
 - ✓ Extension to other zones and size expansion, using the technical package (investment and implementation)
 - ✓ Monitoring and evaluation

- ✓ Planning of new zones and acquisition of funding
- ✓ Implementation in new zones, monitoring and evaluation
- Final phase (2 years): Autonomous phase
 - ✓ Monitoring and evaluation
 - ✓ Collation of lessons learned

2.3 Detailed Implementation Schedule of the Action Plan

Detailed implementation schedule of the Initial phase (4 years), i.e., Action Plan phase is figured in Fig. 2.3.1. The schedule is provided in each proposed action plan program, i.e., 1) Farm management and cropping, 2) Distribution and marketing, 3) Irrigation and water management, 4) Farmers' organization and 5) Capacity development.

Implementation schedule of the Master plan and Action plan is indicated in Fig. F2.2.1 and Fig. F2.3.1, respectively.

Chapter 3 Project Cost

3.1 Basic Assumptions

As explained in Sub-chapter 2.2 Master plan period, the Master plan is divided into three (3) phases. In the initial phase of the Master plan, Action plan is implemented mainly in the selected model sites, 1) Bwafwano irrigation scheme, 2) Natuseko irrigation scheme, 3) Chipapa irrigation scheme and 4) Mulabalaba irrigation scheme in different zones. In the following two phases, intermediate and final phases, other irrigation schemes are selected to extend irrigation agriculture in the Study area with applying the lessons of the Action plan in the four model sites to further development plan.

The project cost is estimated in each project component based on the following conditions:

- 1) Equipment and material costs were surveyed in the Study period of December 2010.
- 2) The exchange rate used in the estimates is as follows:
US\$1.00=ZMK4,700 (ZMK1.00=J¥0.017) as of December 2010
- 3) Price contingency is included in the unit price of employment cost of local government staff and remuneration cost for international and local experts, as well as transportation cost and other labor costs.
- 4) Conditions of cost estimates of the rehabilitation/ construction work for the irrigation facilities are specified in Annex D Extensive Work.

Project cost is comprised of following items:

- 1) Remuneration cost
Remuneration cost is composed of the international and local experts in monthly contract basis.
 - a) International experts : ZMK70 million per month (US\$15,000)
 - b) Local experts : ZMK30 million per month
- 2) Employment cost of the Government
Cost for Government employers is estimated as remuneration for the technical assistance rendered by the project. The cost is by monthly basis.
 - a) Engineer, senior specialists : ZMK7 million per month
 - b) Technical officer, extension officer : ZMK3 million per month
- 3) Operation cost
Operation cost is composed of, 1) seminar, training and study tour (cost for lecturer, venue, transportation of participants, etc.), 2) site trip of government staff and experts (cost for transportation and accommodation/ daily allowance, etc), as well. The following are unit

price of the operation cost:

- a) Seminar : ZMK3 million per holding (30 participants)
- b) Training : ZMK2 million per holding (30 participants)
- c) Study tour : ZMK10 million per holding (30 participants)

4) Project input equipment and materials

Project input materials are 1) farm inputs such as fertilizer, seeds, insecticide, farming tools, etc.), 2) expense for project monitoring materials, as well.

5) Construction cost

Construction cost includes 1) multi-purpose sheds for distribution and marketing and 2) rehabilitation/ construction cost of the irrigation facilities.

6) Administration cost

Administration cost shall be estimated for project management and financial control as well as personal management. The cost is five (5) percent of the employment cost of the Government (see 2) above)

7) Transportation machinery and consumable materials

The following are estimated for smooth project implementation:

- a) Vehicles (4x4 pick up) : ZMK150 million per vehicle
(Two (2) vehicle at project office, four (4) vehicle in Provincial offices)
- b) Motor bicycle (off-road type) : ZMK15 million per bike (one bike per site)
- c) Fuel for transportation : ZMK2 million per site

8) Office equipment

- a) Computer : ZMK7 million per computer
- b) Printer : ZMK2 million per printer
- c) Copy machine : ZMK25 million per machine
- d) Consumable material : 15 % of equipment cost

9) Physical contingency

The physical contingency is exclusive in the estimate.

10) Price contingency

The price contingency of five (5) percent through the Mater plan period is included in the estimate. Contingency of 5% is assumed according to the recent price cost fluctuation. (see Fig. F3.1.1.

3.2 Quantitative Estimates

(1) Assignment schedule

Annual assignment schedule of the foreign/ local experts and government staff is estimated as shown in Table 3.2.1 considering work items of specified field of the Master plan component.

Following table shows the total assignment schedule of each component for the Mater plan period of nine (9) years.

Table 3.2.2 Total Assignment Schedule for the Master Plan Period

		Total
1.	Farm Management and Cropping	
1.1	Foreign expert	28
1.2	Local expert (Soil, contract farming)	25
1.3	Agricultural officer	144
1.4	Extension officer	280
2.	Distribution and Marketing	
2.1	Foreign expert	33
2.2	Local expert	57
2.3	DMDO	164
2.4	Assistant DMDO	280
3.	Irrigation and Water Management	
3.1	Foreign expert	3.5
3.2	Local expert	6.5
3.3	Irrigation engineer	33
3.4	Irrigation technical officer	99
4.	Farmers' Organization	
4.1	Foreign expert	24.5
4.2	Local expert	2.5
4.3	Cooperative Officer	136
4.4	Extension officer	376
5.	Capacity Development	
5.1	Foreign expert	14
5.2	Local expert	6
5.3	Irrigation engineer	40
5.4	Irrigation technical officer	90
Total	1. Foreign expert	103
	2. Local expert	97
	3. Senior officer, irrigation engineer	517
	4. Assistant officer, technical officer	1,125
	Total 1+2+3+4+5	1,842

Note: M/M schedule of 5. Capacity Development is estimated for irrigation and water management component. Those for other component are included in each proposed component.

(2) Operation plans during the Master plan period

Table 3.2.3 shows fluency of the seminar opening, training program and study tour during the Action plan stage.

Table 3.2.3 Operation Plan in Master Plan Period

	Operation Plan	Initial Phase (A/P stage)	Intermediate and final phase
1.	Seminar (Provincial level)	(Total 4 schemes)	(Total 21 schemes)
	1) Farm management and cropping	• 1 times per annum at 4 Provincial offices	• 1 time per annum at 4 Provincial offices
	2) Distribution and marketing	• Co-session with 1) Farm management and cropping	• Co-session with 1) Farm management and cropping
	3) Irrigation and water management	• 1 time per annum at 4 Provincial offices	• 1 time per annum at 4 Provincial offices
	4) Farmers' organization	• 1 time per annum at 4 Provincial offices	• 1 time per annum at 4 Provincial offices
	5) Capacity development	• Co-session with 4) Farmers' organization	• Co-session with 4) Farmers' organization
2.	Training (Scheme level)		
	1) Farm management and cropping	• 1 time per annum for each scheme	• 1 time per annum for each scheme
	2) Distribution and marketing	• 1 time per annum for each scheme Matching meeting is held 2 times per annum for 4 proposed schemes.	• 1 time per annum for each scheme
	3) Irrigation and water management	• 1 time per annum for each scheme	• 1 time per annum for each scheme
	4) Farmers' organization	• 1 time per annum for each scheme	• 1 time per annum for each scheme
	5) Capacity development	• 1 time per annum at 4 Provincial offices	• 1 time per annum at 4 Provincial offices
3.	Study tour (Scheme level)		
	1) Farm management and cropping	• 1 time per annum for 4 proposed schemes	• 1 time per annum by representatives from the several schemes. Total 4 times per annum
	2) Distribution and marketing		
	3) Irrigation and water management		
	4) Farmers' organization		
	5) Capacity development		

(4) Project input materials

The following materials are input for farming management and cropping component:

Table 3.2.4 Input Materials for Farming and Cropping

		Remarks
1.	Seed	Super marmande, etc.
2.	Seed	Mony maker, rodade
3.	Base fertilizer	D Comp, Urea, P. Chloride
4.	Herbicide	Tillam 6E
5.	Insecticide	Malathion
6.	Fungicide	Dithane

Table 3.2.5 Input for Farming and Cropping

		Remarks
1.	Casual labor	
2.	Tractor	Hire base
3.	Oxen cart	
4.	Fuel and repair cost	
5.	Transport and packing materials	Truck, carton box, plastic bag, etc.

(5) Construction works

Details of the rehabilitation/ construction works are shown in Annex D Extensive Works.

(6) Transportation vehicles and consumable materials

Transportation vehicles are procured for each District office during the Master plan period.

Table 3.2.6 Procurement of the Transportation Machinery

		Initial Phase (A/P stage)	Intermediate and final phase
1.	4x4 vehicle	• 2 vehicles in the project office	
2.	4x4 pick-up truck	• 4 trucks for the district offices where proposed 4 schemes are located	• Additional 10 trucks for the selected district offices
3.	Motor bike	• 4 bikes for the district offices where proposed 4 schemes are located Motor bike is used in the project site.	• Additional 20 bikes for the selected district offices Motor bike is used in the project site.

(7) Office equipment

Following office equipment is procured for each Central and District office during the Master plan period.

Table 3.2.7 Procurement of the Transportation Machinery

		Initial Phase (A/P stage)	Intermediate and final phase
1.	Computer	<ul style="list-style-type: none">• 1 computers in the Project office• Total 4 computers in 4 District offices	<ul style="list-style-type: none">• Total 10 computers in selected District offices
2.	Printer	<ul style="list-style-type: none">• 1 printer for each office (Total 5 printers)	<ul style="list-style-type: none">• 1 printer for each office (Total 10 printers)
3.	Copy machine	<ul style="list-style-type: none">• 1 copy machine for Project office	<ul style="list-style-type: none">• 1 printer for each office (Total 5 machines for Province and District offices)

3.3 Project Cost

Project cost is roughly estimated as shown in Table 3.3.1 according to the basic assumption of the cost estimates and quantitative estimates.

Total project cost is estimated at ZMK51,464 million for the Mater plan period with its breakdown of ZMK19,124 million in the initial phase (4-year Action plan stage) and ZMK32,340 million in the intermediate and final phase (5-year) including price escalation rate of 5 % per annum.

Project cost is shown in Table 3.3.1 in detail.

(Detailed cost estimates of the irrigation facilities, dam and its appurtenant structures are shown in Chapter 3, Annex D Extensive Work)

3.4 Cost for Dams and Appurtenant Structures

In addition to the project cost for the Master plan, rehabilitation cost for dams and their appurtenant structures is roughly estimated as shown in Annex D Extensive Work.

Since severe damages of the spillway will reduce dam safety after several years, it is strongly recommended to mitigate the damages of spillway, such as severe erosion of the spillway canal surface and sidewalls.

The total cost is estimated at about 28,118 million including 15% of physical and price contingencies.

Chapter 4 Financial Plan

4.1 Assistance by Donors

Table T4.2.1 indicates outlines the overall objectives/strategy of the donors.

4.2 Assistance by the NGOs

Table T4.2.2 indicates outlines the overall objectives/strategy of the donors.

Tables

Table T3.2.1 Assignment Schedule

(Unit: Man-Month)

	Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
1.	Farm Management and Cropping										
	1.1 Foreign expert	11	8	4	5	0	0	0	0	0	28
	1.2 Local expert (Soil, contract farming)	5	4	3	0	3	3	3	2	2	25
	1.3 Agricultural officer	14	10	10	10	20	20	20	20	20	144
	1.4 Extension officer	20	20	20	20	40	40	40	40	40	280
2.	Distribution and Marketing										
	2.1 Foreign expert	9	8	8	8	0	0	0	0	0	33
	2.2 Local expert	10	9	9	8	5	5	5	3	3	57
	2.3 DMDO	16	16	16	16	20	20	20	20	20	164
	2.4 Assistant DMDO	20	20	20	20	40	40	40	40	40	280
3.	Irrigation and Water Management										
	3.1 Foreign expert	3.5	0	0	0	0	0	0	0	0	3.5
	3.2 Local expert	2.5	0.5	1	2.5	0	0	0	0	0	6.5
	3.3 Irrigation engineer	3	2	2	1	5	5	5	5	5	33
	3.4 Irrigation technical officer	12	6	2	4	15	15	15	15	15	99
4.	Farmers' Organization										
	4.1 Foreign expert	10	5.5	5.5	3.5	0	0	0	0	0	24.5
	4.2 Local expert	2.5	0	0	0	0	0	0	0	0	2.5
	4.3 Cooperative Officer	11	8	8	9	20	20	20	20	20	136
	4.4 Extension officer	48	48	48	32	40	40	40	40	40	376
5.	Capacity Development										
	5.1 Foreign expert	3.5	5	3	2.5	0	0	0	0	0	14
	5.2 Local expert	2	1.5	2	0.5	0	0	0	0	0	6
	5.3 Irrigation engineer	4	4	4	3	5	5	5	5	5	40
	5.4 Irrigation technical officer	10	11	11	8	10	10	10	10	10	90
Total	1. Foreign expert	37	26.5	20.5	19	0	0	0	0	0	103
	2. Local expert	22	15	15	11	8	8	8	5	5	97
	3. Senior officer, irrigation engineer	48	40	40	39	70	70	70	70	70	517
	4. Assistant officer, technical officer	110	105	101	84	145	145	145	145	145	1,125
	Total 1+2+3+4+5	217	186.5	176.5	153	223	223	223	220	220	1,842

Note: M/M schedule of 5. Capacity Development is estimated for irrigation and water management component. Those for other component are included in each proposed component.

Table T3.3.1 Project Cost

(Unit: ZMK million)

Phases	Initial phase (4-year)				Intermediate and final phase (5-year)				Total		2012	
	2013	2014	2015	Sub-Total	2016	2017	2018	2019	2020	Sub-Total		
Master plan	1	2	3	4	5	6	7	8	9			
1. Employment cost												
1.1 International experts	2,590	1,855	1,435	1,330	7,210							7,210
1.2 Local experts	660	450	450	330	1,890	240	240	240	150	150	1,020	2,910
1.3 Senior officer, irrigation engineer	336	280	280	273	1,169	490	490	490	490	490	2,450	3,619
1.4 Assistant officer, technical officer	330	315	303	252	1,200	435	435	435	435	435	2,175	3,375
Sub-Total 1.	3,916	2,900	2,468	2,185	11,469	1,165	1,165	1,165	1,075	1,075	5,645	17,114
2. Operation cost												
2.1 Seminar opening	27	27	27	27	108	27	27	27	27	27	135	243
2.2 Training and matching meeting	56	56	56	56	224	40	40	40	40	40	200	424
2.3 Study tour	40	40	40	40	160	40	40	40	40	40	200	360
Sub-Total 2.	123	123	123	123	492	107	107	107	107	107	535	1,027
3. Project input equipment and materials												
3.1 Farm input	40	40	40	40	160	200	200	200	200	200	1,000	1,160
3.2 Seminar, training tools	20	20	20	20	80	100	100	100	100	100	500	580
Sub-Total 3.	60	60	60	60	240	300	300	300	300	300	1,500	1,740
4. Rehabilitation/ Construction cost												
4.1 Multi-purpose sheds		278			278							278
4.2 Irrigation facilities ^{*1}	3,446				3,446	2,553	2,553	2,553	2,553	2,553	12,765	16,211
Sub-Total 4.	3,446	278			3,724	2,553	2,553	2,553	2,553	2,553	12,765	16,489
5. Administration cost ^{*2}	20	18	17	16	71	28	28	28	28	28	140	211
Sub-Total 5.	20	18	17	16	71	28	28	28	28	28	140	211

	Phases	Initial phase (4-year)					Intermediate and final phase (5-year)					Total			
		Year	2012	2013	2014	2015	Sub-Total	2016	2017	2018	2019		2020	Sub-Total	
		Master plan	1	2	3	4		5	6	7	8		9		
6.	Transportation machinery and consumable materials	A/P	M/P												
6.1	Vehicles (4x4)	2		300		300									
6.2	Pickup trucks (4x4)	4	10	480		480	1,200					1,200	1,680		
6.3	Motor bike	4	20	60		60	300					300	360		
6.4	Fuel and maintenance cost			44	44	44	44	59	59	59	59	59	295	471	
	Sub-Total 6.			884	44	44	44	1,016	1,559	59	59	59	59	1,795	2,811
7.	Office equipment	A/P	M/P												
7.1	Computer	5	10	35		35	70					70	105		
7.2	Printer	5	10	10		10	20					20	30		
7.3	Copy machine	1	5	25		25	125					125	150		
7.4	Maintenance of equipment			11	11	11	11	44	102	102	102	102	510	554	
	Sub-Total 7.			81	11	11	11	114	317	102	102	102	102	725	839
	Total Project Cost			8,530	3,434	2,723	2,439	17,126	6,029	4,314	4,314	4,224	4,224	23,105	40,231

Note: *1 Rehabilitation cost of irrigation facilities excludes physical and price contingency of 15%. Cost of 20 proposed schemes includes these contingency.

Breakdown of cost for irrigation facilities is shown in Annex D.

Cost of 20 schemes constructed in the intermediate and final phase of the Master plan is equally disbursed in its 5-year period.

*2 Administration cost is estimated by equation of: Employment cost of Government staff (1.3+1.4) x 3%

Physical contingency is excluded in the project cost except irrigation construction cost.

Price contingency is assumed at 5%.

Appendix : Cost Estimate and the Basis of Multi-Purpose Shed (MPS)

Multi-Purpose Shed (MPS)

- 1) For three (3) sites (Kabwe district/ Natuseko irrigation scheme; Kafue district/ Chipapa irrigation scheme; and Kazungula district/ Mulabalaba irrigation scheme):

Size and cost of each one (1) site:

Whole floor area: 120 m²

Construction cost: ZMK 28,700,000.-

- 2) For one (1) site (Kalulushi district/ Bwafano irrigation scheme):

Size and cost:

Whole floor area: 220 m²

Construction cost: ZMK 52,700,000.-

◆Cost estimate is made as of September 2010, at the exchange rate of 4,991 ZMK/US\$ and 0.017 JP¥/ZMK.

◆Internal facilities are included.

◆Preparation of land, electric power and water are not included.

◆Investment for construction is assumed to be made over 3 years for completion of MPS
(1st year: 70%/ 2nd year: 15%/ 3rd year: 15%)

Table T4.1.1 Outlines the Overall Objectives/ Strategy of the Donors

Donor	Objectives/Strategy
1. AfDB - African Development Bank	AfDB aims for poverty reduction through the promotion of sustainable growth and productivity grow and strive to operate with country ownership and participatory approaches in project management. Projects belong to the Borrower, and the Bank Group acts simply as a facilitator
2. Australian Government	According to website although Australia funds no programmes directly in Zambia, Australia channels food aid through WFP and FAO
3. Belgium Government	Currently, there is no funding in the agriculture sector
4. British Government	The British Government through its Department of International Development (DFID) aims to eradicate the world of extreme poverty
5. Canadian Government	Although this is an important donor in the country, Canada is currently not involved in the agriculture sector. They are mostly involved in the health sector
6. Chinese Government	China is not currently assisting Zambia in agriculture, although they have done a lot of investment in the country
7. Danish Government	The Royal Danish Embassy has a country framework annual budget of approximately US \$32million. The environmental grant (Special Environment Assistance SEA) NRM is part of the frame. This grant is 'renewed' regularly.Pt. Grants given are approximately 40 million DKK (approximately US \$7million for the period 2004-2007) for a five year period. Note organisations like MS receive their funding directly from the Danish Government and not through the Royal Danish Embassy in Zambia
8. Egyptian Government	The Egyptian Government aims at co-operating with Zambia in mitigation of food deficiency and self support in prisons through agriculture.
9. EU - Delegation of the European Commission of Zambia	The EU's Development mission is to help to reduce and ultimately to eradicate poverty in developing countries and to promote sustainable development, democracy, peace and security. The country strategy is focused on Transport, Institutional Development and Capacity Building together with Macroeconomic support and capacity building for economic governance. Non-focal areas are health and education. The EU support the Government to redefine its role and purpose as the country move towards a better functioning market economy
10. Finnish Government	The Finnish Government Policy (2007-) main goal is to eradicate poverty and promote sustainable development in line with the MDGs. The Finnish Rural Development Strategy supports the Finnish Development
	Policy overall goal to eradicate extreme poverty from the world. Strategy spells out the principles, priorities and channels for Finnish Rural Development support. The guiding principles are: Support for national ownership and enabling political and economic operating environment; Support for representation of the poor; Support for rural livelihoods; Support for sustainable use of natural resources; Women's empowerment; Support for research, extension and services; Attention international operating environment, trade negotiating and policy planning capacity, Finland's focal areas in rural development, guided by partner countries' national development programmes and priorities, are: Support national strategies and support for administrative and institutional actors required in the development; and implementation of these strategies in the field of rural development, Support for the livelihood improvement of the local poor, especially rural women, and economically sustainable productive and income-generating act
11. FAO - Food and Agriculture Organisation	FAO's mandate is to raise levels of nutrition, improve agriculture productivity, better the lives of rural populations and contribute to the growth of the world economy.

Donor	Objectives/Strategy
12. GTZ - German Technical Co-operation of Zambia	GTZ support the project called "The empowerment of small scale farmers involved in animal husbandry and cropping in Southern Province. This project was phased out.
13. IFAD - International Fund for Agricultural Development	The country strategic opportunities paper (COSOP) approved in April 2004 is the basic policy document informing IFAD support to Zambia. The first strategic thrust of the COSOP is to promote smallholder commercialization, including the establishment of equitable links between smallholders and agribusiness and improving access to rural financial services. The second thrust is to assist the more isolated rural populations in raising their productivity, food production and income levels by expanding the outreach and relevance of services and investments to the poorest productive rural households, including women - headed and HIV/AIDS - affected households.
14. Embassy of Japan	In Zambia, Japanese Government places emphasis on rural development as a way to achieve poverty reduction, considering the fact that approximately 70% of the poor resides in the rural area of the country. Particular attention is paid to assistance to enhancing agricultural productivity, such as construction of irrigation, promotion of livestock production, introducing of agricultural production enhancement techniques, and so on. In addition, assistance is rendered in participatory rural development and capacity development at the local level for development plan formulation and implementation in order to contribute to sustainable rural development.
	Japan's ODA to Zambia is currently provided in various forms: grants, technical cooperation, and through funding to international organisations. Embassy of Japan mainly handles grants, including small scale grants to NGOs. Other form of ODA notable in Zambia in the Agriculture sector is through technical cooperation by Japan International Cooperation Agency (JICA).
15. JICA - Japan International cooperation Agency	One of JICA's "priority areas" of cooperation with Zambia, related to agriculture development is Assistance for Poverty Alleviation with the main focus on Rural Development. Under this priority area, JICA has two key programme areas; namely, (i) the Programme to support Rural Development and (ii) Food security Program. Support to agriculture is also rendered through another "priority area" of cooperation, namely the Assistance for Industrial development toward Poverty Alleviation through Economic Growth. Falling under this priority area is the program for Expansion of agricultural production. Projects are implemented under this framework of cooperation between the Governments of the Republic of Zambia and Japan.
17. Libya	Libya has shown strong interest in helping Zambia in agriculture, but negotiations are on going.
18. Netherlands Government	Private sector development Strategic goal: by 2008 enhanced enabling environment for private sector driven growth, especially in the agriculture sector. Note SNV funded directly from the Netherlands Government and not through the Royal Embassy of the Netherlands in Zambia.
19. Norwegian Government	to contribute to enhancing food security and sustainable environment in relation to management of agro-ecosystems.
20. SIDA - Swedish International Development Agency	<p>the overall goal of Swedish development cooperation is to create opportunities for poor people to improve their living conditions through support to the implementation of Zambia's fifth National Development plan, with a specific sector focus on health, agriculture and energy. Continued emphasis is given to democratic development and the respect for human rights, via support to civil society and through mainstreaming into the focus sectors.</p> <p>The specific goal of the cooperative for agriculture sector is to contribute to an increased number of small-scale farmers participating in economic development as economic actors.</p>

Donor	Objectives/Strategy
21 USAID - United states Agency for International Development	The objectives is to increase private sector competitiveness in Agriculture.
	1) Focusing investments on increased access to export Markets, 2) increasing productivity through the adoption of improved production and value-addition technologies, 3) more responsive financial and business development services, 4) the strengthening of Zambia public and private sector institutions and, 5) the adoption of more business-friendly policies
22. WFP - World Food Programme	The Food for Assests/Triaining (FFA/T) component of CP 10157.0 and PRRO 10310 are in line with Strategic Priority No 2, "protect livelihoods in crisis situationand enhance resilience to shocks'. Project activities contribute to millenium Development Doal No. 1 "eradicating extreme poverty and hunger", by providing short-term food assistance to vulnurable households, while helping households create sustainable assets or empowerment through training opportunities. WEP activities in Zambia involve primarily relief and recovery and development aimed at protecting and improving livelihoods, including HIV/AIDS affected households. The agency arrived in Zambia in 1967 when the Government of Zambia requested help with the large influx of regugees fleeing war in Angola. In more recent times the agency has been assisting with food shortages caused by erratic weather, high and HIV/AIDS - a deadly combination that is creating obstacles to long-term national development.
23. World Bank	Working for a free of poverty. Our mission is to help developing countries and their people reach the goals by working with our partners to alliviate porverty. To do that we concentrate on building the climate for investment, jobs and sustainable growth, so that economies will grow, and by investing in and empowering poor people to participate in development. The World Bank builds capacity, contribute to infrastructure, financial system and combating corruption.

