

PART 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The Kudu Dam Irrigation Project is justified to be sound technically and viable economically with 10.5% of EIRR. From the financial viewpoint, the Project is also justified showing that the net annual income of typical farm will be increased to about 12 times of the present. As a conclusion, the Kudu Dam Irrigation project will contribute to the large extent to the improvement of income and living standards of the local people in the Project Area and to give farmers an incentive to farming. The Project will also contribute to supply stable food through increase of crop products and to attain the development target of the national agricultural policy. Therefore, the early implementation of the Project is expected. However, prior to implementation of the Project, it is indispensable to conduct the detailed Environmental Impact Assessment (EIA) including establishment of resettlement program for local people in the submerged area due to the construction of Kudu Dam.

The Nyarupakwe Pilot Project is essential for successful implementation of the Kudu Dam Irrigation Project which has an important role as a pioneering irrigation project for smallholder farmers in Zimbabwe. In order to serve as a place of technical training and trial-and-error learning for promotion of smooth transition to irrigation cultivation for farmers in the area, the Nyarupakwe Pilot Project should be started as early as possible.

5.2 Recommendations

Based on the result of the Study, the following are recommended for the project promotion and sustainability :

(1) Early Establishment of Resettlement Program

The construction of Kudu Dam will force a maximum of 500 households (about 3,100 persons) to leave their own lands and houses. It was confirmed through the social survey in the submerge area conducted during the Phase I Field Work that people have been aware of the Kudu dam proposal and have avoided any property investment for fear of not being properly compensated, and most households in the area would like to be moved as a group. Since no detailed discussions on the resettlement between the Government and local people have been made at present, the resettlement program should be established as soon as possible prior to implementation of the Project. It is recommended that a reliable NGO preferably with international accreditation is employed to facilitate the resettlement process.

(2) Consensus of farmers for Land Re-allocation in Irrigation Areas

According to the regulation on land use for agriculture in Zimbabwe, farmers have to surrender their land to the Government when their land become irrigable. This system is to lessen impartiality in income caused by the introduction of irrigation water. In the existing irrigation projects in Zimbabwe, the allocated irrigation areas are various according to the project conditions. Therefore, it is recommended that the land re-allocation in the proposed irrigation areas should be made based on the consensus of beneficiary farmers taking the existing land holding conditions into consideration. AGRITEX shall facilitate the planning process and draw plot maps with NGO assistance.

(3) Establishment of Lower Munyati Agricultural Development Authority (LMADA)

It is proposed to establish a new independent organization of LMADA for the smooth implementation and efficient O&M of the Project in due consideration of the project scale and recent changes of organizational and management structure of the government agencies. For dealing with important policy matters relating to the operations or financing of LMADA, it is proposed to set up a Steering Committee comprising representatives of the government agencies related to the Project as well as representatives of farmers. The LMADA should be established prior to the project implementation and move into action from the initial stage of the Project.

(4) Early Completion of Seke Dam Irrigation Project

At the interim stage of the Study, it was proposed to establish two(2) pilot project areas. One is Nyarupakwe area on the left bank of Munyati river and the other is Seke area located on the right bank. In the Seke area, a medium-scale dam has already been constructed on the Seke river and the irrigation facilities covering about 150ha are planned to be constructed at the lower reach of the Seke dam under contribution of Rio Tinto Private Company. So it was recommended that a part of this new irrigation area be taken as the project area. However, as leakage through right abutment of the dam and erosion of spillway wall were observed, rehabilitation works become necessary and construction of irrigation facilities shall be delay. From these present conditions, the Seke area is excluded from the proposed pilot project plan for the Phase II Field Work. Though the Nyarupakwe Pilot Project with a Agricultural Extension Center will serve as a training place for farmers in the Project Area, it is strongly recommended that the Seke Irrigation Project should be completed as soon as possible so that farmers in the right bank can get training of irrigation cultivation more easily before completion of Kudu Dam Irrigation Project. A Irrigated Agricultural Extension Center is proposed to be established at the Seke area within the framework of the overall Kudu Dam Irrigation Project.

(5) Further Study of Kudu Dam Design

Through the review works of the Kudu dam design made by DWD in 1993, it is recommended to make the further study on the following points:

- (a) Dam axis: from the viewpoint of safety to the seepage failure at the left abutment of the original dam axis, the possibility of shifting of the dam axis to about 100m upstream should be examined through the geological investigation at the new site. When the original dam axis is kept, special treatment should be considered for protection seepage failure based on the more detailed investigation on permeable strata.
- (b) Permeability test at dam foundation: many boring tests were made by DWD, but permeability analysis was not made. Thus, in this review work, the foundation treatment was examined from the result of observation of boring core, geological column and field investigation, and two lines of sub-curtain grouting and blanket grouting were proposed in order to improve permeability near the surface of the foundation and to make water tightness along the boundary between core zone and foundation, respectively. However, for actual implementation, the permeability test should be made to confirm the permeability at the site.