Source: JICA Zambia Office

Table T4.2.1 Outlines the Overall Objectives/ Strategy of the NGOs

1.	Name	Africare (since 1971)
2.	Type of NGO	International
3.	Contact / Source	Africare- Zambia, Plot 78/100 off Lake Road, P.O Box 33921, Lusaka, Zambia. Tel: (0211) 264406/ 265845, Fax: (0211) 264453 Email: info@africare.org.zm URL: http://www.africare.org/our-work/where-we-work/zambia/index.php
4.	Past support activities	i) Provided resources for knowledge based services and capital investments through innovative marketing, technical and managerial interventions that benefit small scale farmers to improve productivity, quality and efficiency in the agriculture value chains; ii) Improved the growth and competitiveness of Agricultural businesses and small holder farmers through the promotion of innovative business linkages. iii) Promoted innovative technologies and market based solutions for various sectors in the agricultural value chain.
5.	Current support activities	AGRICULTURAL DEVELOPMENT SUPPORT PROJECT Africare has been trying out to establish joint-contribution system (set certain monthly contribution amount by each joint group) for micro-credit among several farmers' groups in rural areas. The organization is dealing with not only the system set-up but also providing these farmers' groups many opportunities to have technical assistances in food processing (cassava), production of soybean milk, plant-extracted oil etc followed by value-addition skills and related knowledge at filed level. This approach may provide the farmers to challenge in starting their own enterprises in future with utilization of the rural credit system. Whereas in crop production area, Africare is stressing on promotion of organic livestock manures / composts use for cropping, early-planting methods within conservation farming, introduction of improved technology for upgraded quality of groundnuts (Eastern Province) and support of "key farmers" for promoting quality seed production etc. Other than this, Africare is collaborating with USAID for technical assistance in water-saving-irrigation technologies (drip irrigation etc) for smallholders in area where lands are susceptible for drought and other natural disasters.
5.	Selected Interventions	<ul style="list-style-type: none"> • Choma District Dairy Cooperative Union; Project: Dairy Processing • Ubuchi Enterprise; Project: Quality honey promotion and production • Crop Serve (Zambia); Project: Appropriate herbicides usage for small scale farmers • Calsap Supplies; Project: Poultry marketing • PRUSA Producers; Project: Soya drinks • Eastern Province Farmers' Cooperatives Ltd; Project: Aflatoxin free groundnuts • Central Growers Association; Project: Tobacco rocket barn promotion • Zambia Small Scale Growers; Project: Hass Avocado export marketing • Southern Bio Power; Project: Jatrop ha – Bio Fuel • Croppack Agro Services; Project: Agro input rural marketing • Sylva Food Solutions; Project: Traditional soup mixes production • Farmers & Builders Supplies; Project: Appropriate irrigation for small holders • Rift Valley Tropicals; Project: Cage Fish Farming

1.	Name	Plan Zambia / Plan International
2.	Type of NGO	International
3.	Contact / Source	Plan, P/Bag 518X Ridgeway, Plot 87A, Kabulonga Road, Kabulonga, Lusaka, Zambia URL: http://plan-international.org/where-we-work/africa/zambia
4.	Past support activities	i) Develop and improve sustainable agricultural activities to avoid food shortages ii) Improve nutrition through crop diversification and better farming techniques iii) Enhance income by identifying and promoting opportunities for rural enterprise iv) Build the capacity of community based organizations and farmer interest groups for post harvest activities

5.	Current support activities	<p>ECONOMIC EMPOWERMENT PROGRAM (currently renamed as “FOOD SECURITY AND INCOME GENERATION PROGRAM”)</p> <p>The program has been implemented in Mazabuka District, Chibombo District (Kanakantapa area), Mansa area and Eastern Province. The program targets on smallholders (rural youth generation) and covers several individual activity such as; fresh-vegetable production with provision of micro-irrigation tools (units of treadle pumps), quality seed production, crop diversification, fish-culture, conservation farming (CF) practice and promotion with CFU (Conservation Farming Unit) of ZNFU, promotion of small-scale livestock business (goats) etc. Main concept of these activities is always rural economic activation throughout motivating youth generation, who are regarded as talented main work-force, in isolated rural areas. Awareness for self-reliance and appreciation of indigenous natural resources (land and water) by young generation, i.e., human resource in future, is invaluable for the activities being implemented by this international NGO. Plan Zambia currently undertakes and implements a comprehensive program funded by EU; entitles as “Integrated Agricultural Development Program”. The program includes five basic activities including; fish-culture, technical assistance for small-scale irrigation, small-scale livestock (goats) breeding etc, crop diversification for increase of nutrition-uptake by rural inhabitants and conservation farming. Minimum three programs of the total five programs are expected for per-smallholder to work on under the support by Plan Zambia. Youth empowerment is in its basis.</p>
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1.	Name	International Development Enterprises (IDE) (since 1981)
2.	Type of NGO	International
3.	Contact / Source	<p>International Development Enterprises In Zambia Plot No. 1800 Nchenja Road, Northmead, P.O Box 32341, Lusaka, Zambia URL: (home) http://www.ideorg.org, (case-study in Zambia) http://www.ide-uk.org/IDE_Case_studies4.html, (blog) http://blog.ideorg.org/category/zambia/</p>
4.	Activities	<p>IDE is a social enterprise organization (headquarters in USA) and has country programs over Asian and African countries. IDE has worked to reduce poverty in these countries by helping the rural poor increase their agricultural productivity, income and job-creation. From this experience, IDE has developed a unique market-oriented approach for rural economic POVERTY REDUCTION THROUGH IRRIGATION AND SMALLHOLDER MARKETS (PRISM).</p> <p>IDE is also well recognized for its field-based activities to provide smallholder farmers with agricultural support services (eg. innovative practices of technologies for small-scale irrigation associated with other fields). The innovative technologies include pump units (treadle pump and rope pump), irrigation kit / system (drip and sprinkle) and water storage systems etc. All of these products are developed for cost-effectiveness and sustainable-use by smallholders. Treadle pumps, <i>MOSI-O-TUNYA Pumps</i>, are currently utilized by many smallholders (micro-irrigators) widely over the presenting study area in Zambia (e.g. Kabwe and Kazungula Districts).</p>
5.	PRISM	<p>PRISM is a set of tools that are used to develop an understanding of the unique situation of the rural poor and to create sustainable solutions to rural poverty. PRISM creates sustainable opportunities through market-oriented interventions by:</p> <ul style="list-style-type: none"> - Creating networks of small enterprises to provide agricultural supplies needed by poor farmers - Working with farmers to improve small farm productivity - Linking small farm families to markets for effective and sustainable poverty reduction <p>PRISM GOALS AND PRINCIPLES</p> <ul style="list-style-type: none"> - Small-holder focus - Make markets serve the poor - Improve water control and use to enable more small-holders to participate - Listen and learn, then implement

		<ul style="list-style-type: none"> - Sustainable resource management <p>ACTIVITIES</p> <ul style="list-style-type: none"> - Market research for market-led production - Pro-poor technology innovation and marketing - Opportunistic approach: identifying untapped, underutilized and/or poorly utilized resources to benefit the smallholder - Water approach: examining untapped, underutilized or inefficiently used water resources in areas where irrigation or improved irrigation practices can benefit the smallholder - Market approach: searching for crops that many small holders can produce and sell for profit. This approach involves understanding market demand and what small holders can produce to meet market demands. - Combination approach: Establishing supply chains for micro-irrigation and agriculture inputs together with technical support, quality control and training of dealers and sub dealers to provide effective services to farmers. <p>Demand creation through social mobilization and through the provision of technical assistance to small holders willing to adopt new ideas.</p> <p>Market development through the establishment of collection centers for small holder produce and through workshops to link traders to the collection centers.</p> <p>Linking farmers to micro credit sources</p> <p>Training farmers in green house management so that farmers can produce off season in order to obtain the highest possible price.</p> <p>Post harvest processing of small holder produce.</p>
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1.	Name	Micro Bankers Trust (since 1996)
2.	Type of NGO	International
3.	Contact / Source	Micro Bankers Trust 57 Zambezi Road, Roma Township, P.O Box 51122, Lusaka, Zambia Email: mbt@mbt.com URL : (not available)
4.	Introduction	Micro Bankers was formed by the Ministry of Community Development and Social Services in collaboration with the European Union as a non-profit making Zambian organization. It was established out of the need for creating an institution to champion the provision of alternative financial services for the vulnerable and viable population in Zambia with special emphasis to women. It was established predominantly for those who do not have access to loans from formal financial institutions to borrow for enterprise development, with the assumption that financial provision would lead to poverty reduction among the poor.
5.	Loans offered	<p>AGRICULTURE EQUIPMENT LOANS</p> <p>The Agriculture Equipment Loans is a combination of 2 loan products i.e. Irrigation Equipment and the Power Tiller products with the support of MACO. The client must reside at the farm. For irrigation loans there should be a borehole on the farm.</p> <p>SMALL LIVESTOCK LOANS</p> <p>These loans are primarily for small scale farmers engaged in rearing of small livestock for on business lines. These include poultry rearing and piggery.</p> <p>DAIRY LOANS</p> <p>The Dairy Loan product is primarily a credit line for Dairy animals that are accessed by targeted groups. The loan shall finance the purchase of dairy animals and a limited amount will meet the cost of the starter medication kits, milk bucket and transportation cost not exceeding 20% of the cost of the animal.</p>

1.	Name	ELIF/ IFC COMESA SME Tool Kit Project
2.	Type of NGO	International
3.	Contact / Source	COMESA ZAMBIA SME TOOLKIT PROJECT, COMESA Secretariat , Banking Hall, P.O Box 30051, Lusaka, Zambia URL: www.zamcom.smetoolkit.org
4.	Introduction	Elif business solutions is an ICT based enterprises development support agency or institution through the promotion of multi-stakeholder partnership with CBOs, NGOs with public and private sector support, while on the other hand involving the local and international cooperating partners/funding agencies. Now partnering with IFC and COMESA (Common Market for Eastern and Southern Africa) to promote training of SMEs and business development service providers in new sustainable business management practices through the SME toolkit.
5.	Objectives	To allow BDS providers to provide support, advise and follow on training to their clients using the toolkit. Provide hands on training in selected areas to business owners and managers Determine additions that should be made to the toolkit to make it more useful and relevant to local businesses. Promote capacity building in new sustainable business management practices for SMEs. To promote the awareness on carbon finance and CDM programs and BDS services with possible financing opportunities or options.

1.	Name	MM Consultancy (since 2005)
2.	Type of NGO	International
3.	Contact / Source	MM Consultancy, Kulima Tower, 6th floor Tyecorp Office, Lusaka Zambia. URL : (not available)
4.	Introduction	MM consultancy is headed by Ms Maureen Musabula who has vast experience in the field of Agro-Training in rural areas having worked for Village Industry Service where she was Hammer mill programme coordinator. Areas of Specialty <ul style="list-style-type: none"> - Agro Entrepreneurship - Marketing and Market Linkages - Leadership Training - Rural women Agro based entrepreneurship - Training in the 7 major local languages of Zambia

1.	Name	Care International, Zambia (since 1992)
2.	Type of NGO	International
3.	Contact / Source	URL: http://www.care.org/careswork/countryprofiles/108.asp
4.	Activities	Agriculture Care International (hereafter as CARE) responded to the food crisis in 2005 by distributing food and helping farmers to improve their crops to make them more drought-resistant. The focus for CARE in Zambia has been on helping farmers get the most out of their land by improving agricultural techniques and ensuring they are able to use their land as effectively as possible, without reducing its fertility. Microfinance They are also helping people to set up small businesses by giving them small loans. Microfinance helps whole communities out of poverty Affordable financial services are central to addressing poverty. Microfinance services help the poorest earn a living, grow their businesses and create new jobs, pulling whole communities out of poverty. CARE's programmes work hard to ensure that poor people across the world have access to the financial tools and training they need to help lift themselves out of poverty. CARE has been working on microfinance for more than two decades and currently has 131 microfinance projects in 39 countries, helping poor people to increase their incomes and make their futures more secure.

		<p>CARE works with local community groups around the world, helping them organise and finance their own Village Savings and Loans Associations (VSLAs). VSLAs are groups formed by communities that begin by pooling the savings of those involved and ultimately use these savings to make loans to individual members.</p> <p>CARE receives support from a number of financial institutions for their work in microfinance. In one initiative Barclays, CARE and Plan International have joined together to improve the quality of life for over 500,000 people across Africa, Asia and South America through microfinance.</p>
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1.	Name	World Vision, Zambia (since 1981)
2.	Type of NGO	International
3.	Contact / Source	URL: http://www.worldvision.org/content.nsf/learn/world-vision-zambia
4.	Introduction	<p>World Vision is a Christian humanitarian organization dedicated to working with children, families, and their communities worldwide to reach their full potential by tackling the causes of poverty and injustice. World Vision serves all people, regardless of religion, race, ethnicity, or gender.</p> <p>World Vision's history in Zambia</p> <p>In 1981, World Vision began its work in Zambia by hosting a Christian Council conference in Livingstone. In addition to evangelistic and leadership efforts, sponsorship was initiated to provide assistance for 900 children.</p> <p>In 1989, World Vision's project for Zambia Flood Relief assisted 65,000 people affected by nearly a month of torrential rains and flooding. Victims received food, blankets, medicine, and insecticides to combat malaria.</p>
5.	Key projects	<p>World Vision helps farmers increase their productivity by facilitating procurement of locally adapted seeds and tools, teaching them improved agricultural practices, and training them on improved post-harvest storage and processing techniques. Rural families need easy access to markets to profit from their increased farm production, but they are hindered by lack of information and poor infrastructure. World Vision helps farmers organize themselves into cooperatives, access credit and other financial services, and learn how to succeed in markets so they can graduate from subsistence to commercial farming.</p> <p>World Vision ensures the long-term impact of its interventions, both through training and by assisting farmers to protect and conserve their natural resources, as well as to restore already degraded areas. Farmers learn to prevent erosion, rebuild the fertility of their soil, use water more efficiently, and preserve the biodiversity of their farms and the surrounding landscape</p> <p>Collaborations and Partnerships</p> <p>World Vision intentionally works through alliances and collaborative partnerships with non-profit organizations, universities, research organizations, and private sector companies to magnify the impact of its agricultural development and environmental protection efforts. The organization holds partnerships also with MACO and ZNFU in some areas. Financial resources are provided by the U.S. government, major foundations, and many private groups and individual donors, large and small. In country wide project with relation to agricultural field, Food Vouchers Program is now under implementation (maize mill-mill, plan oil, beans and soap are included items). "Food security" and "sustainable land use" are keywords for the activities and indispensable in Zambia.</p>

Note:

The JICA Study Team has shared information with some of above listed NGOs for overall project objectives and outlines coupled with detailed Action Plan components, in the period of November to December 2010. The information contented is derived originally either from visiting interview / hearing or source of their supplemental matters issued officially (includes web contents and brochures). The web source contents have been last verified in December, 2010.

Figures

Fiscal year		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Components		1	2	3	4	5	6	7	8	9	10
		← Initial phase: 4 years →				← Intermediate phase: 3 years →			← Final phase: 2 years →		
1.	Preparation for the Pilot Projects	■									
2.	Irrigated agriculture										
	Soil improvement	■	■	■	■						
	Strategic cultivation		■	■	■						
	Improvement of farming		■	■	■						
3.	Distribution and Marketing										
	Promotion of Collective Marketing	■	■	■	■	■	■	■	■		
	Strengthening of Practical Marketing Skill	■	■	■	■	■	■	■	■		
	Technology Transfer by OJT	■	■	■	■	■	■	■	■		
4.	Irrigation and water management										
	Rehabilitation of existing irrigation schemes	■	■	■	■	■	■	■	■	■	
	Acceleration of surface water use		■	■	■	■	■	■	■	■	
	Proper water use		■	■	■	■	■	■			
5.	Strengthening of farmers' organizations										
	Enhancement of market activities	■	■	■							
	Support of farmers' groups		■	■	■	■	■	■	■		
	Strengthening of water users associations		■	■	■	■	■	■	■		
6.	Capacity building of farmers and Government officials										
	Capacity building of farmers	■	■	■	■						
	Improvement of extension services	■	■	■	■						
	Irrigation, water management		■	■	■	■	■	■			
7.	Monitoring and Evaluation	→ ■	→ ■	→ ■	→ ■	→ ■	→ ■	→ ■	→ ■	→ ■	→ ■
8.	Reports	■	■	■	■	■	■	■	■	■	■

Fig.F2.2.1 Project Implementation Schedule

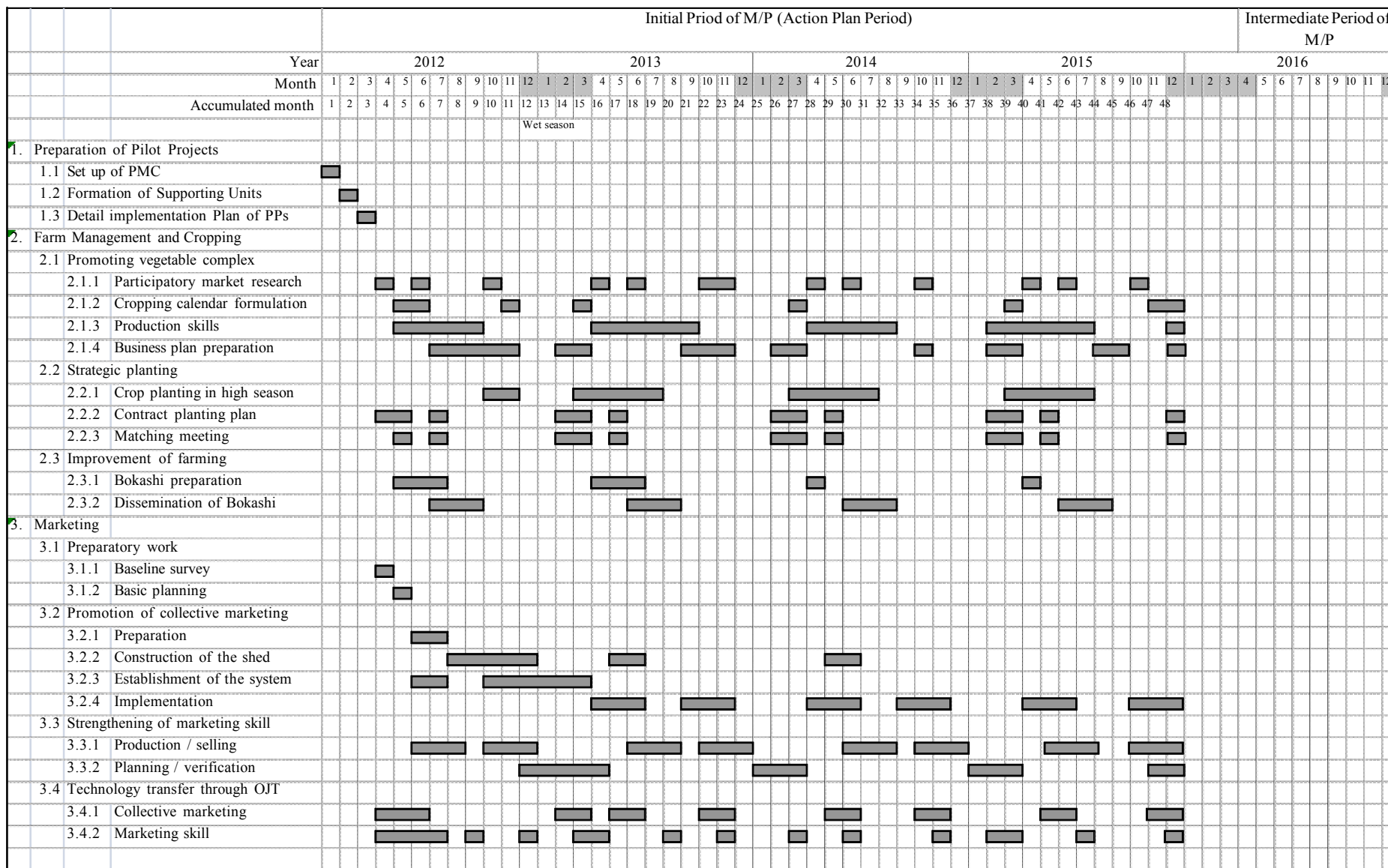


Fig. F2.3.1 Implementation Schedule of the Action Plan (1/2)