(c) Spillway:

In the original design by DWD, the only part of overflow weir section of spillway was designed as the concrete structure with the design flood discharge of 2000-year return period. The flood discharges after overflow portion will be running through the natural ground and then flow into the river, which will erode and devastate the natural ground gradually. In the review, it is proposed to install service spillway and emergency spillway in consideration of the frequency of use. The service spillway is designed to be able to release the flood discharge of 250-year return period, and is designed as a concrete structure so as to keep the stable flow condition of the discharge. The emergency spillway is designed to be able to release the flood discharge of a 2000-year flood and the channel is not lined with concrete except the inflow section. As the construction cost of the spillway becomes high by this proposal, it is recommended that the geological conditions be checked in more detail before implementation.

- (d) Diversion work during construction: In Zimbabwe, the construction method without diversion channel is often applied. This method is to provide a weir section cutting a part of dam body filled in the dry season and to discharge river stream through this weir section in the rainy season. In the original design by DWD, the above construction method was applied, because DWD has many experiences in construction of fill-type dams with this construction method. However, the Kudu dam is a large scale dam with about 9.5 MCM of embankment volume and construction period will

be about 5 years. Also, the Munyati river is a big river and the catchment area at the proposed damsite is very wide at about 17,000 km². Therefore, in case of application of this construction method, careful attention should be paid to the adjacent zone between previous embankment and new embankment because previous embankment may be damaged by floods in the rainy season. From the viewpoint of safety construction, it is recommended that a diversion tunnel be provided or the originally designed intake tunnel be re-studied so as to have the function as the diversion channel.

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TABLES

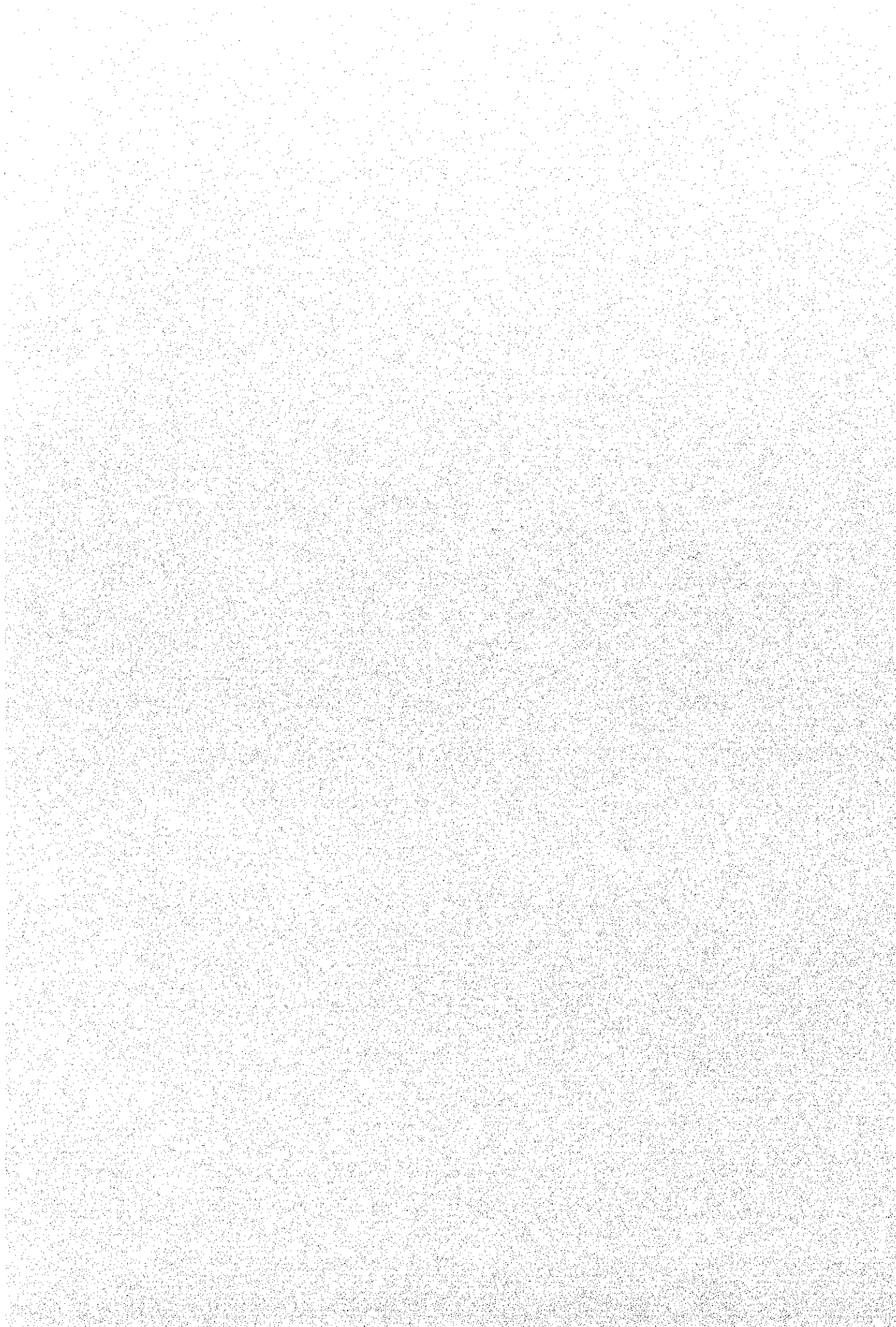


Table 1.5.1 JICA Study Team and Counterpart Personnel

POSITION	JICA STUDY TEAM	COUNTERPART
1. Team Leader	Mr. Takeshi Kawaguchi	Mr. A. Dube (Agritex, Midlands P.O) Mr. P. Murwisi (Agritex, Mashonaland West P.O)
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15. Supervise for Canal Route Survey	Mr. Ryousuke Itoh	—

Table 3.1.1 Mean Monthly Climatological Data

Name of Station : Kadoma

Description	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Average Rainfall (mm)	184.7	128.0	86.7	27.7	6.8	1.5	0.3	1.2	8.3	35.0	90.8	164.4	735.4
Air Temperature													
- Max. (°C)	28.6	28.4	28.9	28.1	26.4	24.1	24.0	26.7	30.4	32.0	30.7	29.0	28.1
- Min. (°C)	17.7	17.3	16.3	14.5	11.4	8.8	8.5	10.3	13.8	16.8	17.6	17.8	14.2
Relative Humidity (%)	-	-	-	-	-	-	-	-	-	-	-	-	-
Pan Evaporation (mm)	5.5	5.2	5.5	5.3	4.9	4.5	4.8	6.3	8.4	9.0	7.6	5.8	6.1
Wind Speed (km/hr)	176.6	162.4	172.0	193.5	194.2	212.5	226.9	246.2	264.9	276.2	244.2	204.0	214.5
Sunshine Hour (hrs)	7.2	7.3	8.3	8.9	9.2	9.2	9.4	10.0	9.9	9.1	7.5	6.6	8.6

Note : Data for relative humidity are not available.

Name of Station : Gokwe

Description	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Average Rainfall (mm)	182.1	158.7	76.3	34.4	5.9	1.1	0.2	0.7	3.5	26.3	85.2	160.4	734.8
Air Temperature													
- Max. (°C)	27.3	27.1	27.6	26.8	25.0	22.8	22.6	25.3	29.0	30.2	29.4	27.6	26.7
- Min. (°C)	17.7	17.4	17.0	15.1	12.0	9.3	8.9	11.4	15.2	17.6	18.0	17.6	14.8
Relative Humidity (%)	74.0	72.1	67.3	59.3	53.4	50.5	48.5	41.4	37.0	41.6	51.7	68.5	55.4
Pan Evaporation (mm)	5.5	5.5	5.8	5.6	5.1	4.6	4.9	6.3	10.4	8.9	7.5	5.7	6.3
Wind Speed (km/hr)	158.5	160.6	171.7	182.5	173.3	177.7	190.6	200.4	223.4	229.9	205.2	173.5	187.3
Sunshine Hour (hrs)	7.1	7.4	8.0	8.9	9.3	9.4	9.6	10.2	10.0	9.4	8.0	6.8	8.7

Table 3.1.6 Results of Water Quality Analysis (1/3)