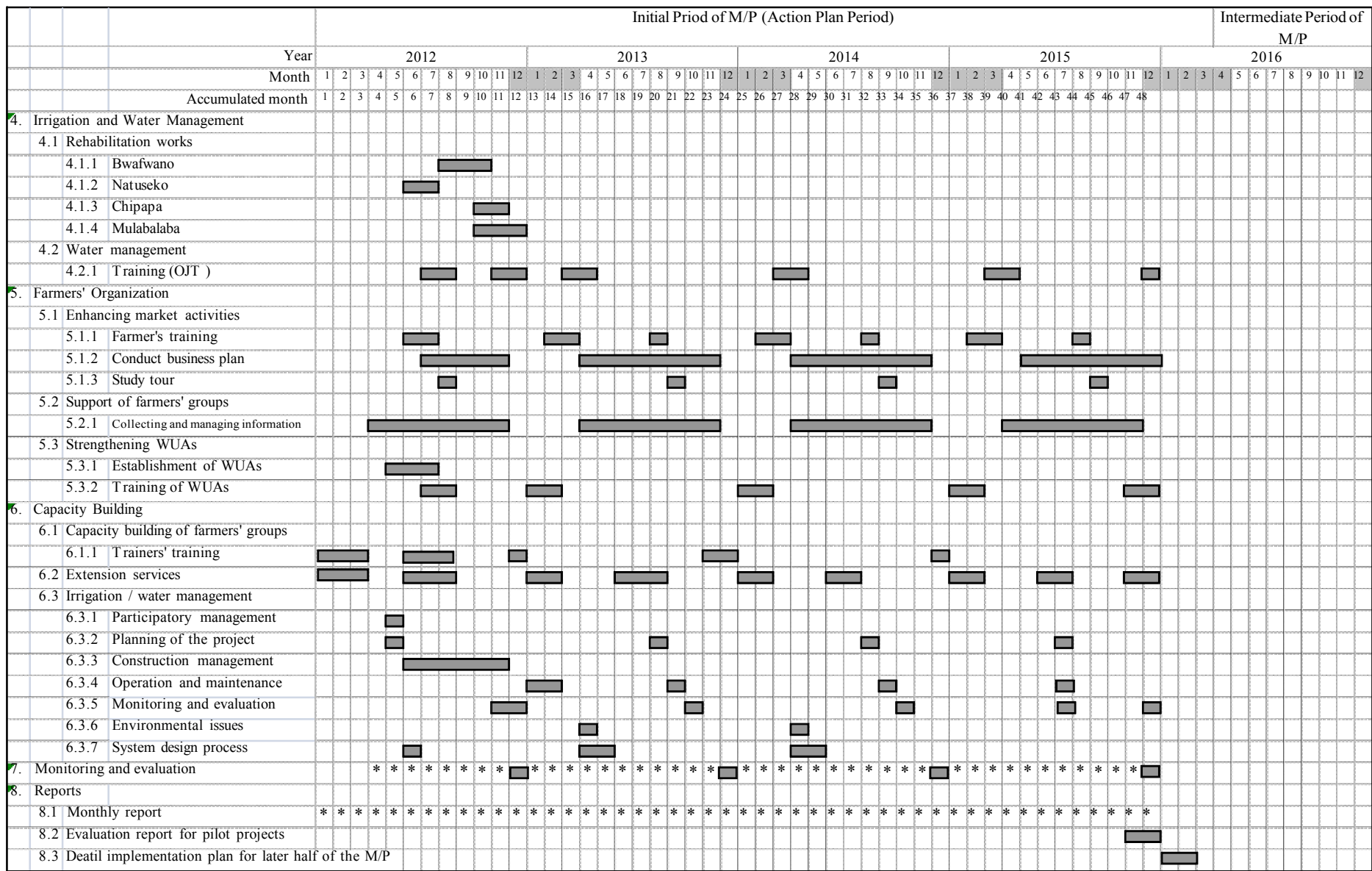
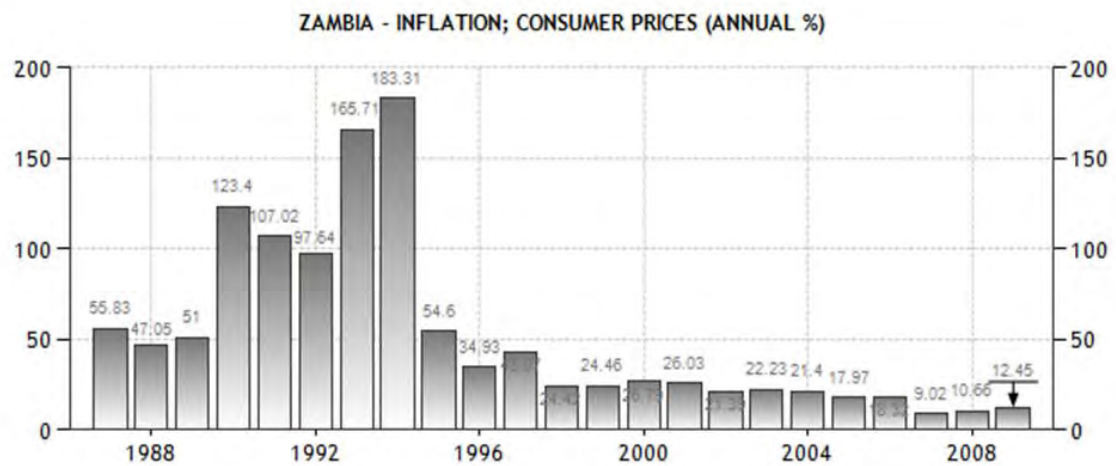
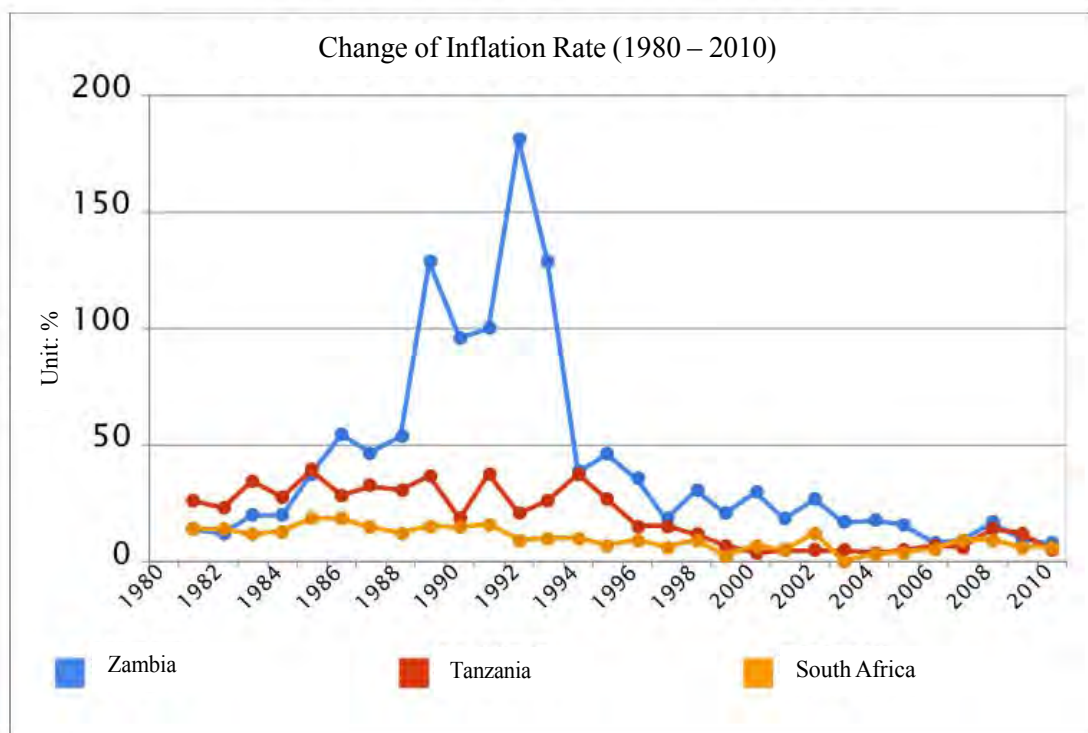


Fig. F2.3.1 Implementation Schedule of the Action Plan (2/2)



Source: TradingEconomics.com

Fig. 3.1.1 (1) Inflation, Consumer Prices



Source: http://ecodb.net/country/ZM/imf_inflation.html

Fig.F3.1.1 (2) Change of Inflation Rate of Zambia, Tanzania and South Africa

Annex H

General Aspects of the Model Sites for Action Plan

The Master Plan for Promotion of Irrigated Agriculture for Smallholders
in the Peri-Urban Areas in the Republic of Zambia
Final Report
Annex H. General Aspects of the Model Sites for Action Plan

Table of Contents

	page
Annex H. General Aspects of the Model Sites for Action Plan	
H.1 Bwafwano Irrigation Scheme, Kalulushi District / Copperbelt Province	H-1
H.2 Natuseko Irrigation Area, Kabwe District / Central Province.....	H-4
H.3 Chipapa Irrigation Scheme, Kafue District / Lusaka Province	H-7
H.4 Mulabalaba Irrigation Scheme, Kazungula District / Southern Province	H-10

H.1 Bwafwano Irrigation Scheme, Kalulushi District / Copperbelt Province

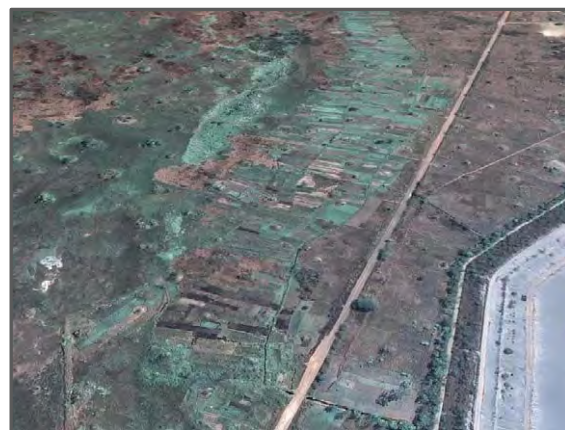
Basic Information

Name of Agricultural Block	Mwambashi
Name of Agricultural Camp	Ichimpe
No of farmers' groups in the area	3 groups; Bulimi (B), Tiwonge (Tw), Tusheni (Ts)
No of membership for each group	B: 60, Tw: 40, Ts: 76
Actual no of farmers participating	176
Sum of gardens under irrigation (m ²)	440,000
Unit garden allocated per member (m ²)	2,500 on average
Unit garden under rainy season (m ²)	2,000 on average
Unit garden under irrigation (m ²)	2,500 on average
Remarks	-

Source : DACO and farmers' groups

General Aspect of the Area

Bwafwano community falls under Ichimpe camp in Mwambashi Block 8 km to the East of Kalulushi town centre. The area is easily accessible via Kalulushi-Chingola Road which is, however, in poor condition. The irrigation area covers an area of approximately 0.375 km². Demographically, Ichimpe has a total population of 3,764 comprising of 749 households. Due to its gentle undulation, the major land use for the area is agricultural and agro-forestry.



Bwafwano area. Source: Google Earth (earth.google.co.jp, date last verified 21 December, 2010).

Farmers grow different crops, both rain fed and irrigated. Maize is the major crop grown in rain season, while farmers grow a variety of irrigated vegetables in the dry season; these include tomato, baby marrow, carrots, green beans, cabbage, okra, onion etc. There are also vast plantations of pine under the custody of Zambia Forestry and Forest Industries Corporation (ZAFFICO) and a few small scale mines. The land is utilized mostly for gardens with a source of water mainly from stream and dug up wells to irrigate their crops.

Landscape

Bwafwano area lies on the eastern part of the Boma at an altitude of between 1225-1250 m above sea level. The land is generally flat but tends to undulate eastwards making it suitable for canal irrigation as water freely flows from the source to the gardens without any inducement. In addition, they are not prone to excessive erosion because of the favourable topography.

The area is on a low lying zone extending from Mwambashi River, a tributary of the Kafue River, characterized by dambo black alluvial soils which are mainly waterlogged during the rainy season. However, the soils have particularly proven to be suitable for different crop cultivation, including Maize (staple), sweet potatoes and vegetables.

Ecological Conditions

The area has vegetation typical of a dambo area characterized by mainly dambo grass comprising, typha, sedges, reeds, short shrubs and a few trees scattered mostly of Acacia. On the western side, 200-500 m from irrigation scheme, is a residential area where people who utilize the area stay while the northern side has a plantation of pines which serves as a wind breaker, making the area a beautiful site. The plantation is Ichimpe Forest Reserve Number 8.

The source of water is mainly from two perennial streams merging to form Kafikondo Stream. A supplemental water body is a tailings dam (Mindro pond / reservoir) for the mines whose discharge is harnessed via a canal for irrigation but tends to reduce flow and or dry up between September-November just before rains start. In addition the area has great potential in underground water; hence shallow wells are dug for consumption and irrigation purposes when water supply becomes erratic.

Due to the flatness of the land, the available water resources are quite supportive to irrigation agriculture when properly utilized.

Agronomic Conditions

Kalulushi district lies in Agro-Ecological Zone III receiving annual rainfall of about 1341mm for the period spanning for about 160 days, starting from November to February. The average drought period in each rain season is about 2.5 days.

The rain fed crops are mainly maize, cassava, and sweet potatoes; while vegetables such as cabbages, carrots, baby marrow, tomatoes, onion, okra and green beans are grown under irrigation.

Other Unique Features


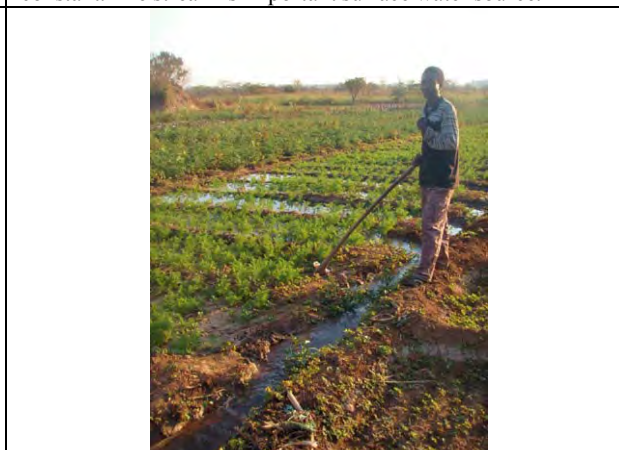

The area is typical of a peri-urban area accessible through a tarred road which links it to Kitwe, Chingola and Mufurila posing a huge market demand for vegetables. More than 80% of the total population of the province settle in urban area whereas potentials for farm land, water resource and marketing are not fully utilized.

Major Markets for Fresh Vegetables produced by the Areal Smallholders

Chisokone market (Kitwe), local markets in Kalulushi, Sabina (Kalulushi), to other district (e.g. Chililabombwe), and to Kasumbalesa (Zambia - DR. Congo boarder).

Figures of the Site

(see the following pages)

	
<p>Mindro pond located nearby Bwafwano irrigation area. Part of storage water within the pond will flow into regional stream as overflow discharge after leveling-up of water under rainy season.</p>	<p>Channel of the stream flowing along farm area and feeder road. The photo indicates that flow volume appears less under dry season although base-flow is kept somewhat constant. The stream is important surface water source.</p>
	
<p>Shallow well also exists within the garden. Farmers prepared the well as the last resort to surpass insufficient water availability for irrigation. Shallow ground water level remains under rainy season.</p>	<p>A member of the farmers' group is inletting water from secondary canal (earthen) for flood irrigation over a small-plot.</p>
	
<p>The long side of a rectangle shape plot along with secondary canal. Irrigation is well managed by utilizing gravitational flow of channel with slight land inclination.</p>	<p>Plots are well established (zoned) and prepared by the farmers' group. Unit plot size is 100 x 12 m², approximately.</p>

H.2 Natuseko Irrigation Area, Kabwe District / Central Province

Basic Information

Name of Agricultural Block	Waya
Name of Agricultural Camp	Natuseko
No of farmers' groups in the area	2 groups; Moto Moto A (M-A), Moto Moto B (M-B)
No of membership for each group	M-A : 40 (M 21, F 19)*, M-B : 36 (M 23, F 13)
Actual no of farmers participating	M-A : 40 (M 21, F 19), M-B : 36 (M 23, F 13)
Sum of gardens under irrigation (m ²)	M-A : 300,000, M-B : 295,000
Unit garden allocated per member (m ²)	M-A : 15,000, M-B : 12,500
Unit garden under rainy season (m ²)	15,000 on average
Unit garden under irrigation (m ²)	7,500 on average
Remarks	There are more irrigable lands whose owners are ready to join the scheme.

Source : DACO and farmers' groups * (M , F) denotes individual number for Male and Female.

General Aspect of the Area

The population of Natuseko irrigation scheme is approximately 640 with a total number of 80 households. The area in question is a dambo mainly utilized by the local authority on the eastern part as discharge ponds for sewerage dispose. Mainly the land is utilized for gardening with a source of water mainly from stream and dug up wells to irrigate their crops. The crops grown are mainly vegetables, sweet potatoes and sugar canes. Therefore the main industry is agriculture.



Natuseko area. Source: Google Earth (earth.google.co.jp, date last verified 21 December, 2010).

Landscape

The area is on a low lying zone characterized by dambo black alluvial soils which are mainly waterlogged during the rainy season. There are no trees except the dambo grass which characterized the area. The area has a gentle slope with a stretch from the south eastern to the north western point. On the eastern part of the area is residential homes where the people who utilize the area come from.

Ecological Conditions

The area is mainly dambo whose vegetation type is mainly grass, river reeds and the surrounding area is characterized by short shrubs of trees especially on the western part of the stream.

The source of water is mainly from the stream. The stream is more utilized during the dry season for irrigation. Water sources are also from the shallow wells within the dambo area. The remarkable site specific wild nature is that the area is a wet land in the sense that it is a source of both surface and

groundwater.

Agronomic Conditions

Natuseko lies in the Zone II of the Agro-Ecological Region meaning that it receives an annual rainfall range 800 to 1,000 mm per annum.

The rain fed crops are mainly maize, sugar cane and rice at a small scale level; while vegetables such as cabbages, carrots, tomatoes, okra and green beans are grown under irrigation.





Other Unique Features

The area stretches along the railway on the western and a residential compound on the eastern side can easily be accessed from main road (Great North Road) through a gravel road. On the northern side of the site are tall silos used mainly for grain.

Major Markets for Fresh Vegetables produced by the Areal Smallholders

Kasanda market, New Kasanda market, Nakoli market and Ngonga market etc in Kabwe township area.

Figures of the Site

	
<p>Stream area (on the left side) and gardens for the farmers' groups. The area is characterized by dambo utilization.</p>	<p>Lima-scale garden with upland residential area in distance. Unit plot size in the area varies, however, revealed less than 1 lima (2,500 m²) according to field interviews to the farmers' groups.</p>
	
<p>Part of the gardens of the irrigation site are located on lower part and are characterized by dambo black alluvial soils</p>	<p>The garden located on site with shallow ground-water-level. The photo shows crop plants in initial stage on ridge prepared for water logging condition.</p>



Shallow well constructed nearby cabbage garden (winter dry season). Farmers utilize treadle pumps for up-taking water from well to their gardens.



Members of the farmers' group in Natuseko. Some bicycles seen are well utilized as transportation for shipping their fresh vegetables to markets.

H.3 Chipapa Irrigation Scheme, Kafue District / Lusaka Province

Basic Information

Name of Agricultural Block	Chipapa
Name of Agricultural Camp	Chipapa
No of farmers' groups in the area	1 groups; Chipapa Dam Garden Committee
No of membership for each group	120
Actual no of farmers participating	120
Sum of gardens under irrigation (m ²)	100,000
Unit garden allocated per member (m ²)	250 on average
Unit garden under rainy season (m ²)	250 on average
Unit garden under irrigation (m ²)	250 on average
Remarks	Some farmers have more than 1 plot.

Source : DACO and farmers' groups

General Aspect of the Area

The area covers three villagers namely Mwando, Chityolyolo and Mulendema with population of 850, 700 and 800, respectively. The number of households participating in irrigation at Chipapa irrigation scheme is 120. Agriculture is the mainstay activity for the community and 10 ha scheme area is used for gardening during the post rainy season only. Crops grown are tomatoes, green beans, onion, green maize, and water for irrigation is from



Chipapa area. Source: Google Earth (earth.google.co.jp, date last verified 21 December, 2010).

Chipapa Dam located 400 m away. Water from the dam is released by means of an outlet pipe up to the distribution box after which it is conveyed to the field via a canal network system.

Landscape

The garden area is low lying, with a relatively flat and gently sloping land that is susceptible to partial logging during the rain season. The dam is mainly recharged by an ephemeral stream that conveys runoff water from the bordering mountain ranges located on the southern, eastern and northern sides. The community farmers, as cooperative members, are settled around the scheme land to the south, west and north of the dam.

Ecological Conditions

The area lies in agro-ecological zone II with average rainfall ranging between 800 to 1,000 mm. The gardening area is a dambo. On the borders and up to the mountain ranges that is grass and three vegetation cover. Deforestation for the purpose of charcoal burning is rampant and this has reduced the vegetation thickness.

The water source is Chipapa dam fed by an ephemeral stream carrying runoff water from the

surrounding mountains which form the catchment.

Rain-fed crops on the upland are maize, sweet potatoes, groundnuts and a little sorghum,

Agronomic Conditions

Irrigation of crop is by furrow and flooding. The soils are clayey and thus allowing growing of leafy and fruit vegetables than root crops. The cropping pattern follows the seasons; the garden is grown to vegetables during the dry season whereas maize is grown during the rainy season.

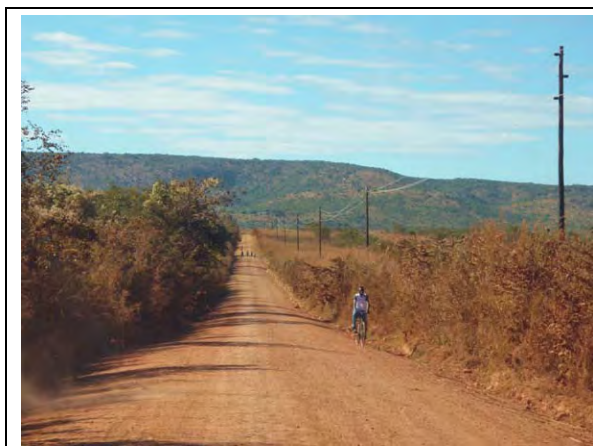
Other Unique Features

The areas are accessed by a 7 km gravel road off Kafue-Lusaka Road in Chilanga. Along the way and up to the rail line crossing are smallholder farmers who practice mixed farming. Crossing over the railway, the area reaches traditional land with traditional farmers. Community-support services are provided by area staff under MACO for community development, veterinary, education, health including the local court and religious organization.

Major Markets for Fresh Vegetables produced by the Areal Smallholders

Targeting market for Chipapa area is dominantly the Soweto Market in center of Lusaka city area. Farmers in the community utilize public transportation (mini bus) for shipping their produces to the market. The produces are also (re) distributed over major town markets in Lusaka.


Figures of the Site



Feeder road connecting Kafue road (principal road) and Chipapa community. The road is currently under rehabilitation work (November, 2010). The areas are accessed by a 7 km gravel road off the principal road.



Canal with lining and gardens of the irrigation scheme. Gardens are well managed by participants of the irrigation scheme (i.e., farmers' group). Unit plot size is 10 x 10 m², approximately.

	
<p>Dam bank and water body (dry season in November). Water level comes to deplete though still remains to supply water to the garden.</p>	<p>Water flowing into a secondary canal (earthen) from a principal canal. All of the plots under the scheme appreciate irrigation system under the same manner for its good reclamation.</p>
	
<p>Cattle manure is under the process of decomposition on ground. Farmers co-utilize these manures for their garden to improved soil fertility.</p>	<p>Establishment of green beans over the plots (winter season in July). These green beans will be harvested and shipped to Soweto market in Lusaka.</p>

H.4 Mulabalaba Irrigation Scheme, Kazungula District / Southern Province

Basic Information

Name of Agricultural Block	Musokotwane
Name of Agricultural Camp	Kabuyo
No of farmers' groups in the area	3 groups; Mukamba (M), Tulime (T), Sima Sikabwe (S)
No of membership for each group	M: 125, T: 65, S: 65
Actual no of farmers participating	M:29(M 18, F 11) *, T:19(M 13, F 6), S:16(M 8, F 8)
Sum of gardens under irrigation (m ²)	160,000
Unit garden allocated per member (m ²)	2,500 on average
Unit garden under rainy season (m ²)	2,500 on average
Unit garden under irrigation (m ²)	2,500 on average
Remarks	There are 84 plots and the scheme has room to expand (100,000 m ²) with the available water from the dam.

Source : DACO and farmers' groups * (M , F) denotes individual number for Male and Female.

General Aspect of the Area

The population of Mulabalaba irrigation scheme is approximately 600 with a total number of 132 households in 3 villages of Mulabalaba, Sikabwe and Likunyi. The operation area is utilized mainly by the local people for agricultural production. In addition, the surrounding anthills (termite mounds with large-scale basal diameter, height and high population density) have been used for molding of pan bricks. The land is used



Mulabalaba area. Source: Google Earth (earth.google.co.jp, date last verified 21 December, 2010).

mostly for gardening with the water source mainly from the dam. The agricultural camp is 43 km from the block office in Musokotwane. Further point is 18 km from camp office. The dam is built on Nampongo stream which takes water into Ngwezi River. All of these streams belong to Zambezi River basin.

Landscape

The area is located on plateau covered with sandy-sandy loam soils. Rainfall range between 600-700 mm. Vegetation is characterized by Miombo woodlands. The Ngwezi River passes north of the camp with Zimba hills to the north. The place is inhabited by the Toka people living in scattered settlements. The main occupation is crop production and grazing (cattle and goats). Infrastructure development in the area includes a new rehabilitated Zimba Livingstone roads and electricity in the area. The area has severe soil erosion problems due to adulating terrain and thus high erodibility under intensive rains (short period with relatively high rainfall intensity) of dry seasons.

Ecological Conditions

Mulabalaba area is mainly characterized by some savanna grassland and scattered shrubs.

The source of water is from the dam which is more utilized during the dry season and the dam even in the worst drought experience in the past 10 years has never dried up.

Agronomic Conditions

The area lies in Zone 1 of Agro-Ecological Region of Zambia meaning that it receives an annual rainfall range of 600 to 700 mm per annum.

Major rain fed crops are maize, groundnuts, cotton and sweet potatoes at a small scale, whilst vegetables such as tomatoes, cabbages, carrots, eggplants, green pepper and green maize are grown under irrigation.

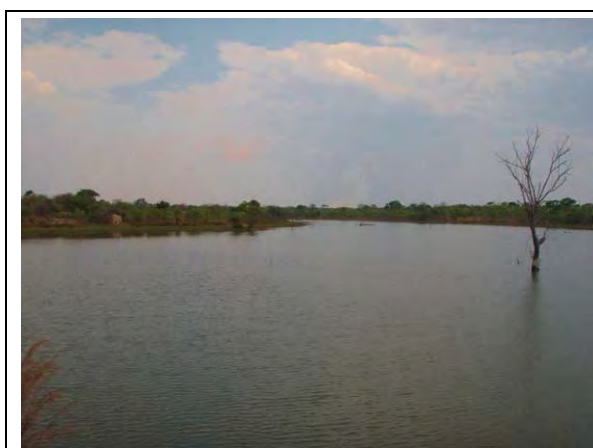
Other Unique Features

Mulabalaba scheme can be accessed from the South East by the newly rehabilitated Zimba Livingstone road and graded feeder road which was used by the contractor to get water from the dam. There is electricity about 6 km from Kabuyu Basic School. There are 3 hand pumps, equipped for groundwater uplifting, and located over beneficiary area of the dam.

Major Markets for Fresh Vegetables produced by the Areal Smallholders

Maramba main market and Mbita market in Livingstone township area. There is also an opportunity for cross-boarder trading via exporters of Kazungula border market (Botswana etc) or selling to the buyers (*Mo-Business* etc.) from Livingstone city. It is well recognized that the area holds favored marketing potential for tourist facilities such as hotels, lodges and motels.

Figures of the Site



Overview of the dam (dry season). Dam was constructed by damming up a stream flowing in the area.



Members of the farmers' group are inspecting inlet of pipes, which are connected to a siphoning box on the bank.



View of garden area from the bank side. Canal conveys water up-taken by siphon system to gardens in downstream direction.



Some gardens located nearby water source (within catchment area) need micro-irrigation method; i.e., treadle pump use for irrigation.



Typical arrangement of gardens cropped with cabbage. It should be noted that the garden seen in photo is located on upper position than principal canal and therefore needs man-power irrigation (i.e. treadle pump use) for inletting water from the canal. Unit plot size is less than 1/2 Lima (1,250 m²) though it varies by and large.



Major market in Livingstone (Maramba main market in township area). The farmers' groups in Mulabalaba also ship their fresh vegetables to this market while they are shipping seeking for different marketing channels currently.

Annex I

Manual for GIS Operation

The Master Plan for Promotion of Irrigated Agriculture for Smallholders
in the Peri-Urban Areas in the Republic of Zambia

Final Report

Annex I. Manual for GIS Operation

Table of Contents

	page
Annex I. Manual for GIS Operation	
Chapter 1 Raster Data Editing	
1. Geometric correction of raster data	I-1
2. Input and Editing of Vector Data	I-8
(1) Start of edit.....	I-8
(2) Establish snapping.....	I-9
(3) Edit of point.....	I-10
(4) Edit of line	I-14
(5) Edit of polygon.....	I-17
Chapter 2 Edit of Attribution	
1. Introduction	I-19
2. Display of Attribute data.....	I-20
(1) Display of “Tools” bar.....	I-20
(2) Display of Attribution.....	I-21
(3) Attribution of meteorological and hydrological data base.....	I-25
(4) Attribution of farming and marketing information.....	I-29
3. Input and editing of the attribute data.....	I-30
1) “Edit” button	I-30
“Save” button	I-31
“Undo” button.....	I-32
Confirmation of editing.....	I-33
5) Input and editing of the rainfall and run-off data.....	I-34
6) Input and editing of the irrigation data	I-36
7) Input and editing of production data.....	I-38
4. Print of irrigation data.....	I-39
(1) Display of print data	I-39
(2) Print of all data.....	I-39
(3) Print.....	I-40
Forbidden clause	I-41

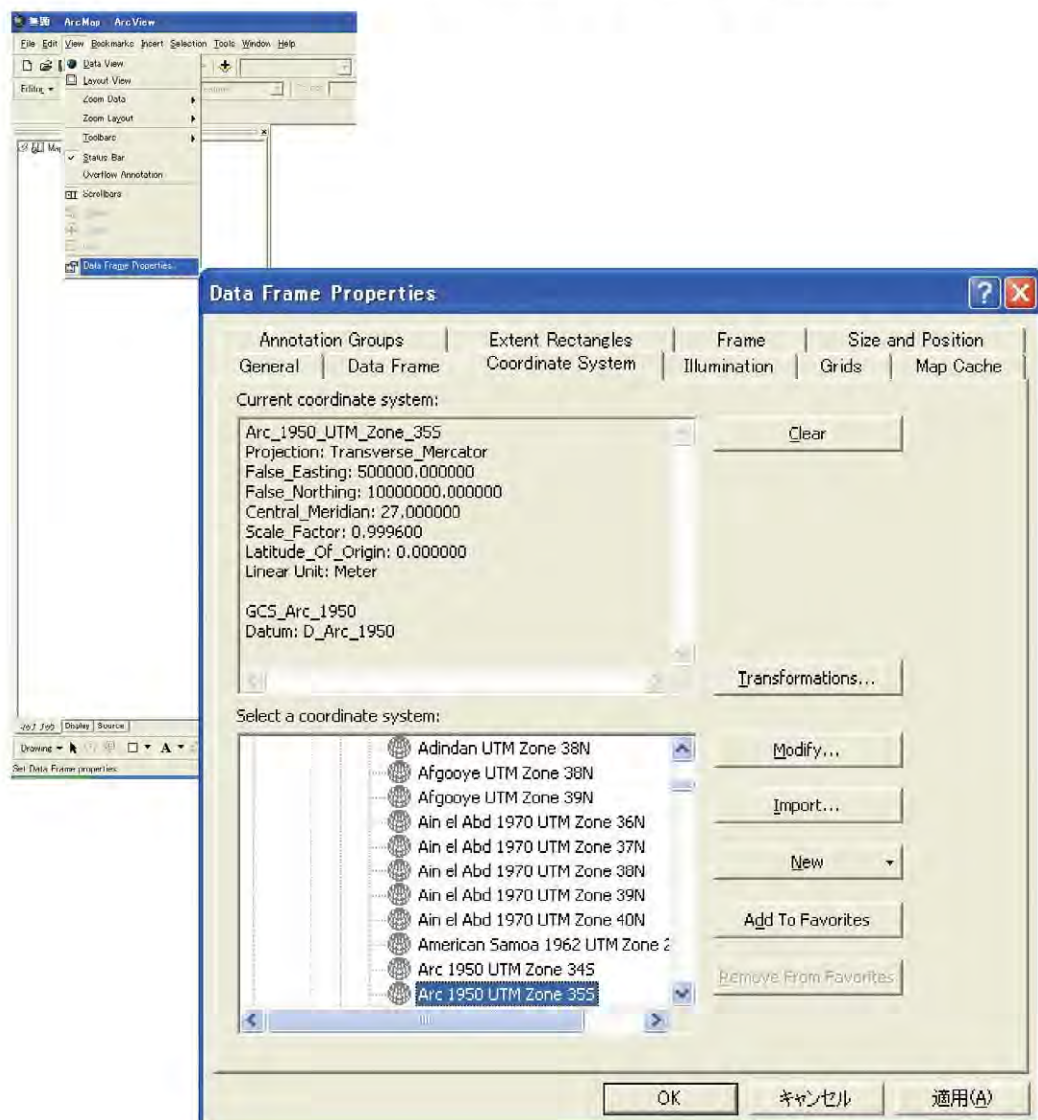
I. Geometric correction of raster data

1. Geometric correction of raster data

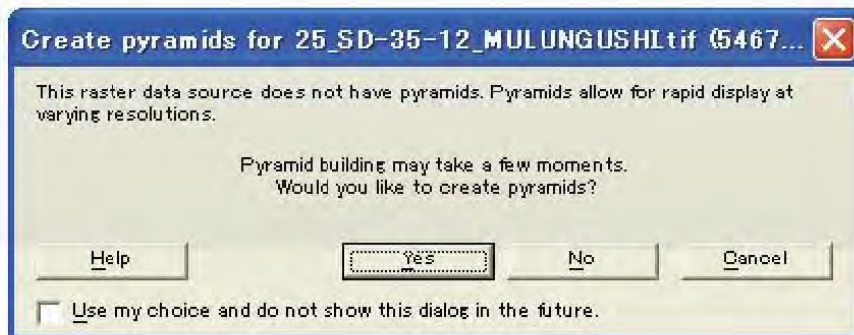
Method of Geo coded that designate coordination on scanned map

(1) Geo coded

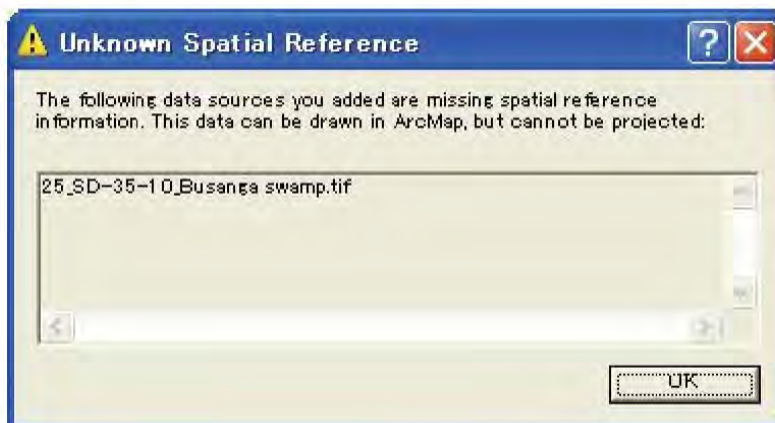
- 1 Confirm spherical projection of map, and establish projection by “Coordinate System” in “Data Frame properties” of GIS. (ex. Arc 1950 UTM Zone 35 below)



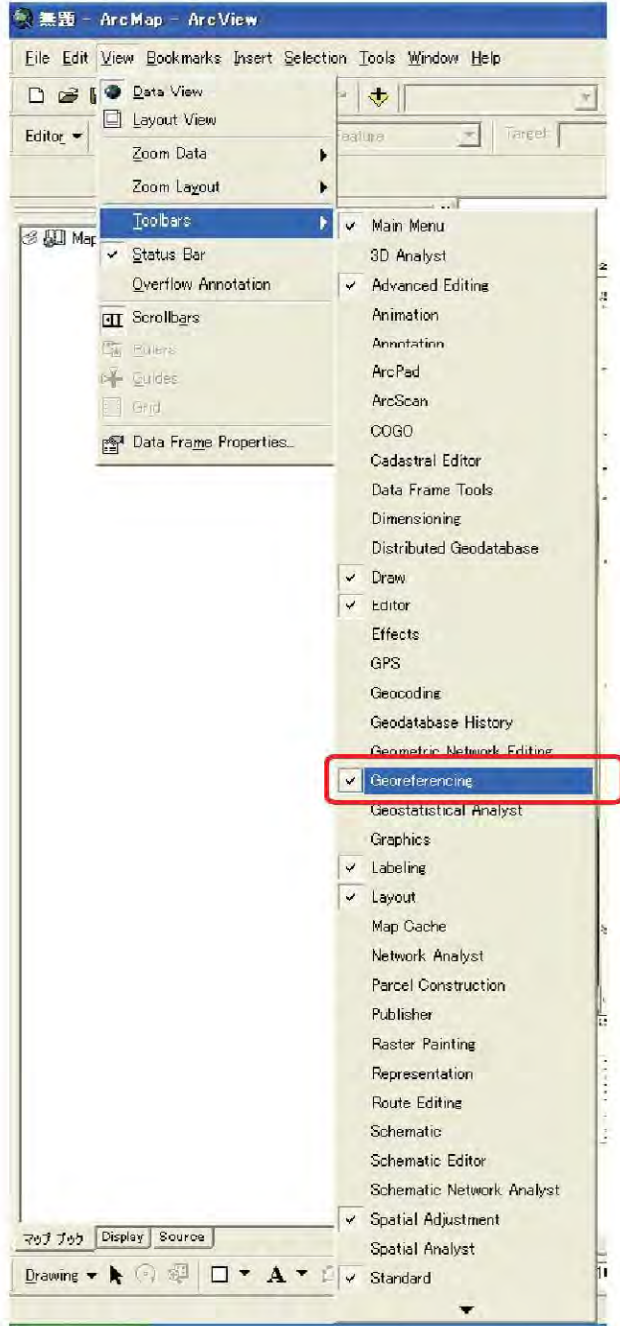
2. Add image file into Arc Map. When message “Would you like to create pyramid?”, select “Yes” or “No”.



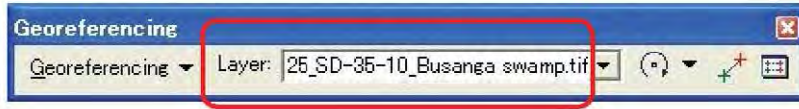
3. If message below is displayed, click “OK”, and close dialog box.



4. Click “Georeferencing” in “Toolbars”, “View” to display geo-reference tool bar

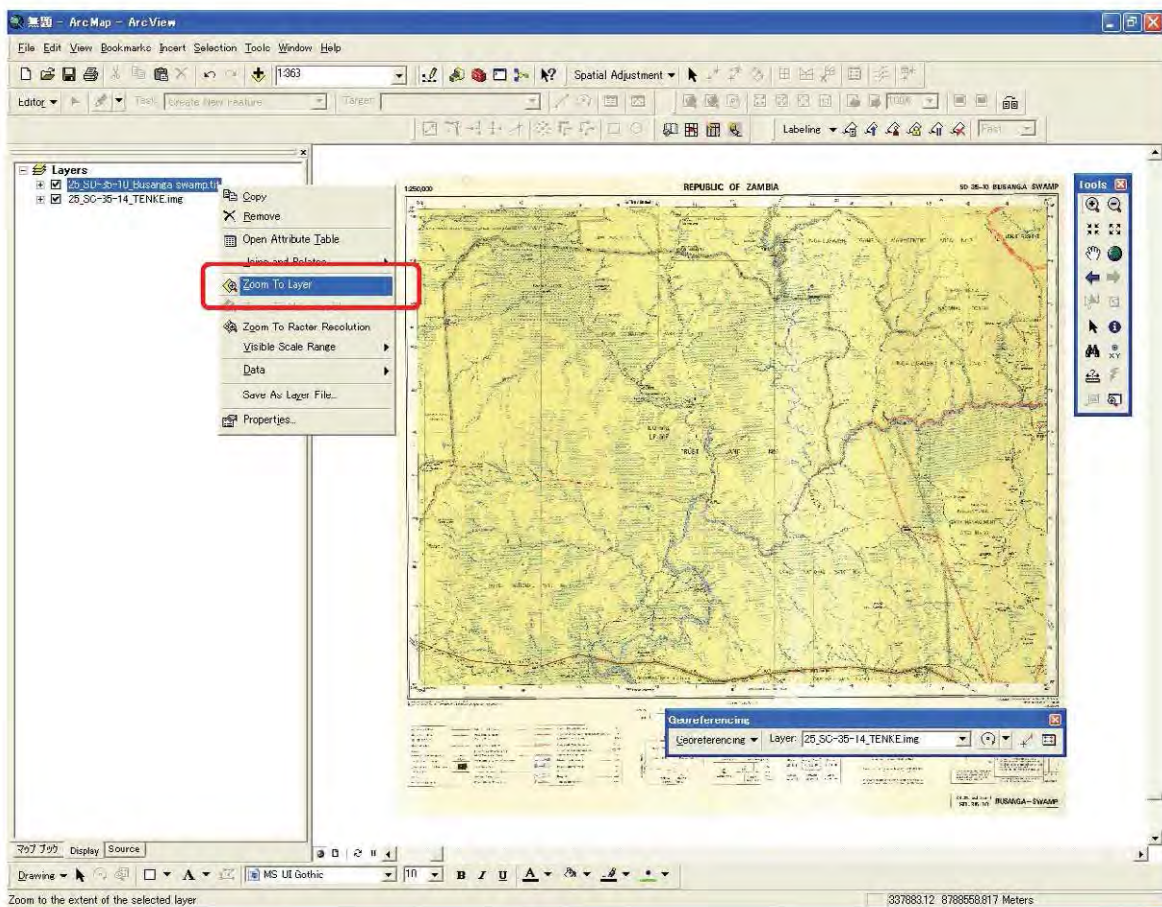


5. Select raster data that corrected.
(Figure below shows 25 SD-35-10 Busangaswamp.tif)

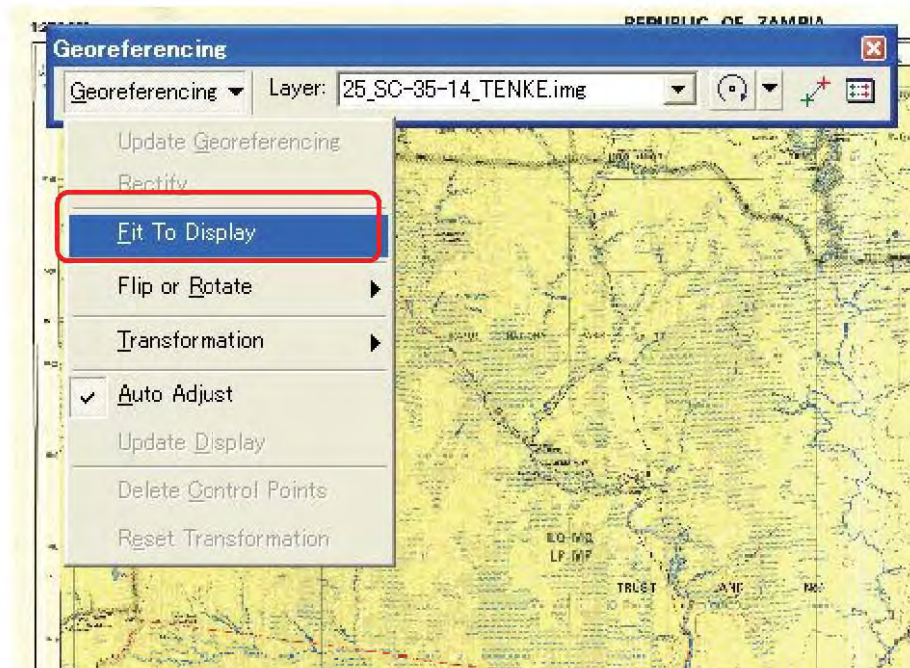


6. Display raster data by either method below:

- a. Right Click on displayed data in Layers of Display, and select “Zoom To Layer”.

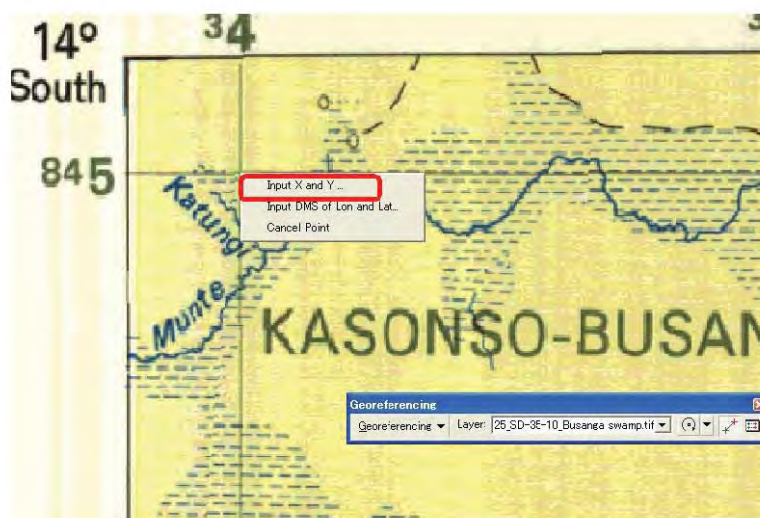
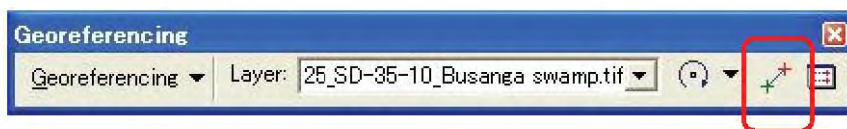


- b. Select “Fit To Display” in “Georeferencing” in “Georeferencing” tool.

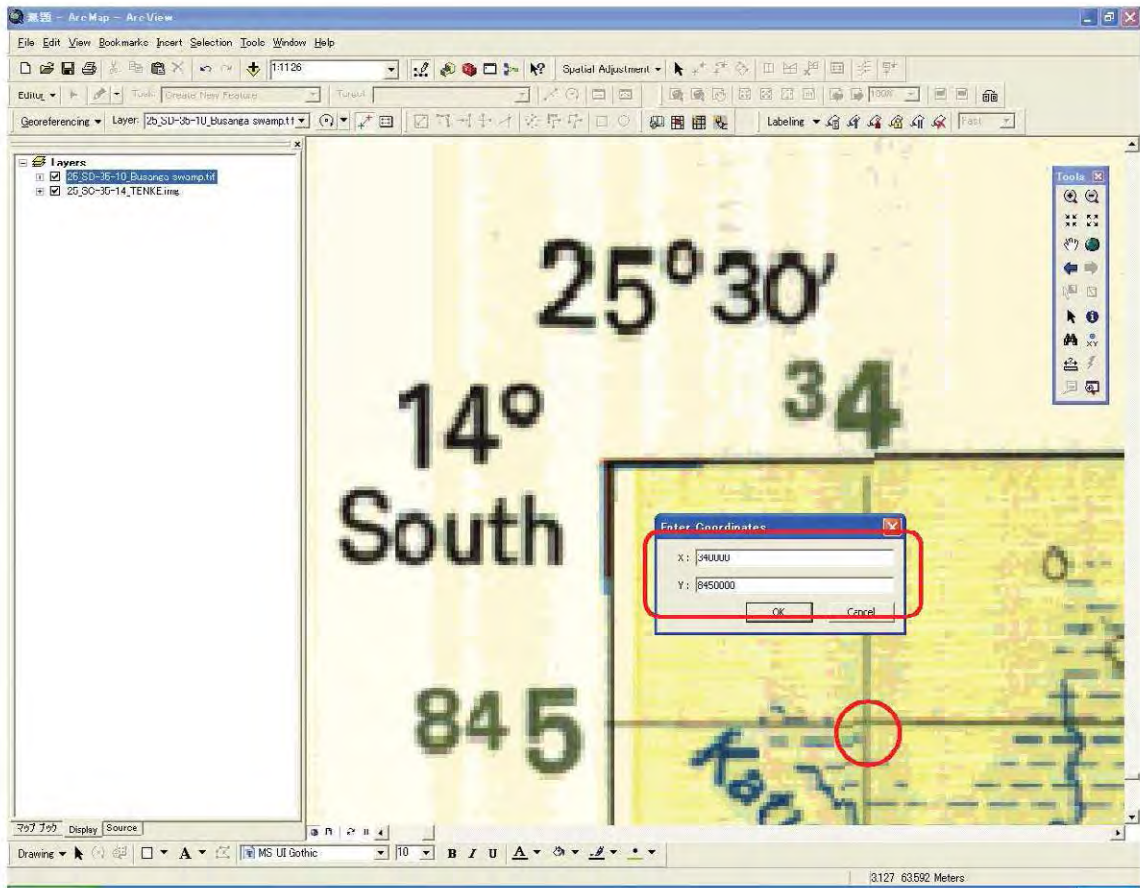


7. Provide coordination into map

- a. Click “Add Control points”, and click upper corner of map. Continuously, right click and select “Input X and Y”.

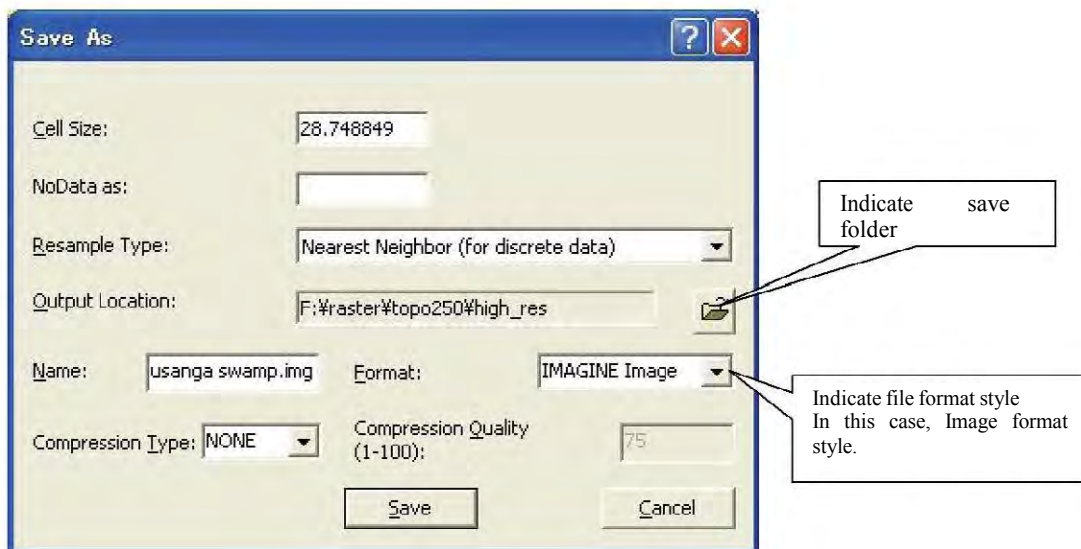
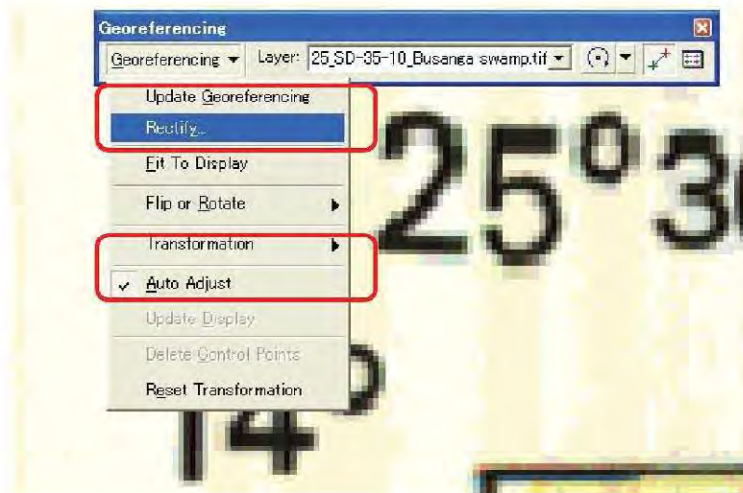


b. Input coordination



- c. Same procedure as 2. is carried out for other points. Minimum 4 points shall be select in raster data, but not localized.

- 8. Save image by “Ractify” command. Check box of “Auto Adjust” at that time.