Analysis Items	WHO Standard (1993)	Samples taken from Rivers on December 1998									
		Site 1 (Mazoe R.)	Site 2 (Umsweswe R.)	Site 3 (Upper M.R.)	Site 4 (Sebakwe R.)	Site 5 (Kwekwe R.)	Site 6 (Munyati R.)	Site 7 (Ngondoma R.)	Site 8 (Munyati R.)	Site 9 (Munyati R.)	Site 10 (Lower M.R.)
Color (TCU)	15.0	20.0	15.0	15.0	10.0	7.5	10.0	20.0	15.0	20.0	100.0
Turbidity (NTU)	5.0	163.2	92.1	57.7	6.1	90.3	275.0	185.0	202.0	1,605.0	
Water Temperature (°C)		25.1	28.0	24.5	26.2	77.2	86.0	55.0	26.6	27.6	
TDS (mg/l)	1,000.0	43.3	57.3	43.3	290.7	0.003	0.03	0.04	0.03	0.04	
SS (mg/l)		0.04	0.03	0.06	7.1	6.9	7.1	7.7	7.4	7.1	
pH	6.5 - 9.5	6.7	7.1	7.1	7.1	7.8	7.7	7.7	7.4	7.1	
EC (mSm ⁻¹)		7.4	9.8	7.4	14.3	49.7	13.2	14.7	9.4	10.0	
DO (mg/l)		19.1	11.2	9.0	11.7	12.4	9.7	9.3	9.6	9.4	
Na (mg/l)	200.0	4.0	10.0	6.0	11.0	35.0	9.0	8.0	6.0	6.0	
F (mg/l)	1.50	0.05	0.06	0.05	0.07	0.18	0.06	0.12	0.05	0.05	
N (mg/l)	50.0	not detected	not detected	not detected	not detected	2.1	not detected	not detected	not detected	not detected	
P (mg/l)		not detected	not detected	not detected	0.1	not detected	not detected	not detected	not detected	not detected	
Mg (mg/l)		4.5	5.5	6.5	9.0	29.0	8.5	8.5	6.5	7.0	
Ca (mg/l)		9.0	12.3	7.4	17.2	45.0	15.6	22.9	9.8	12.3	
K (mg/l)		5.8	6.1	5.5	8.8	7.8	6.5	8.8	6.4	7.0	
Hg (mg/l)	0.001	0.02	0.09	0.09	0.08	0.08	0.11	0.11	0.10	0.09	
Pb (mg/l)	0.01	0.20	0.25	0.35	0.25	0.12	0.29	0.08	0.33	0.27	
Cr (mg/l)	0.05	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	
Cd (mg/l)	0.003	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	
Cu (mg/l)	1.00	not detected	0.06	0.04	0.08	0.08	0.16	0.21	0.20	0.22	
BOD (mg/l)	5.0	3.4	2.8	2.9	2.5	2.4	2.6	1.5	2.7	2.5	
COD (mg/l)	30.0	not detected	not detected	not detected	23.7	15.8	19.8	19.8	23.7	35.6	
COLIFORM (MPN/100ml) (CFU/ml)	10	920 1 x 10 ³	920 1 x 10 ³	350 2 x 10 ³	140 2 x 10 ²	180 2 x 10 ¹	1,600 2 x 10 ⁵	> 1,800 2 x 10 ⁴	> 1,800 1 x 10 ²	> 1,800 2 x 10 ²	

(Note) TDS : Total Dissolved Solid, SS : Suspended Solid, EC : Electric Conductivity, DO : Dissolved Oxygen, Na : Sodium, F : Fluorine, N : Nitrogen, P : Phosphoric Acid, Mg : Magnesium, Ca : Calcium, K : Potassium, Hg : Mercury, Pb : Lead, Cr : Chromium, Cd : Cadmium, Cu : Copper, BOD : Biological Oxygen Demand, COD : Chemical Oxygen Demand

Table 3.1.6 Results of Water Quality Analysis (2/3)