2. Input and Editing of Vector Data

Features (point, line, polygon) is edited using “Editor” tool on Arc Map.

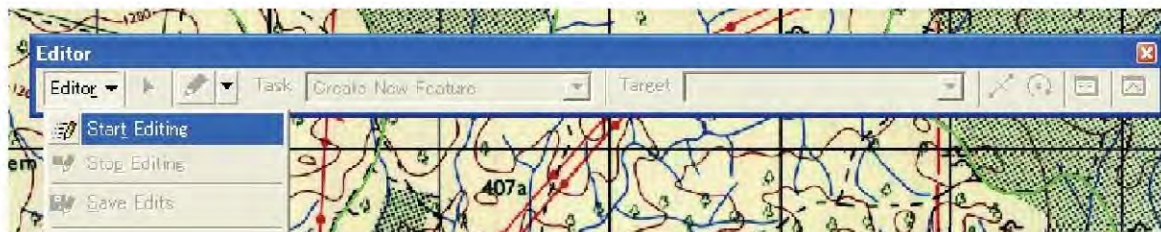


When “Editor” toolbar is not displayed, add on Arc Map by click “Editor tool bar” button.

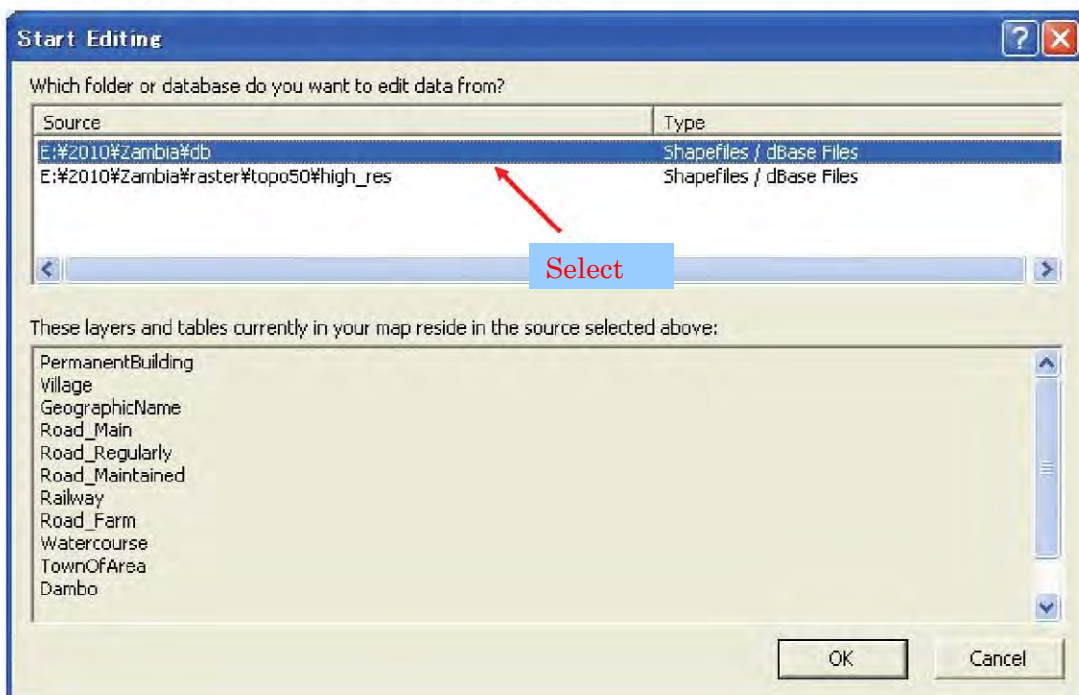


(1) Start of edit

1. Select “Editor” → “Start Editing”

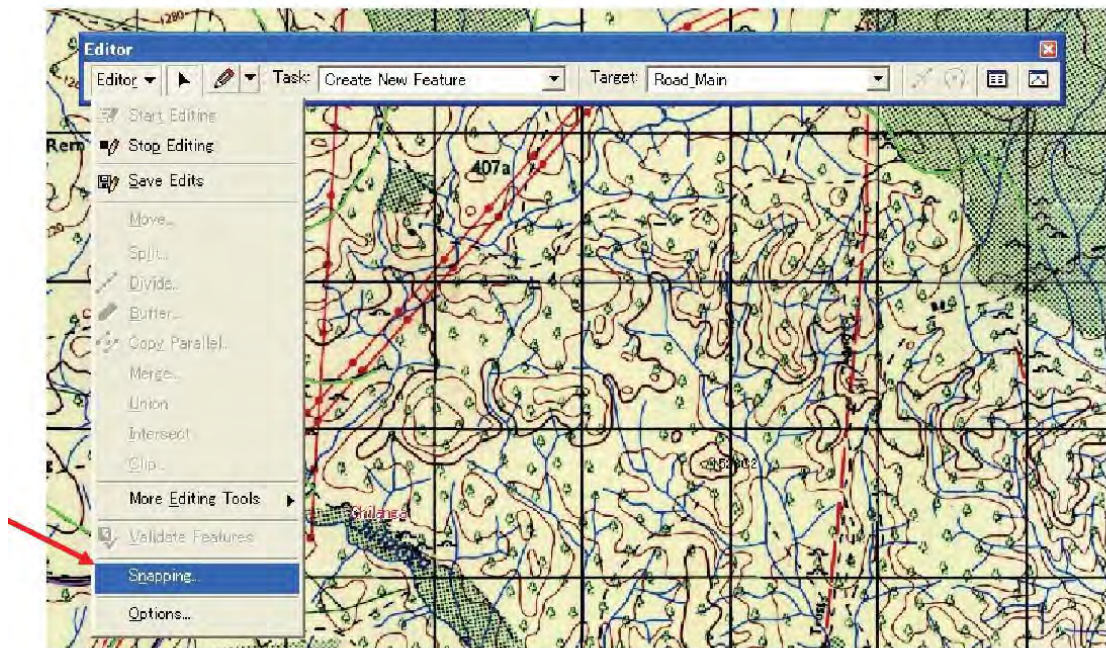


2. When map is composed of several data sets, selection prompt in data sets are displayed, then select data sets.

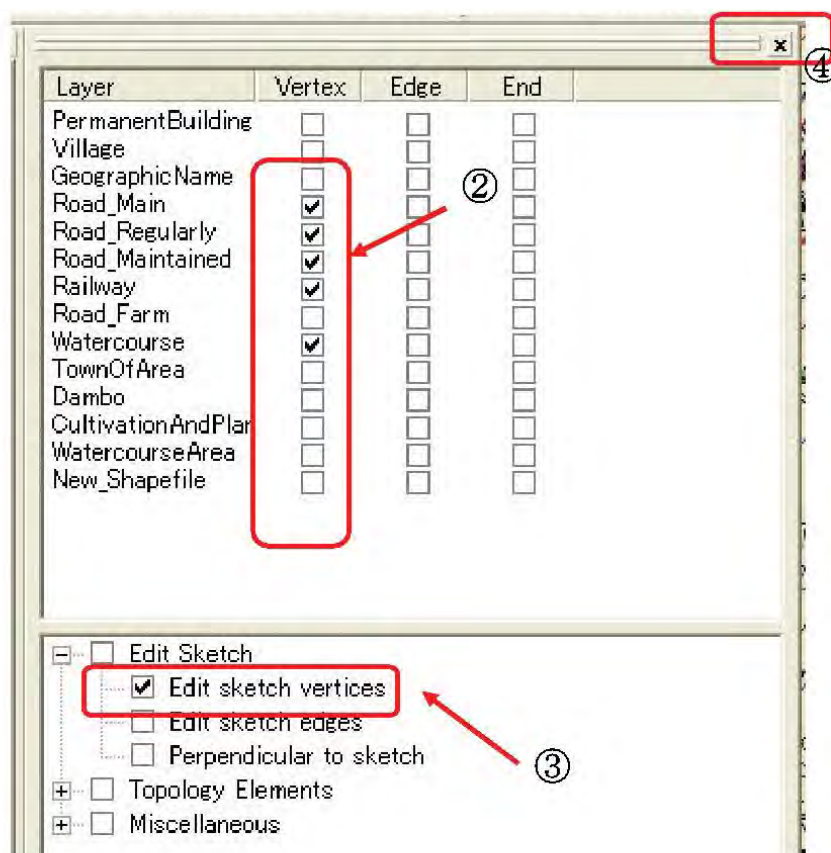


(2) Establish snapping

1. Open snap window from “Editor” → “Snapping”.



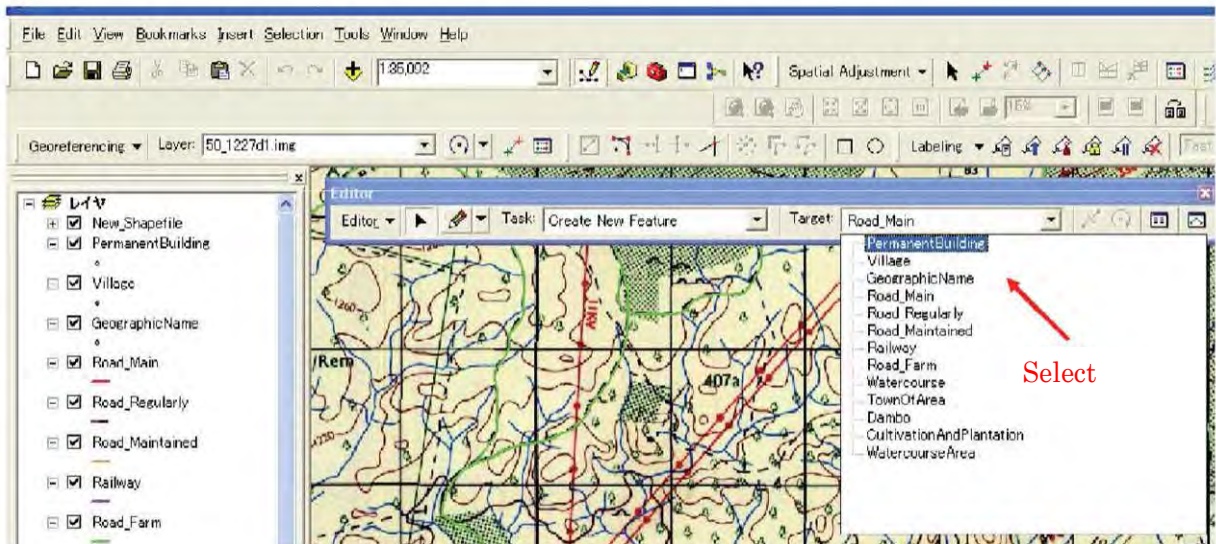
2. Check “Vertex” that snapping is set effective.



3. Put check on “Edit sketch vertices” in lower column (establishment of snapped portion)
4. Close snap window.

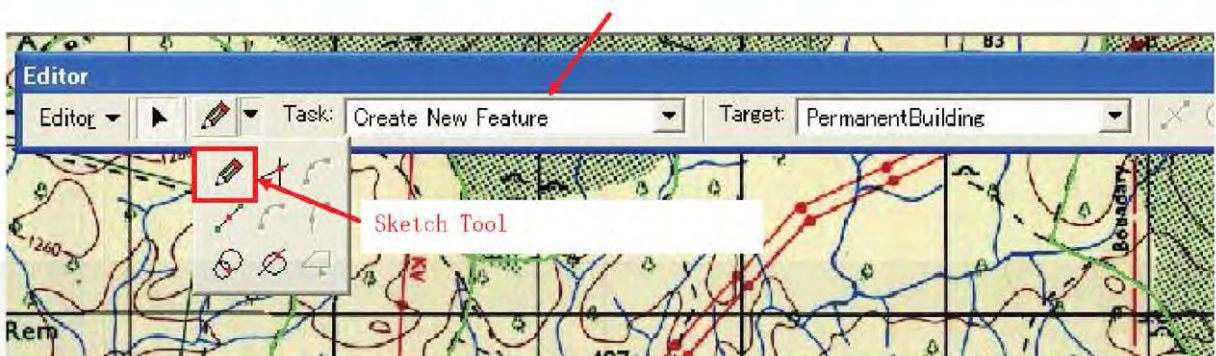
(3) Edit of point

Select layer from “Target” in “Edit” toolbar.



1. New establishment of point

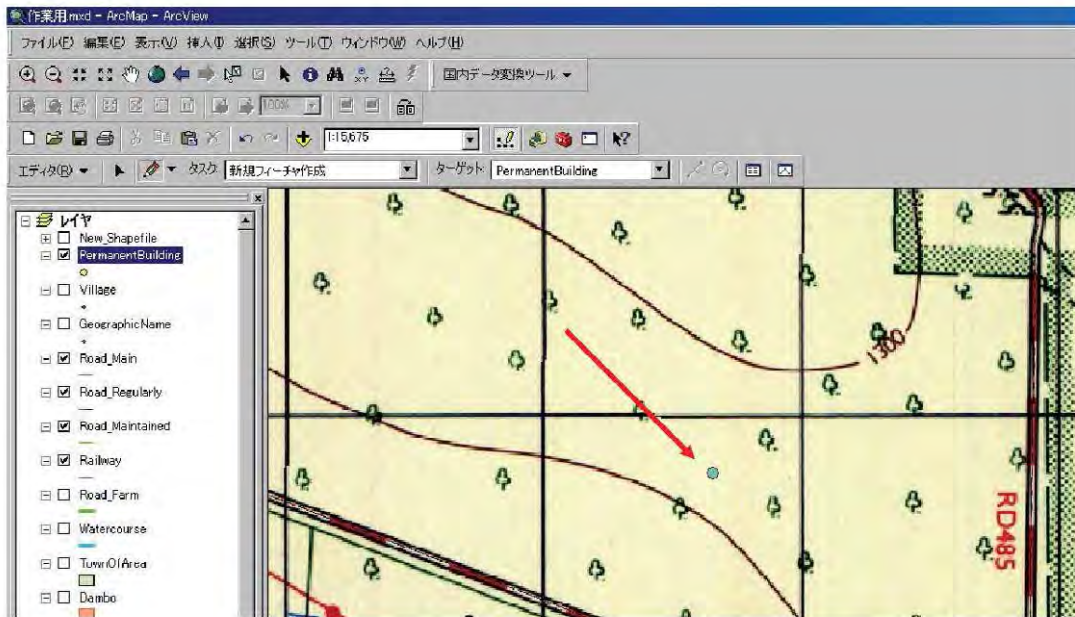
- a. Turn “Task” to “Create new feature” in “Editor” toolbar



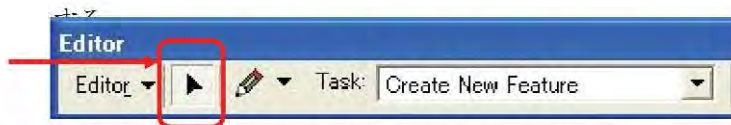
- b. Selection of sketch tool:

Select “Sketch Tool” from tool palette on “Editor” toolbar.

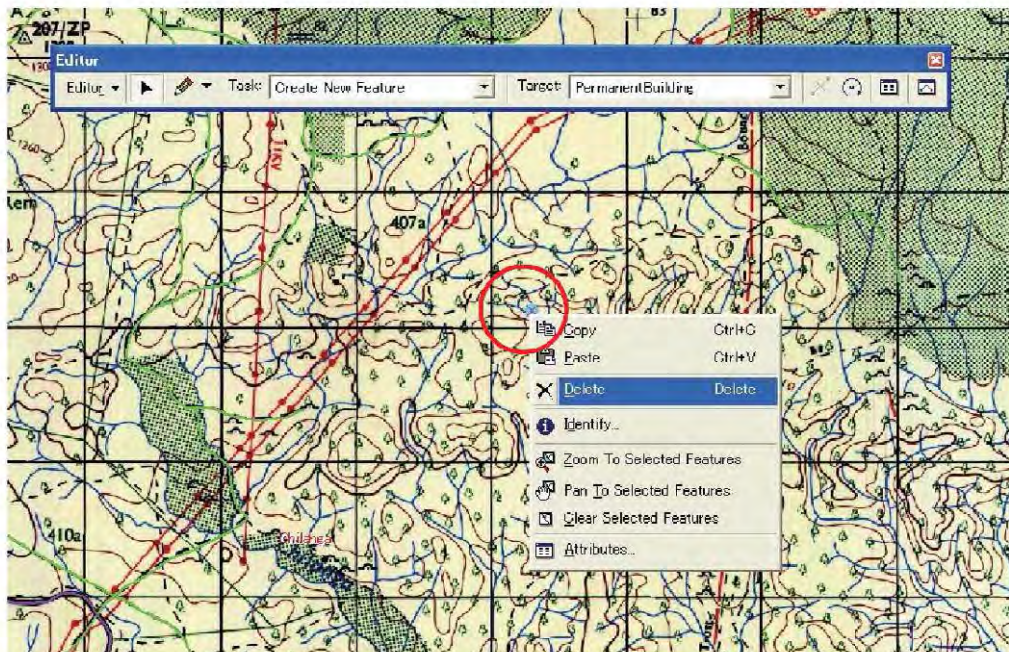
- c. Put point by left click.



- 2. Erase and move of point
- a. Click "Edit Tool".



- b. For erase, select point by left click, and "delete" by right click.
- c. Drag when move.

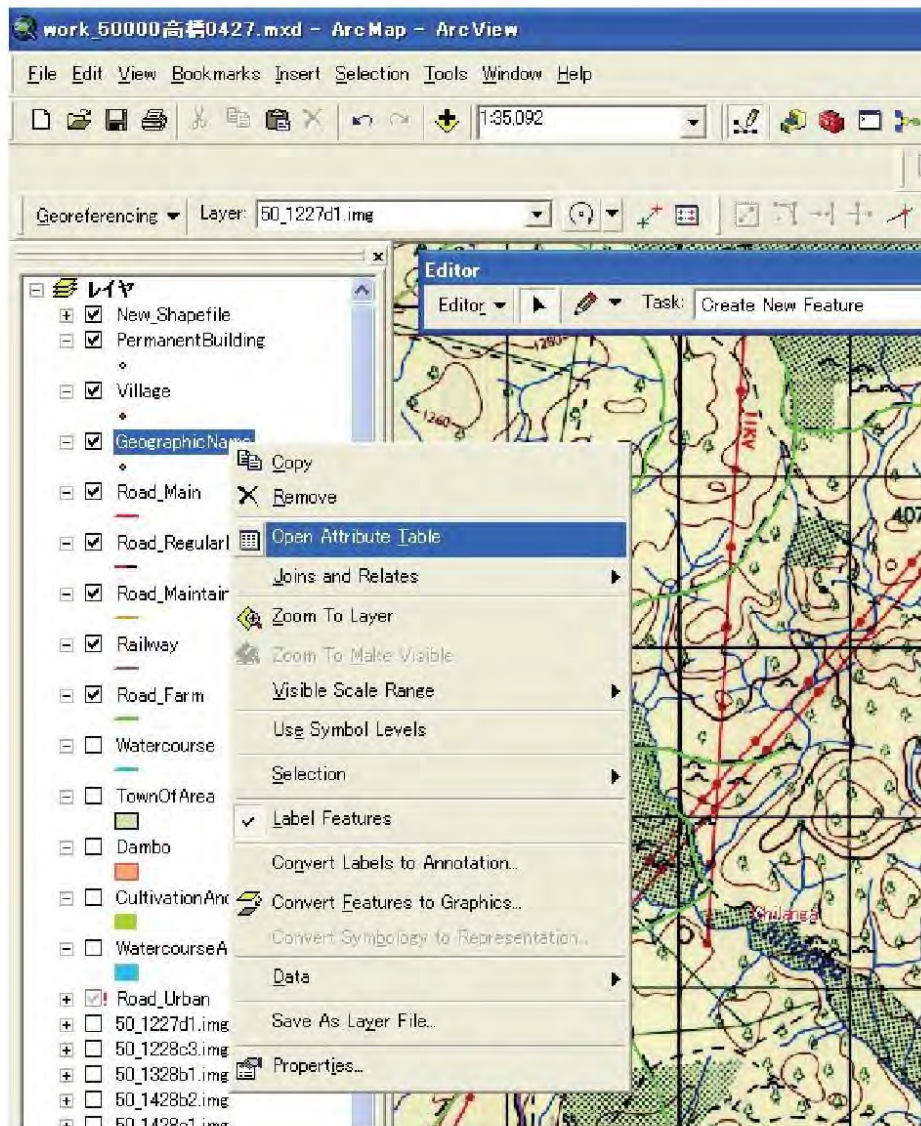


3. Editing of point attribution

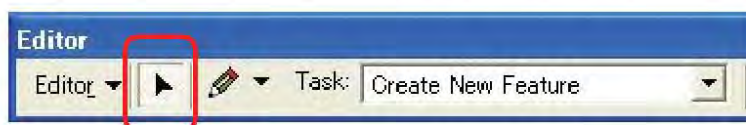
Here it is subject to “Geographic Name” layer

Add location, river name, etc. on point attribution input in “Geographic Name”.

- a. Right click on “Geographic Name” layer of “Table of content” to select “Open Attribute table”. (Attribute Table is opened.)



- b. Click by “Edit Tool” where be corrected.



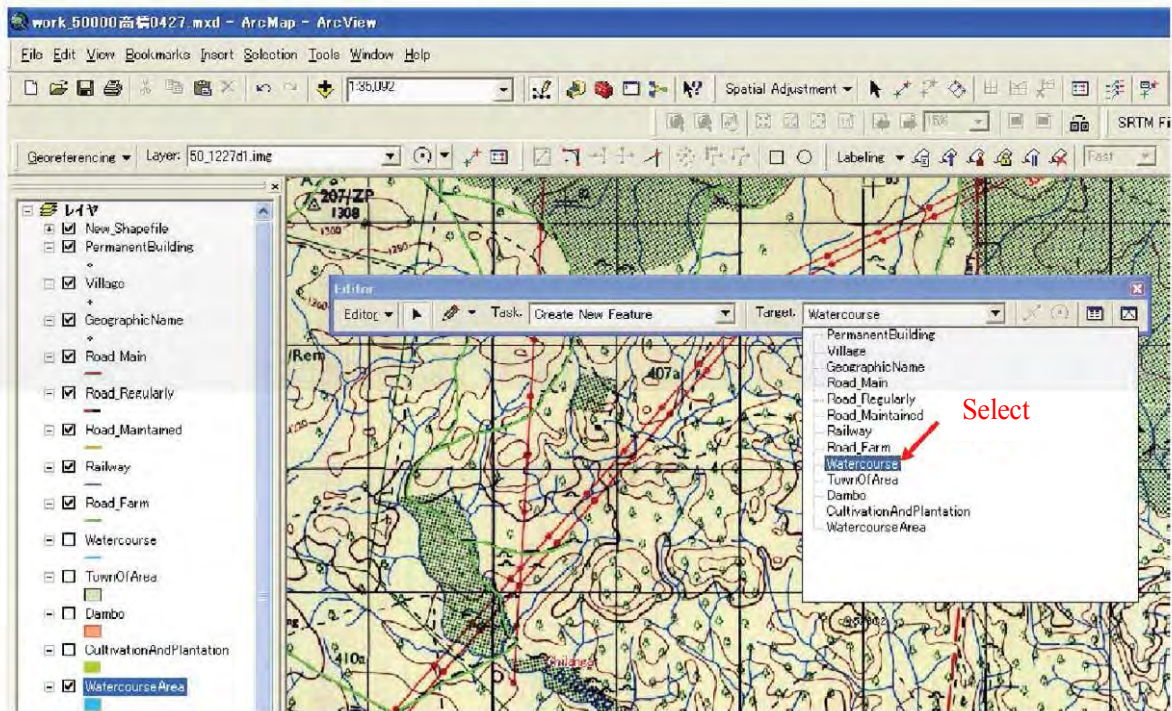
- c. Since column is colored in blue when point is selected, input title in “name” field.

The screenshot shows a software window titled "Attributes of GeographicName" containing a data table. The table has five columns: FID, Shape *, Id, name, and mark. The rows list various geographic features with their corresponding IDs and names. The "name" column is highlighted in blue, and a red arrow points to its header. Another red arrow points to a selected row (FID 317) with a text box that says "Input in this column".

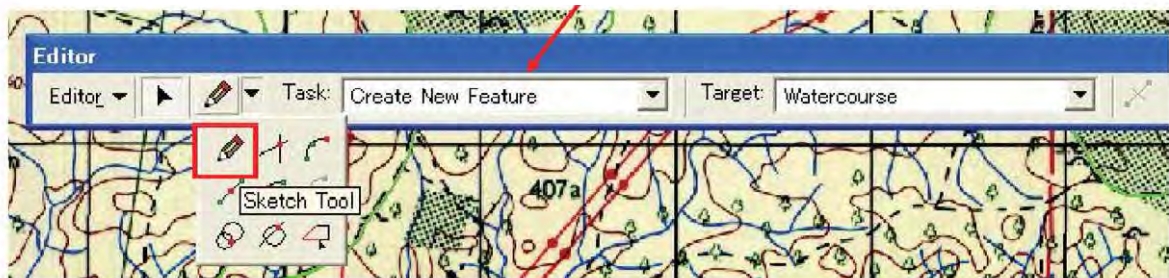
FID	Shape *	Id	name	mark
277	Point	0	Kamindulu Hill	
278	Point	0	Chipuluka	
279	Point	0	Kapelo	
280	Point	0	Mubula	
281	Point	0	Matambula	
282	Point	0	Lyoma	
283	Point	0	Chipasha	
284	Point	0	Kamwenda	
285	Point	0	Kasinga	
286	Point	0	Mufunge	
287	Point	0	Chipasha	
288	Point	0	Nkomasha	
289	Point	0	Kwenda	
290	Point	0	Chikuta	
291	Point	0	Kanzabala	
292	Point	0	LAKE KARIBA	1
293	Point	0	KAMPYOLONGA HILLS	1
294	Point	0	Sikopa	
295	Point	0	School	
296	Point	0	Domwe Hill	
297	Point	0	Ndanzala Hill	
298	Point	0	MALIMA HILLS	
299	Point	0	O Ho Bai Bridge	
300	Point	0	CHIRUNDU	
301	Point	0	NYANZARA FLATEAU	
302	Point	0	Sikashyban yama	
303	Point	0	Lukunzu	
304	Point	0	Njonzole	
305	Point	0	Siwaku	
306	Point	0	LUSITU	
307	Point	0	School	
308	Point	0	385	
309	Point	0	Lyansa	
310	Point	0	Kashinge	
311	Point	0	Chambamwari	
312	Point	0	Ohankumba	
313	Point	0	Malombe	
314	Point	0	Fisheries	
315	Point	0	4 National Parks	
316	Point	0	Uhimbula Hill	
317	Point	0		

(4) Edit of line

Select layer from “Target” in “Editor” toolbar.



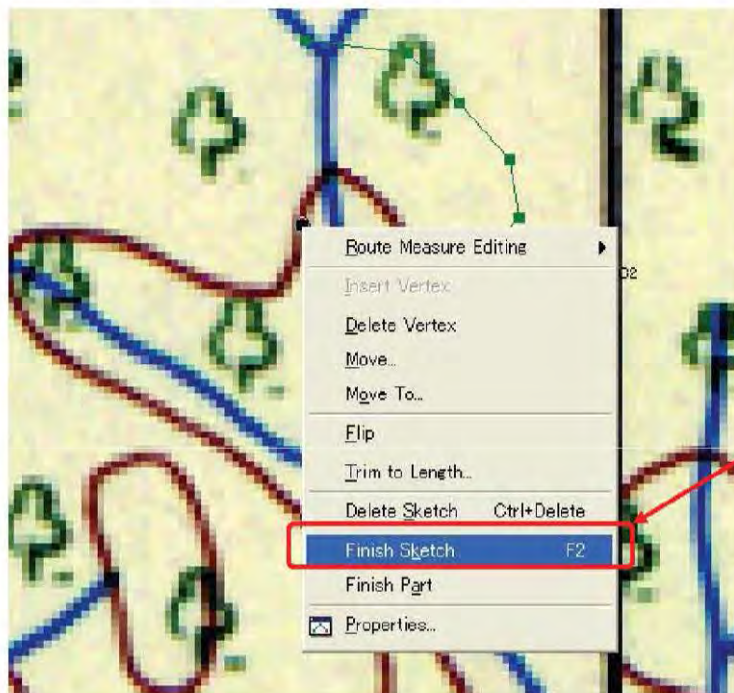
1. New line
 - a. Turn “task” to “Create new feature” in “Editor” toolbar.
 - b. Select “Sketch Tool” of tool palette on “Editor” toolbar.



- c. Input line of feature by left click.



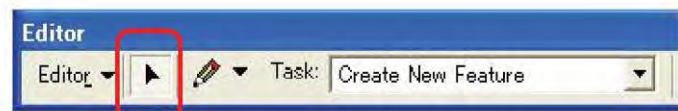
- d. Select “Finish Sketch” after open dialog by right click after end point of line is clicked.
Or double click of end point.



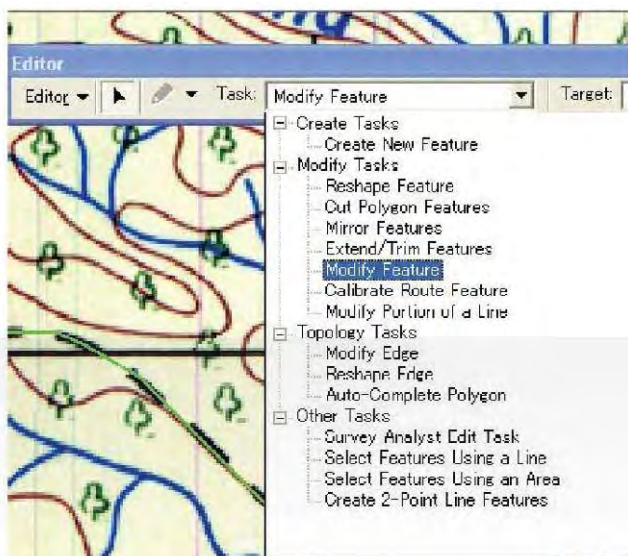
Right click → Finish Sketch
Or
Double click

2. Edit line style

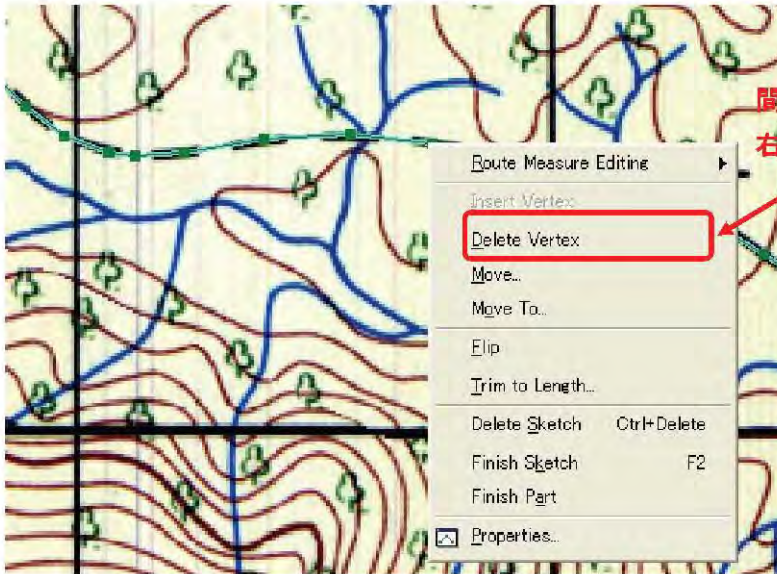
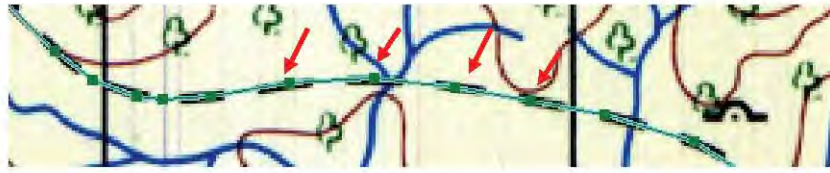
- a. Click “Edit Tool”



- b. Click Arrow symbol, and select “Modify Feature”.

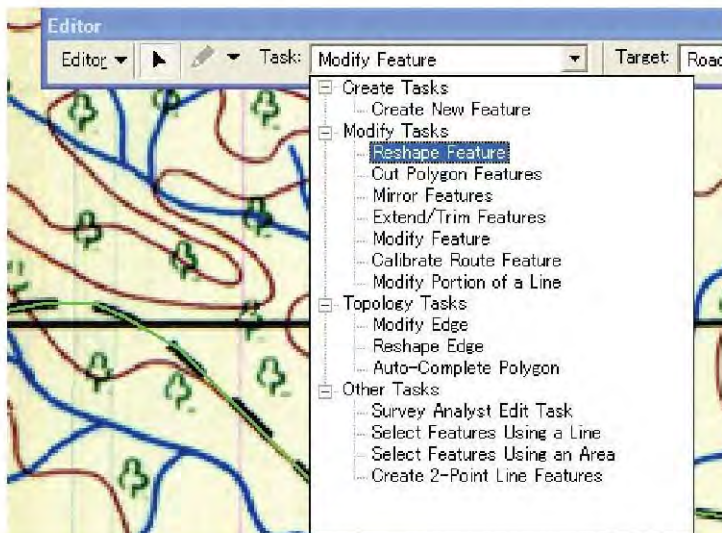


- c. When click target line, edit becomes possible.



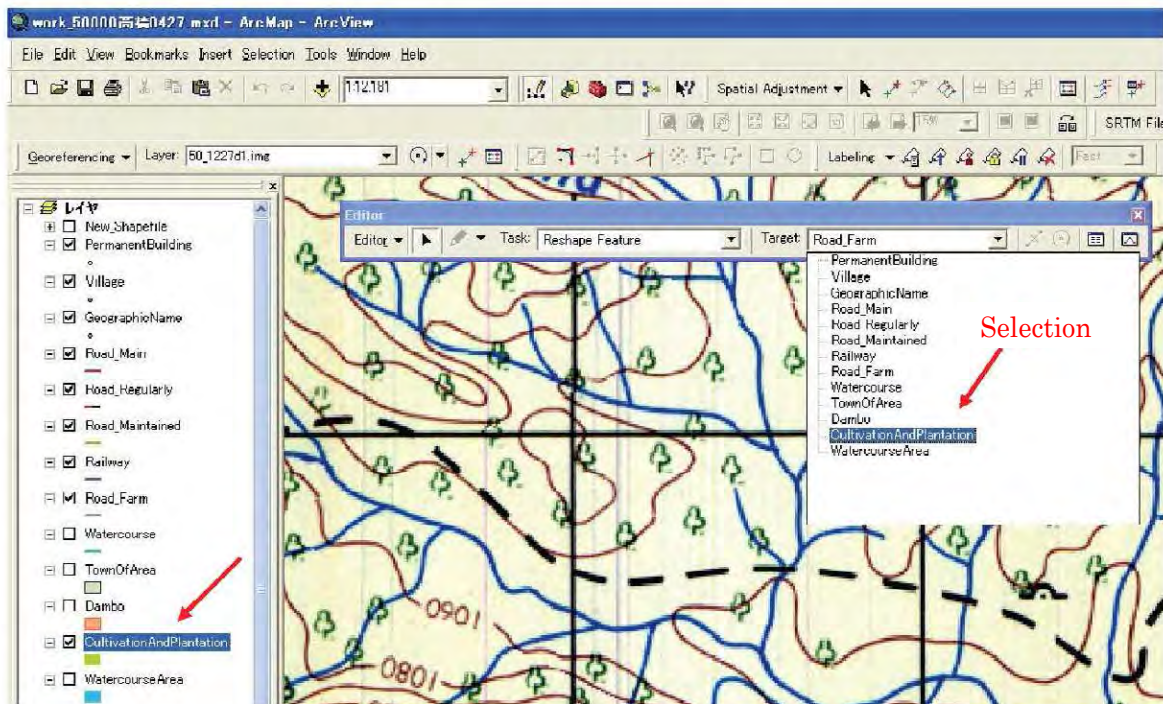
Put pointer on corrected portion, right click →erase vertex.

3. Erase and move of line
 a. Click arrow symbol in “Task”, and select “reshape Feature”.

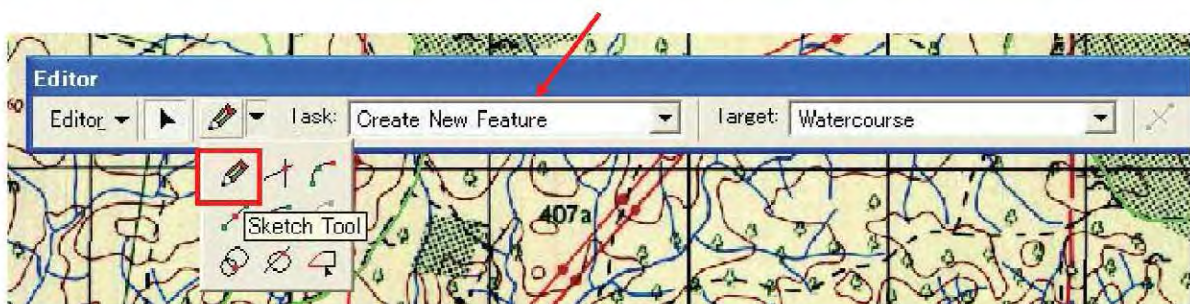


- b. When erase, click “Delete” after selection of line subject to erase.
 c. When move, just drag.

- (5) Edit of polygon
 - Select layer subject to edit from “Target” in “Edit” toolbar.



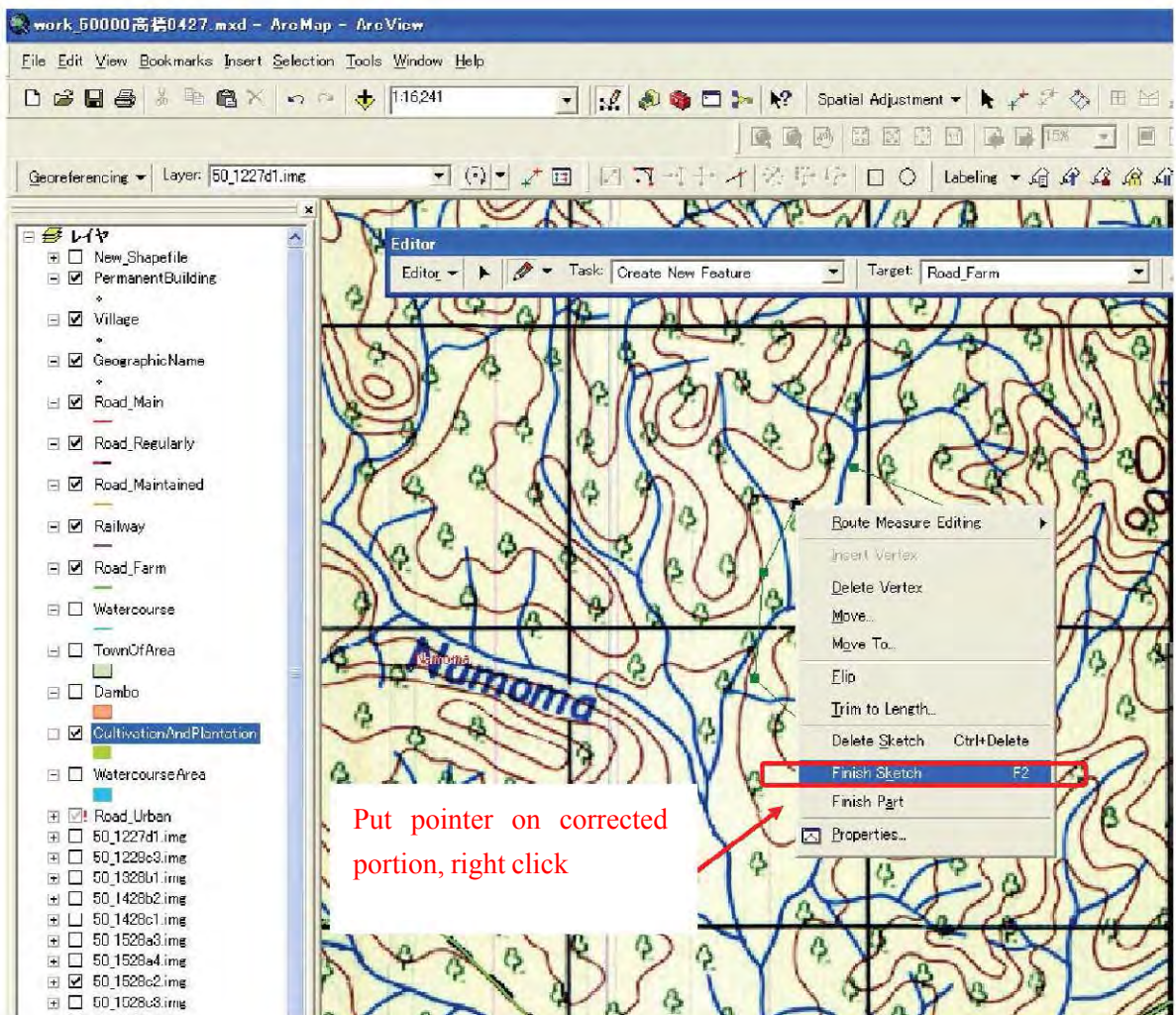
1. New polygon input
 - a. Turn “Task” to “Create new feature” in “Editor” toolbar.
 - b. Select “Sketch Tool” from tool palette on “Editor” toolbar.



- c. Create polygon by left click.
- d. “ Finish Sketch” is selected by right click to finish polygon.
Or
Double click on end portion.



Put pointer on corrected portion, right click



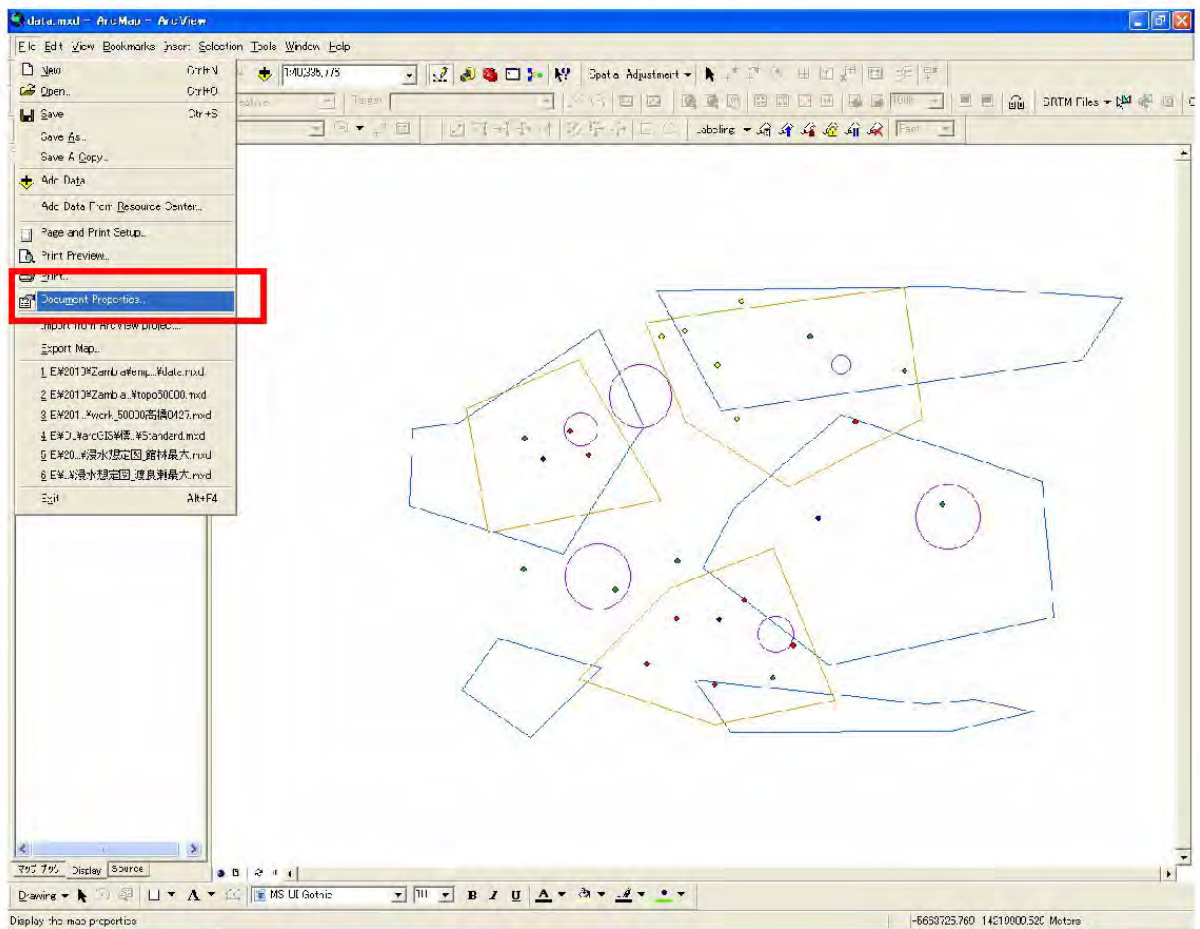
2. Reshape of polygon: see (4) line edit
3. Erase and move of polygon: see (4) line edit, 3. reshape of line

Chapter 2 Edit of Attribution

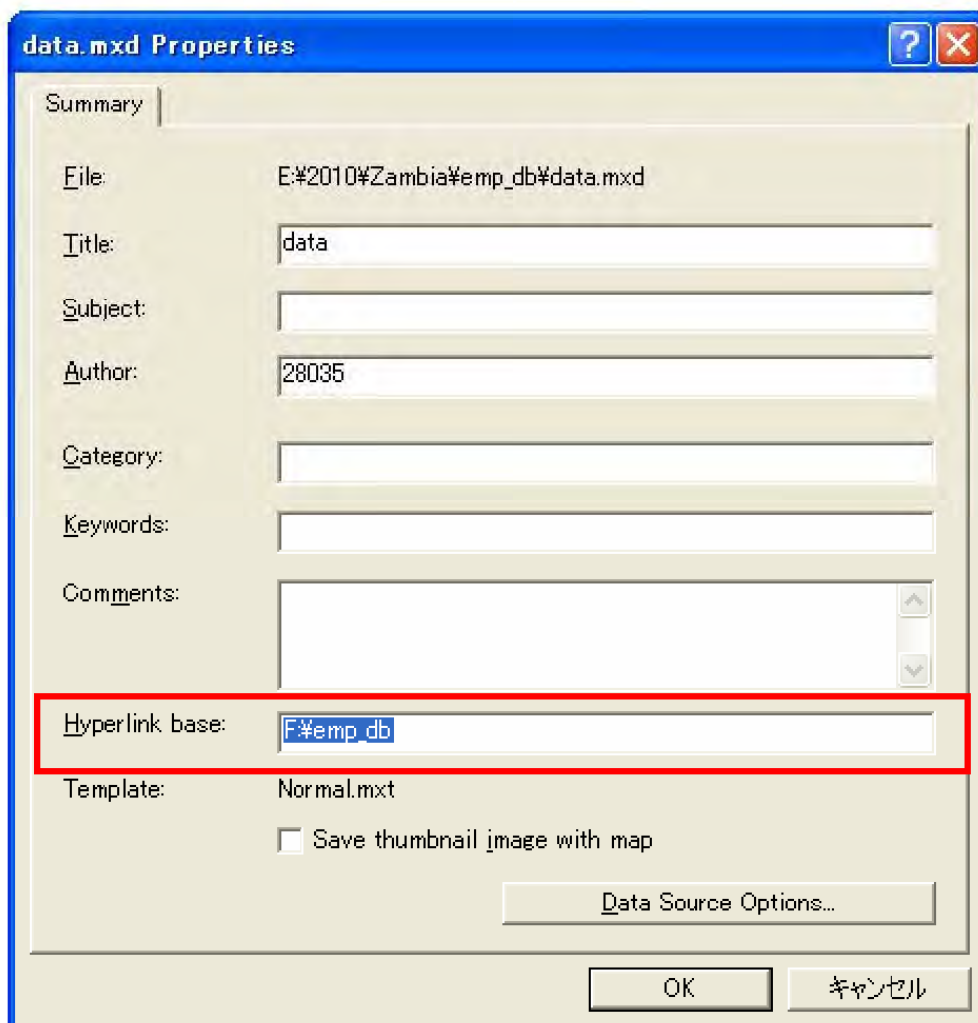
1. Introduction

First set hyperlink information of the ArcMap.

- (1) Open (data.mxd) from ArcMap.
- (2) Select “Document Properties” from (File) menu.



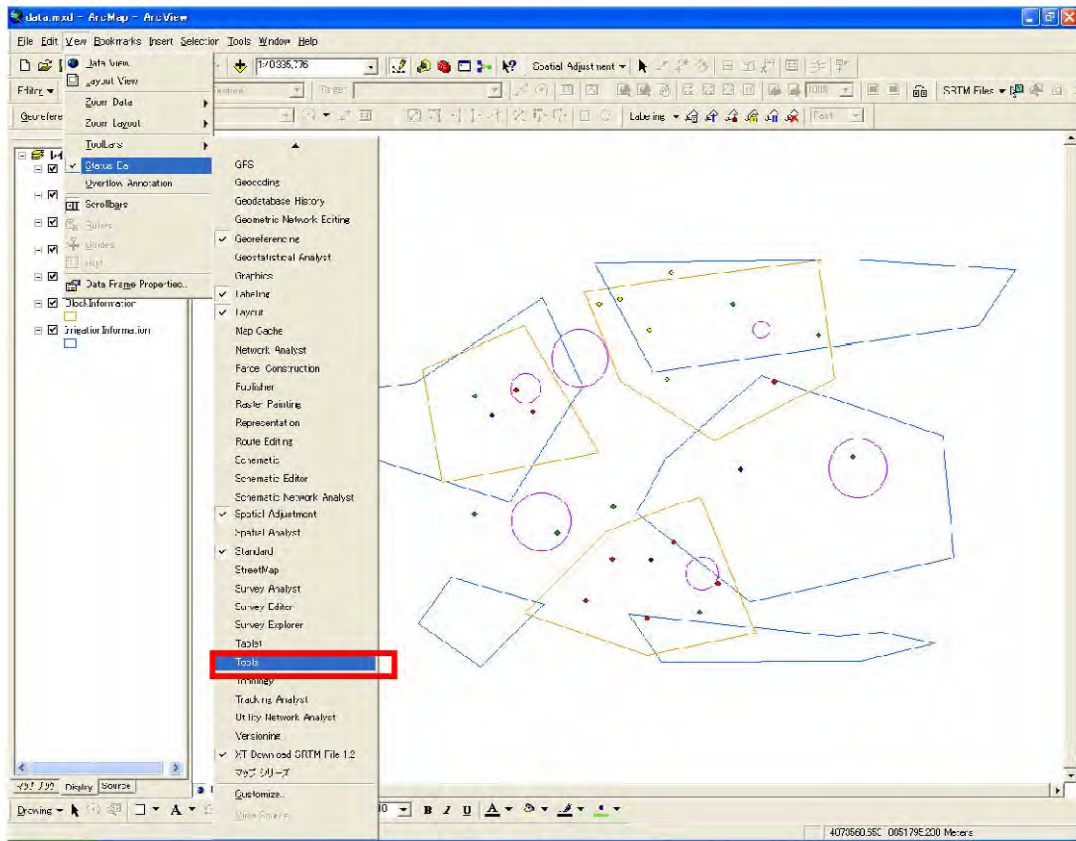
- (3) Input Absolute pass (ex. F: /emp_db) of (emp_db) which is the save-folder of MS Access data base in “Hyperlink bas information”



2. Display of Attribute data

(1) Display of "Tools" bar

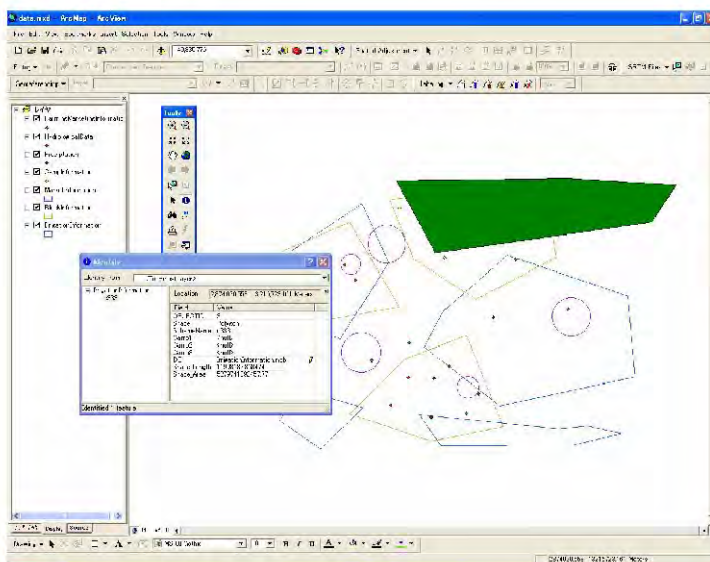
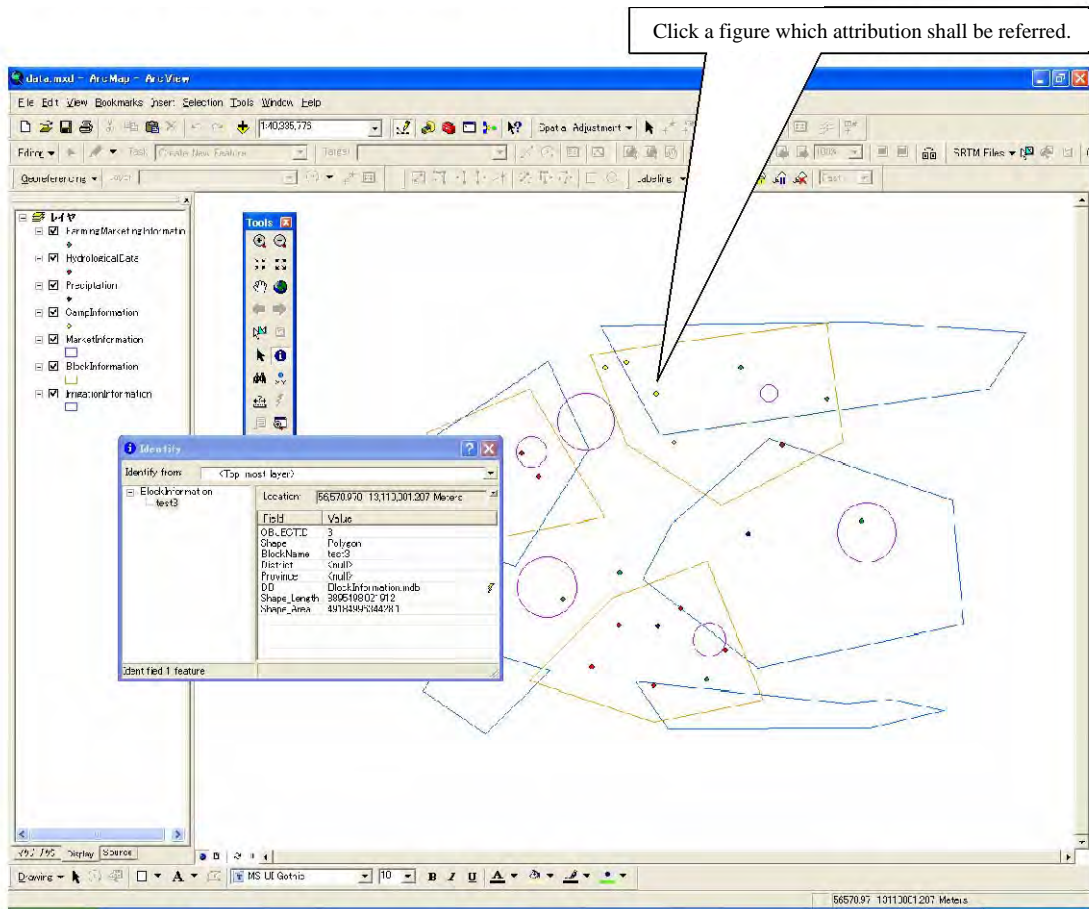
To display "Tools" bar, check "Tools" in "status Bar" in "View" menu in the ArcMap.



- (2) Display of Attribution
- 1) Select "Identity" in "Tools" bar.

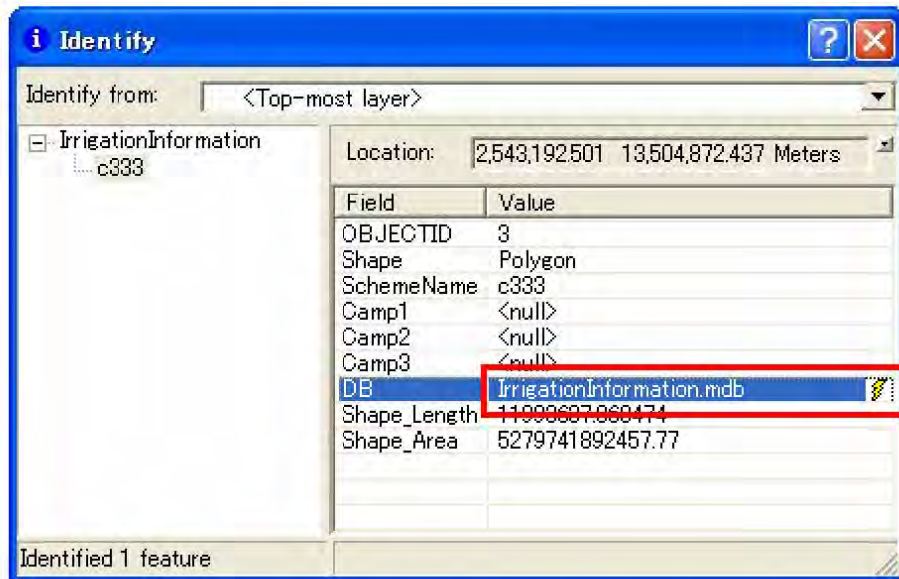


2) Click a figure which attribution shall be referred.

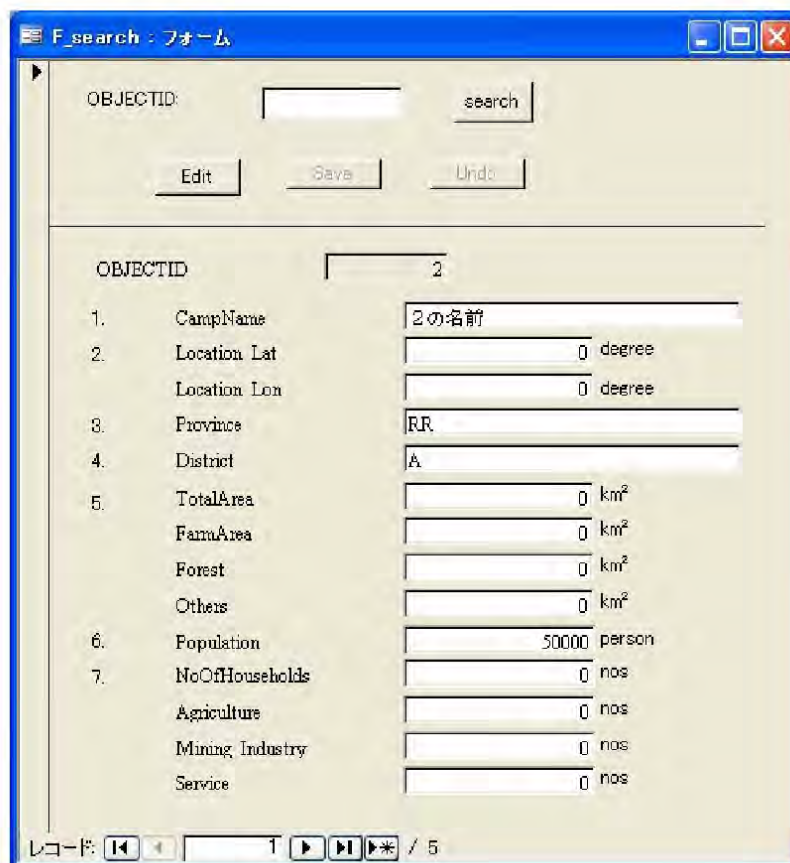


Display of polygon data

- 3) Click MS Access data base name in “DB” in “Identity” dialog.

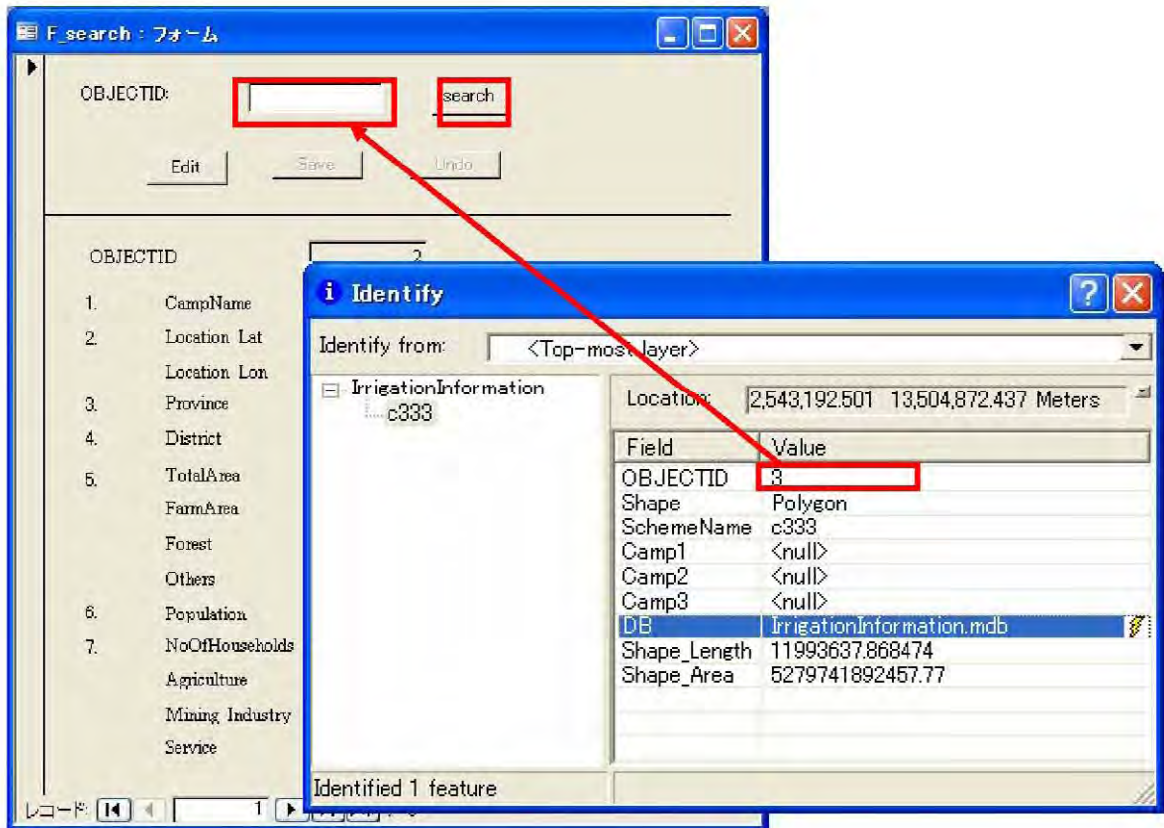


- 4) MS Access is booted and Explorer is displayed.



Example of Camp information data

- 5) Input value of (OBJECTID) in “OBJECTID” in “Identity” dialog and click (Search).



- 6) Search result is displayed below.

OBJECTID: 3 [search]

Edit Save Undo

OBJECTID	3	
1.	CampName	bzz
2.	Location Lat	0 degree
	Location Lon	0 degree
3.	Province	WW
4.	District	A
5.	TotalArea	0 km ²
	FarmArea	0 km ²
	Forest	0 km ²
	Others	0 km ²
6.	Population	20000 person
7.	NoOfHouseholds	0 nos
	Agriculture	0 nos
	Mining Industry	0 nos
	Service	0 nos

レコード: [1] [2] [3] [4] [5] / 5

(3) Attribution of meteorological and hydrological data base

Display of research and attribution is similar to other data bases. Meteorological and hydrological data base can be presented by graph,

- 1) When click “View Precipitation Data” of the meteorological data base, rainfall amount is indicated. Similarly when click “View Hydrological Data” of the meteorological data base, run-off data are indicated.

Q_Precipitation

OBJECTID:

OBJECTID

StationName:

StationCode

Observation Point

Province

District

Responsible Agency

Location

Latitude / Longitude

Update

Elevation m

ObservationPeriod -

Legend

レコード: / 3

Display of rainfall data

Q_Precipitation_Data

StationName: test1 StationCode: OBJECTID: 1

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	245	324	400	320	300	400	450	200	250	300	200	250	3669
2001	384	250	300	350	400	200	250	300	400	350	200	200	3584
2002	250	300	350	400	450	300	450	400	350	300	250	200	4200
2003	134												134

レコード: / 4 (全記録)

F_search : フォーム

OBJECTID:

OBJECTID:

StationName:

StationCode: -

Observation Point

Province

District

Responsible Agency:

Location

Latitude / Longitude

ObservationPeriod -

Update

River: River
(Tributary of river)

DrainageArea: km2

Legend

レコード: / 8

Displzy of hydro-
logical data base

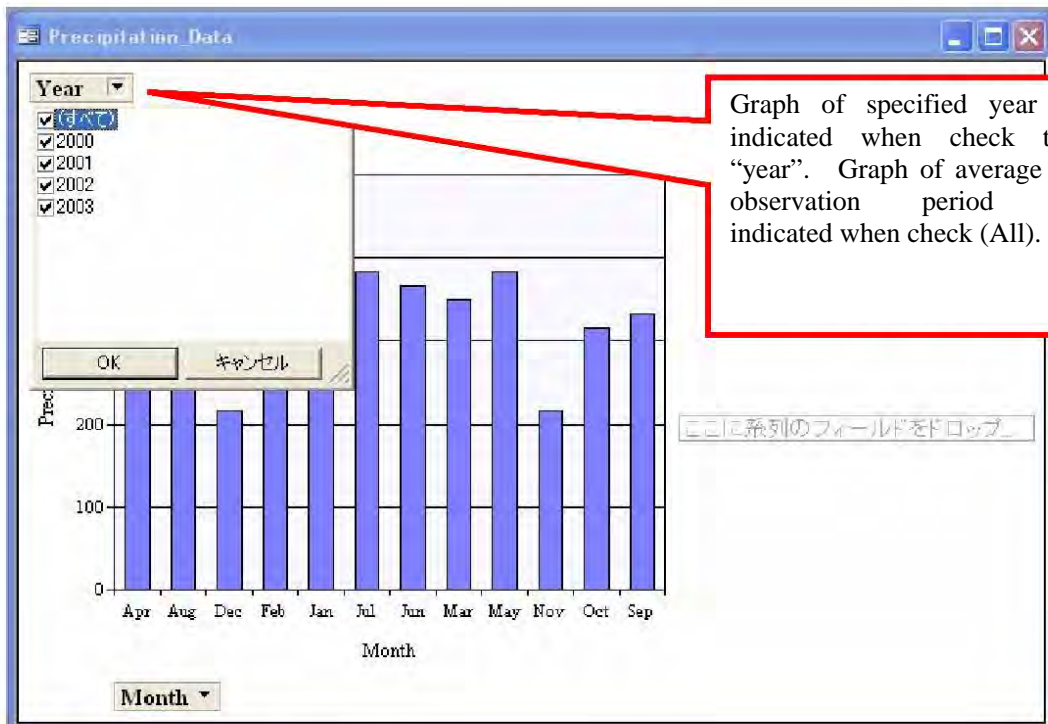
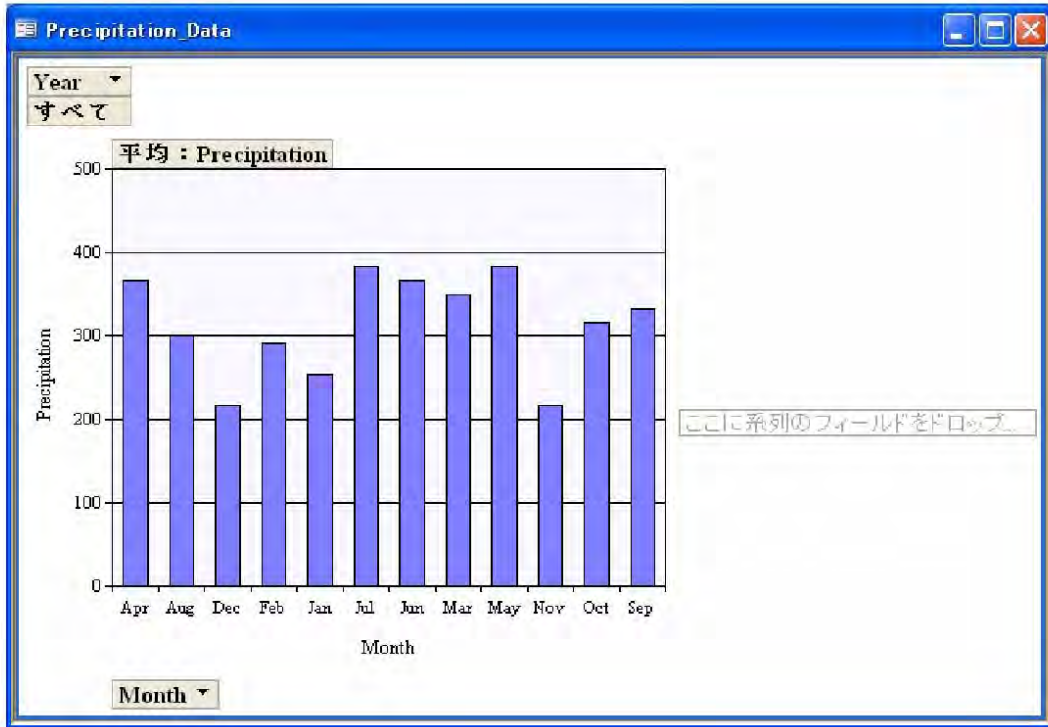
F_HydrologicalData_view

StationName: test1 OBJECTID: 1

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	245	324	400	350	300	400	450	200	250	300	200	250	3669
2001	384	250	300	350	400	200	250	300	400	350	200	200	3584
2002	250	300	350	400	450	500	450	400	350	300	250	200	4200

レコード: / 3 ページ

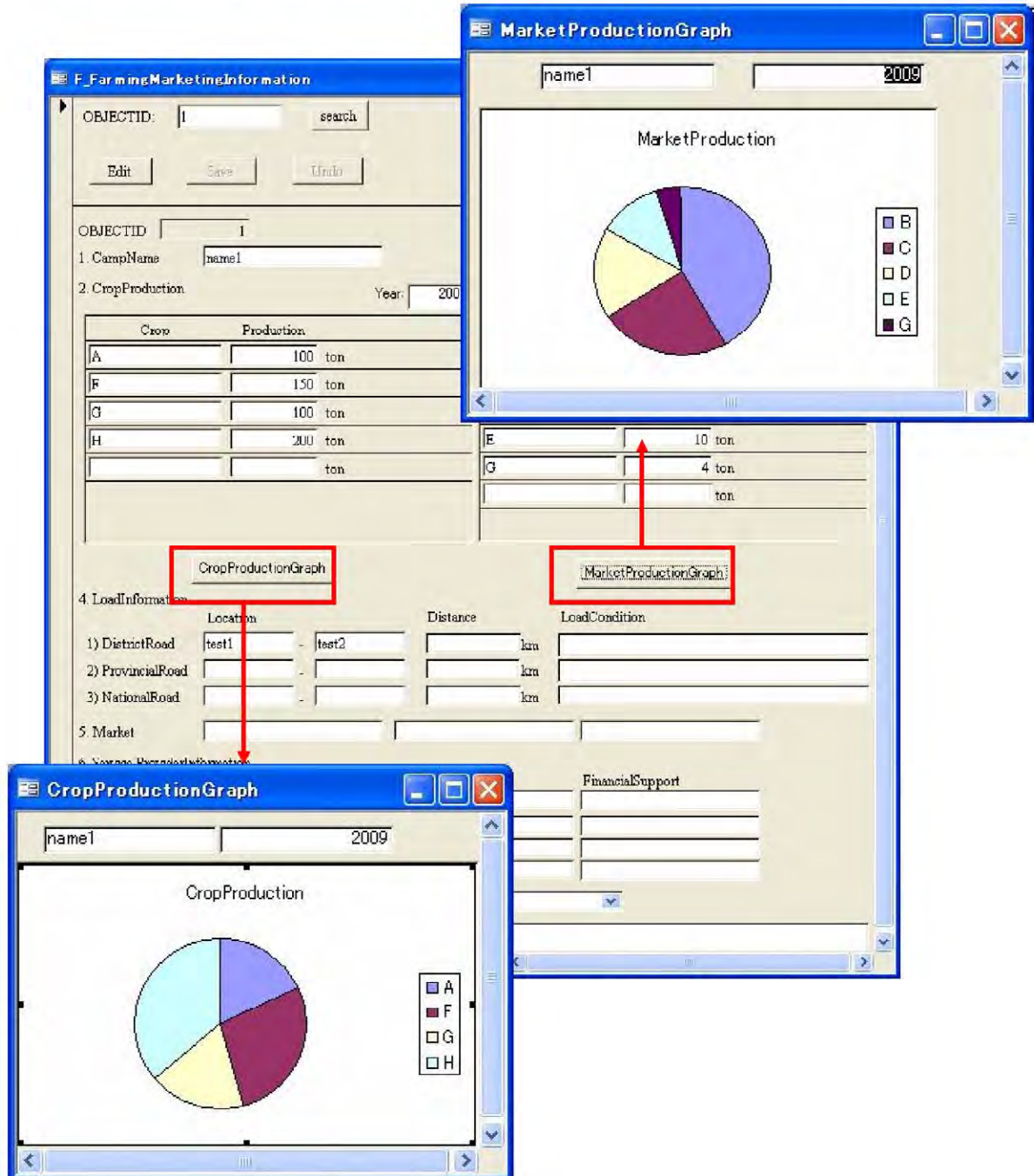
(2) Graph is indicated when click “Graph”



Graph of specified year is indicated when check the “year”. Graph of average of observation period in indicated when check (All).

(4) Attribution of farming and marketing information

Production data are graphically indicated for farming and marketing information.



3. Input and editing of the attribute data

Input and editing is possible for figures which are already input.

- 1) "Edit" button

The screenshot shows a software window titled "F_search : フォーム". At the top, there is a field for "OBJECTID:" containing the value "3" and a "search" button. Below this, there are three buttons: "Edit" (highlighted with a red box), "Save", and "Undo".

The main area of the form is a table with the following data:

OBJECTID		3
1.	CampName	bzz
2.	Location Lat	0 degree
	Location Lon	0 degree
3.	Province	WW
4.	District	A
5.	TotalArea	0 km ²
	FarmArea	0 km ²
	Forest	0 km ²
	Others	0 km ²
6.	Population	20000 person
7.	NoOfHouseholds	0 nos
	Agriculture	0 nos
	Mining Industry	0 nos
	Service	0 nos

At the bottom of the window, there is a record navigation bar with the text "レコード:" followed by navigation icons and the text "2 / 5".

2) “Save” button

“Save” button is operational when “Edit” button has been clicked (“Editing” mode). “Save” button is clicked for saving during editing.

The screenshot shows a software window titled "F_search : フォーム". At the top, there is a search field labeled "OBJECTID:" with a "search" button. Below this, there are three buttons: "Editing" (disabled), "Save" (highlighted with a red box), and "Undo". The main area of the form displays a table of data for "OBJECTID 2".

OBJECTID	2	
1.	CampName	2の名前
2.	Location Lat	0 degree
	Location Lon	0 degree
3.	Province	RR
4.	District	A
5.	TotalArea	0 km ²
	FarmArea	0 km ²
	Forest	0 km ²
	Others	0 km ²
6.	Population	50000 person
7.	NoOfHouseholds	0 nos
	Agriculture	0 nos
	Mining Industry	0 nos
	Service	0 nos

At the bottom of the window, there is a record navigation bar labeled "レコード:" with navigation buttons and a page indicator showing "1 / 5".

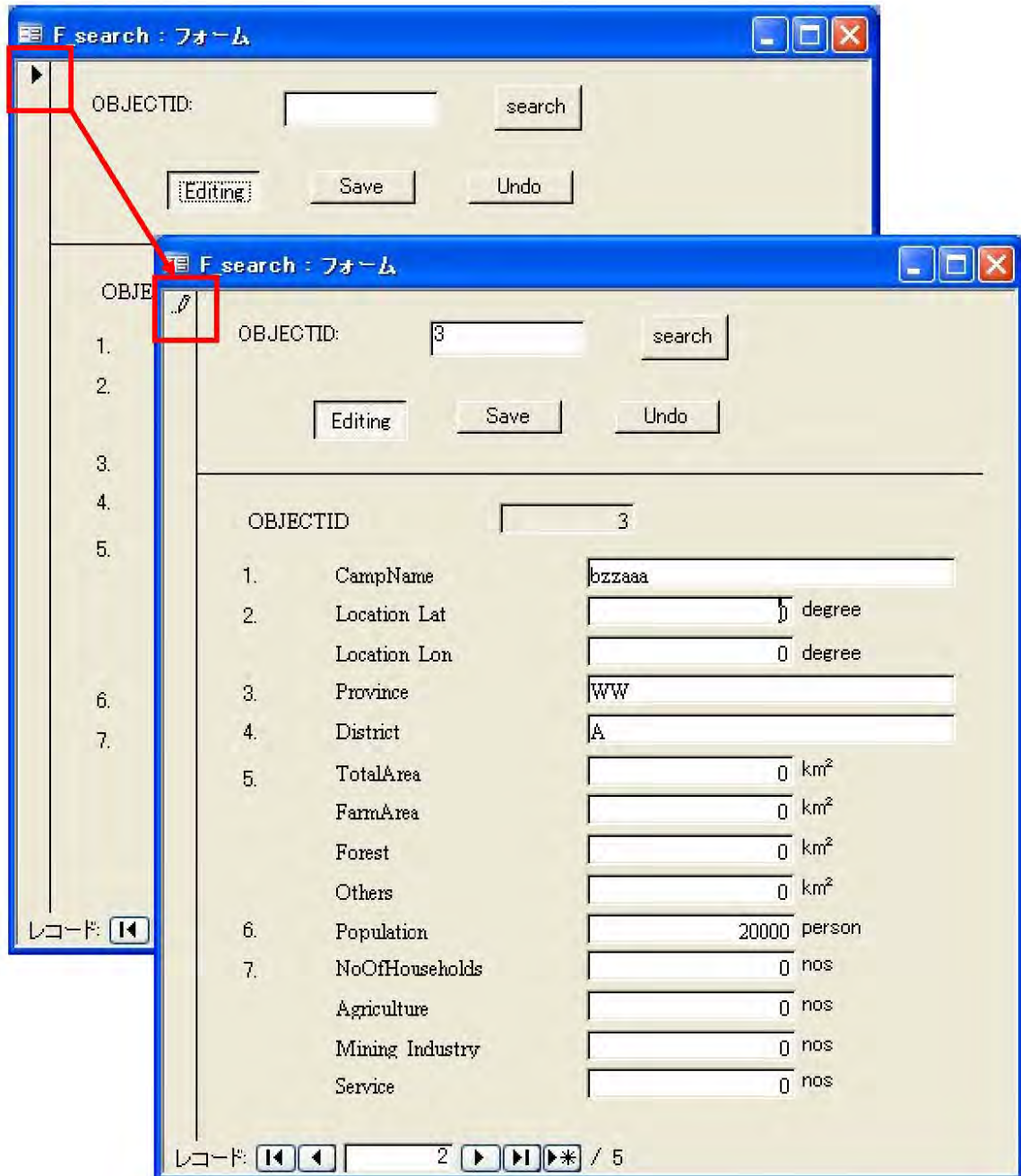
3) “Undo” button

When click “Undo” button, data are re-edited, however after saving (click “Edit”), editing is invalid.

The screenshot shows a software window titled "F_search : フォーム". At the top, there is a search field labeled "OBJECTID:" with a "search" button. Below this are three buttons: "Editing" (disabled), "Save", and "Undo" (highlighted with a red rectangle). The main area contains a form for editing data for "OBJECTID" 2. The form includes fields for "CampName" (value: 2の名称), "Location Lat" (0 degree), "Location Lon" (0 degree), "Province" (RR), "District" (A), and several area fields (TotalArea, FarmArea, Forest, Others) all set to 0 km². Below these are fields for "Population" (50000 person), "NoOfHouseholds" (0 nos), "Agriculture" (0 nos), "Mining Industry" (0 nos), and "Service" (0 nos). At the bottom, there is a record navigation bar with "レコード:" and a list of navigation icons, with "1" selected out of 5 records.

4) Confirmation of editing

When input data are changed during editing work, Indicator at left-up is changed for user's reference.



5) Input and editing of the rainfall and run-off data

Q_Precipitation_Data

StationName: StationCode: 222-1 OBJECTID: 2

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	400	450	200	250	300	200	250	300	250	300	350	400	3650
2001	200	250	300	400	350	200	200	250	300	350	400	450	3650
2002	500	450	400	350	300	250	200	200	300	400	350	300	4000

Edit Precipitation Data Refresh

Precipitation_Data_input

OBJECTID	Year	Month	Precipitation
2	2000	Jan	400
2	2000	Feb	450
2	2000	Mar	200
2	2000	Apr	250
2	2000	May	300
2	2000	Jun	200
2	2000	Jul	250
2	2000	Aug	300
2	2000	Sep	250
2	2000	Oct	300
2	2000	Nov	350
2	2000	Dec	400
2	2001	Jan	200
2	2001	Feb	250
2	2001	Mar	300
2	2001	Apr	400
2	2001	May	350
2	2001	Jun	200
2	2001	Jul	200
2	2001	Aug	250
2	2001	Sep	300
2	2001	Oct	350
2	2001	Nov	400
2	2001	Dec	450
2	2002	Jan	500
2	2002	Feb	450

レコード: 1 / 36 (ファイル)

Note: Indicated value in "View" shall be input in (OBJECTID) column.

Month is input using "Pull down" menu.

OBJECTID	Year	Month	Precipitation
2	2000	Jan	400
2	2000	Jan	
2	2000	Feb	
2	2000	Mar	
2	2000	Apr	
2	2000	May	
2	2000	Jun	
2	2000	Jul	
2	2000	Aug	
2	2000	Sep	
2	2000	Oct	300
2	2000	Nov	350
2	2000	Dec	400
2	2001	Jan	200
2	2001	Feb	250
2	2001	Mar	300
2	2001	Apr	400
2	2001	May	350
2	2001	Jun	200
2	2001	Jul	200
2	2001	Aug	250
2	2001	Sep	300
2	2001	Oct	350
2	2001	Nov	400
2	2001	Dec	450
2	2002	Jan	500
2	2002	Feb	450

When click "Refresh", data editing becomes effective in "View".

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	400	450	200	250	300	200	250	300	250	300	350	400	3650
2001	200	250	300	400	350	200	200	250	300	350	400	450	3650
2002	500	450	400	350	300	250	200	200	300	400	350	300	4000

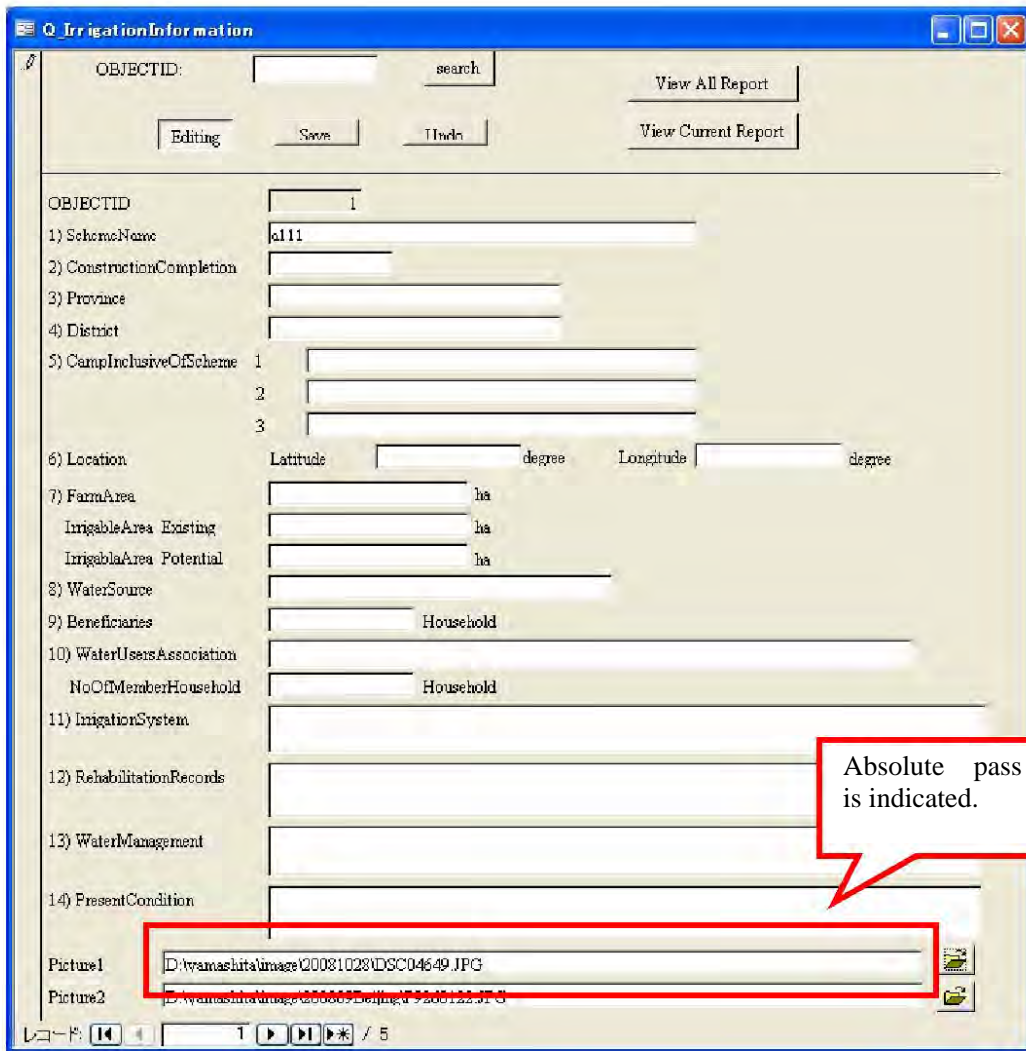
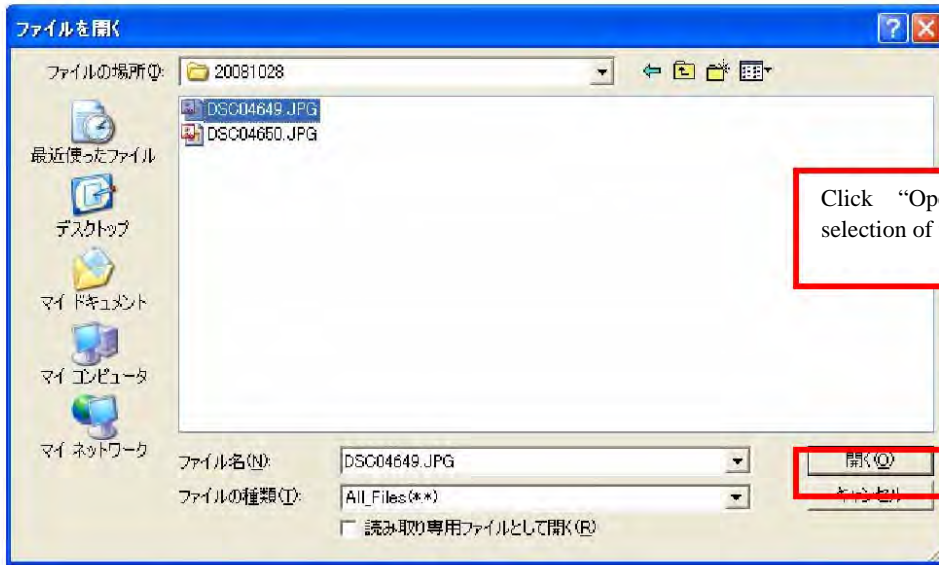
6) Input and editing of the irrigation data

Two photographs are input in an irrigation site. Click folder icon and select photograph with absolute path in "Picture1" and "Picture 2", respectively.

The screenshot shows a software window titled "Irrigation Information". At the top, there is a search bar for "OBJECTID:" with a "search" button and two report buttons: "View All Report" and "View Current Report". Below this is a toolbar with "Editing", "Save", and "Undo" buttons. The main form contains the following fields:

- OBJECTID: 1
- 1) SchemeName: all1
- 2) ConstructionCompletion: [empty]
- 3) Province: [empty]
- 4) District: [empty]
- 5) CampInclusiveOfScheme: 1, 2, 3 (each with a corresponding input field)
- 6) Location: Latitude [] degree, Longitude [] degree
- 7) FarmArea: [] ha
- IrrigableArea Existing: [] ha
- IrrigableArea Potential: [] ha
- 8) WaterSource: [empty]
- 9) Beneficiaries: [] Household
- 10) WaterUsers Association: [empty]
- NoOfMemberHousehold: [] Household
- 11) IrrigationSystem: [empty]
- 12) RehabilitationRecords: [empty]
- 13) WaterManagement: [empty]
- 14) PresentCondition: [empty]
- Picture1: [empty] (with a folder icon button highlighted by a red box)
- Picture2: D:\yamashitainage\200809Beijing\9260122.JPG (with a folder icon button highlighted by a red box)

At the bottom, there is a record navigation bar with the text "レコード: 1 / 5" and navigation icons.



7) Input and editing of production data

The following are remarkable points of farming and marketing information

OBJECTID: 1

OBJECTID: 1

1. CampName: name1

2. CropProduction Year: 2009

Crop	Production
A	100 ton
B	100 ton
C	50 ton
F	150 ton
	ton

3. MarketProduction Year: 2009

Crop	Production
A	30 ton
B	35 ton
C	20 ton
D	15 ton
E	10 ton
F	5 ton
G	4 ton

4. LoadInformation

	Location	Distance	LoadCondition
1) DistrictRoad	test1 - test2	km	
2) ProvincialRoad		km	
3) NationalRoad		km	

5. Market

6. Service ProviderInformation

	Provider Name	ServiceType	FinancialSupport
1) Government			
2) Private			
3) NGO			
4) Others			

7. NonAgricultural:

8. Others

1 / 8

Produce is selected not more than seven (7) kinds.

When erase "row", both (Crop) and (Production) shall be erased.

"Undo" is not d in the file.

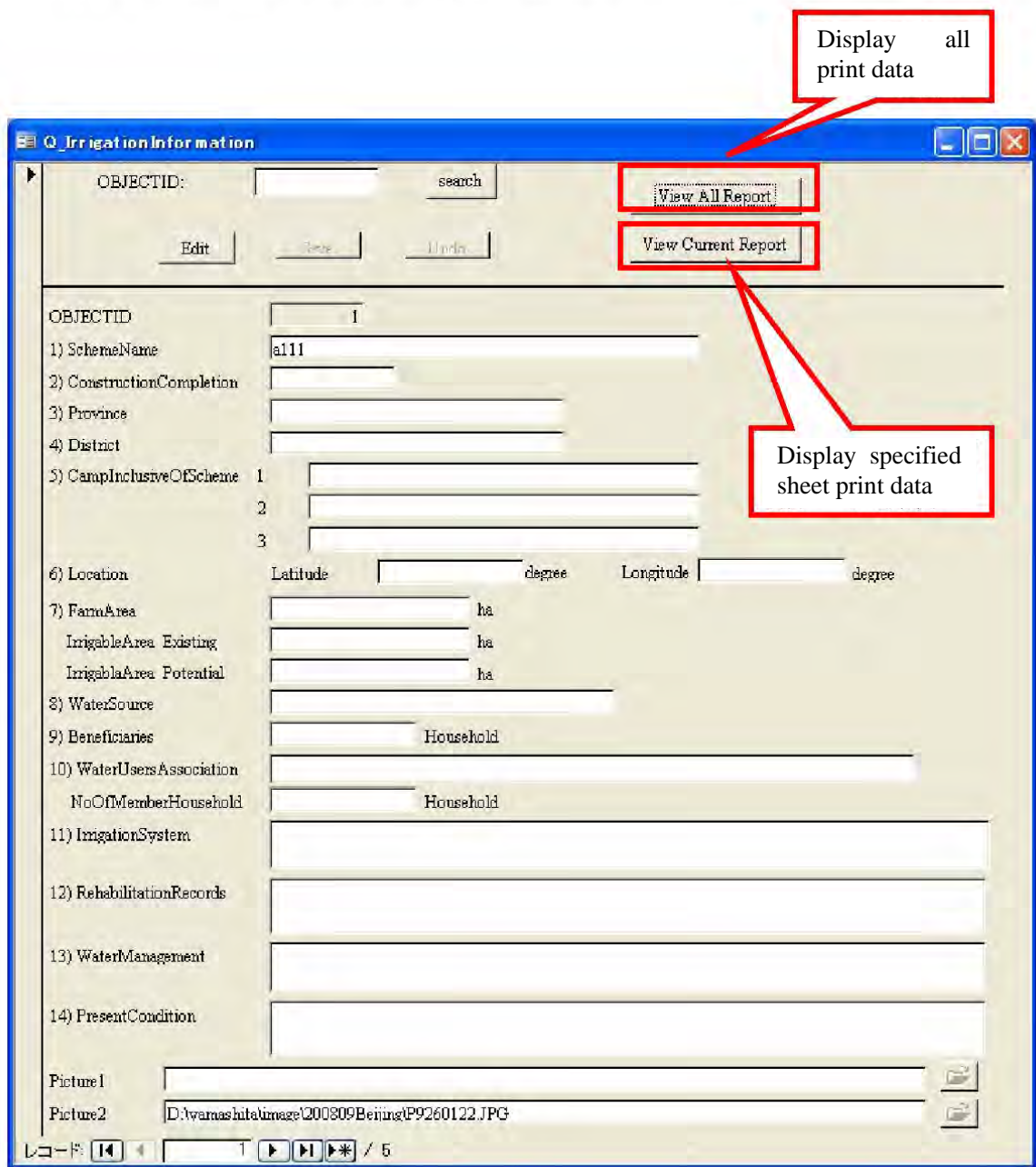
4. Print of irrigation data

(1) Display of print data

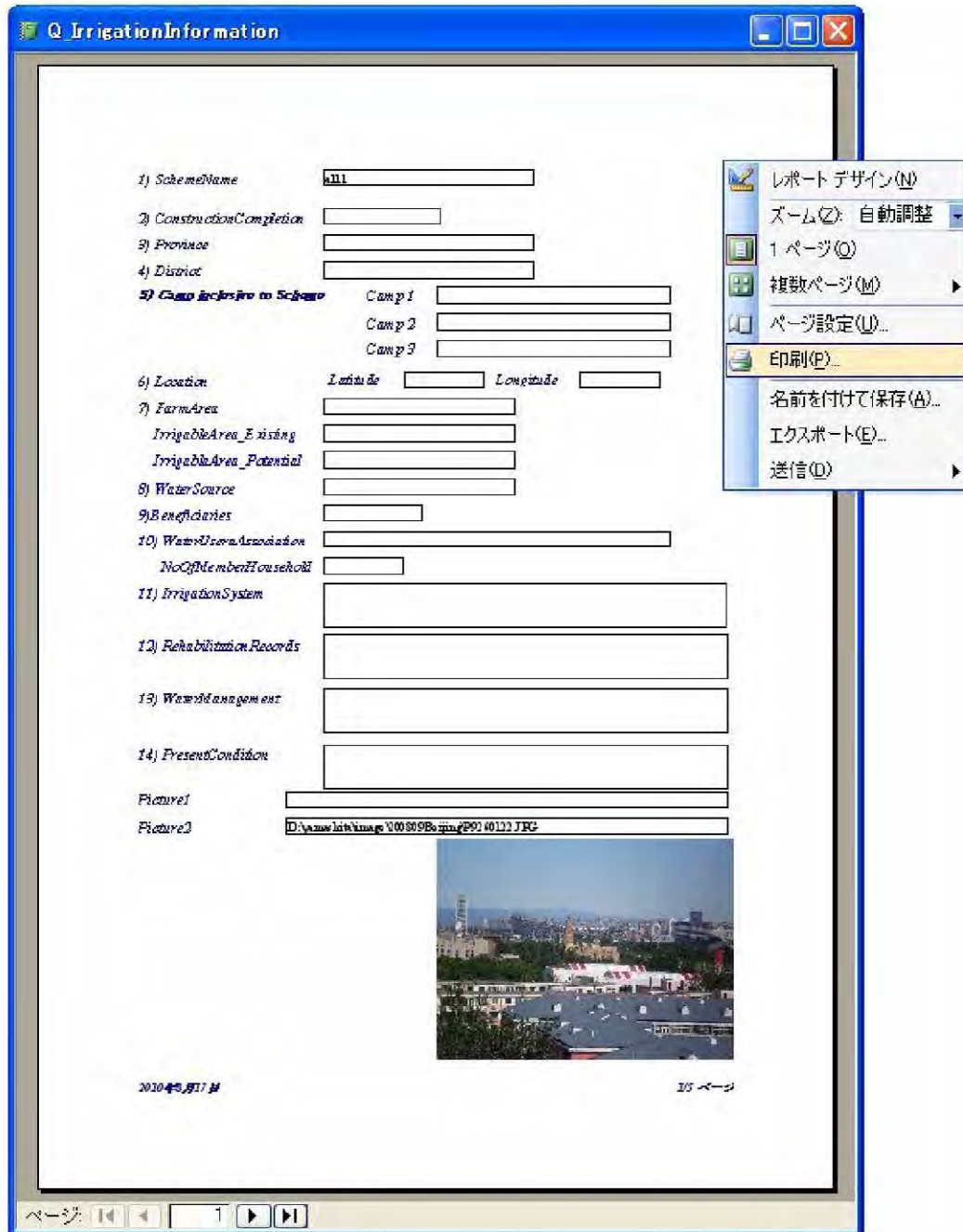
When click “View Current Report”, report in specified page is indicated.

(2) Print of all data

When click “View All Report”, all sheets are indicated.



- (3) Print
Right – click in the report, and select “Print”.



Forbidden clause

The following are forbidden without permission.

- Erase of Table Query form of MS Access
- Change name of Table Query form of MS Access
- Change of definition of Table Query form of MS Access

Since MS Access data base includes figure data, any changes above may cause invalidity of attribution and also display of figures.