Analysis Items	WHO Standard (1993)	Samples taken from Rivers on February 1999									
		Site 1 (Mazoe R.)	Site 2 (Umsweswe R.)	Site 3 (Upper M.R.)	Site 4 (Sebakwe R.)	Site 5 (Kwekwe R.)	Site 6 (Munyati R.)	Site 7 (Ngondoma R.)	Site 8 (Munyati R.)	Site 9 (Munyati R.)	Site 10 (Lower M.R.)
Color (TCU)	15.0	2.5	5.0	5.0	2.5	7.5	10.0	2.5	5.0	5.0	7.5
Turbidity (NTU)	5.0	41.2	75.1	37.7	51.0	68.1	83.4	117.0	58.8	78.7	83.7
Water Temperature (°C)		25.8	24.9	24.6	23.9	23.2	23.9	26.2	24.3	24.9	24.8
TDS (mg/l)	1,000.0	63.8	44.5	53.8	48.6	69.0	46.8	97.1	51.5	42.1	45.0
SS (mg/l)		0.001	0.001	0.001	0.006	0.003	0.002	0.004	0.003	0.002	0.005
pH	6.5 - 9.5	7.5	7.5	7.7	7.5	7.5	7.6	7.9	7.7	7.7	7.4
EC (mSm ⁻¹)		10.9	7.6	9.2	8.3	11.8	8.0	16.6	8.8	7.2	7.7
DO (mg/l)		17.7	17.4	20.2	18.3	18.9	20.9	20.6	19.5	21.1	20.3
Na (mg/l)	200.0	8.0	7.0	5.0	7.0	11.0	6.0	15.0	7.0	6.0	6.0
F (mg/l)	1.50	0.05	0.02	0.02	not detected	not detected	not detected	0.01	not detected	0.01	not detected
N (mg/l)	50.0	2.5	not detected	4.6	2.4	5.8	0.7	3.4	3.2	not detected	not detected
P (mg/l)		0.01	0.01	0.03	0.10	0.13	0.30	0.40	0.20	1.00	1.20
Mg (mg/l)		4.5	3.5	7.0	6.0	4.0	4.0	4.5	4.0	3.5	3.5
Ca (mg/l)		13.1	8.2	7.4	6.5	13.1	7.4	21.3	9.0	7.4	9.8
K (mg/l)		3.9	5.3	4.1	5.0	5.0	4.6	7.3	4.8	5.1	6.5
Hg (mg/l)	0.001	0.12	0.09	0.11	0.10	0.11	0.12	0.07	0.11	0.14	0.07
Pb (mg/l)	0.01	not detected	not detected	0.01	not detected	0.01	0.02	0.03	0.04	0.08	0.04
Cr (mg/l)	0.05	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected
Cd (mg/l)	0.003	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected
Cu (mg/l)	1.00	not detected	not detected	not detected	0.06	0.03	0.03	0.04	0.01	0.06	0.01
BOD (mg/l)	5.0	3.6	2.0	2.6	2.9	3.8	2.8	1.8	2.7	3.0	2.7
COD (mg/l)	30.0	15.8	7.9	11.9	11.9	35.6	35.6	27.7	27.7	11.9	27.7
COLIFORM (MPN/100ml) (CFU/ml)	10	> 1,800 3 x 10 ²	920 9 x 10 ²	> 1,800 9 x 10 ⁴	> 1,800 8 x 10 ²	920 7 x 10 ³	1,600 2 x 10 ²	1,600 1 x 10 ²	> 1,800 7 x 10 ²	1,600 2 x 10 ²	1,600 1 x 10 ⁴

(Note) TDS : Total Dissolved Solid, SS : Suspended Solid, EC : Electric Conductivity, DO : Dissolved Oxygen, Na : Sodium, F : Fluorine,
 N : Nitrogen, P : Phosphoric Acid, Mg : Magnesium, Ca : Calcium, K : Potassium, Hg : Mercury, Pb : Lead, Cr : Chromium,
 Cd : Cadmium, Cu : Copper, BOD : Biological Oxygen Demand, COD : Chemical Oxygen Demand

Table 3.1.6 Results of Water Quality Analysis (3/3)

Analysis Items	WHO Standard (1993)	Samples taken from Wells on January 1999									
		Site 1 (Village 24)	Site 2 (Village 9)	Site 3 (Village 25)	Site 4 (Village 32)	Site 5 (Village 2)	Site 6 (Marundu)	Site 7 (Nyamatsem)	Site 8 (St.C.School)	Site 9 (Mak. School)	Site 10 (Ung. School)
Color (TCU)	15.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5	0.0	0.0	10.0
Turbidity (NTU)	5.0	5.4	36.4	20.5	55.5	2.2	16.5	6.0	4.7	1.9	570.0
Water Temperature (°C)		28.6	27.4	27.8	27.7	25.1	28.5	26.2	27.5	27.7	26.2
TDS (mg/l)	1,000.0	501.3	108.2	294.3	80.7	445.8	233.4	685.0	869.3	413.6	459.2
SS (mg/l)		not detected	0.001	0.001	0.002	0.001	0.002	not detected	not detected	not detected	0.06
pH	6.5 - 9.5	7.2	6.5	7.2	6.3	7.1	7.5	7.6	7.3	7.3	7.0
EC (mSm ⁻¹)		85.7	18.5	50.3	13.8	76.2	39.9	117.1	143.6	70.7	78.5
DO (mg/l)		3.0	7.1	3.2	3.9	2.8	2.6	4.1	4.6	5.3	1.3
Na (mg/l)	200.0	11.0	8.0	49.0	12.0	52.0	245.0	175.0	62.0	21.0	17.0
F (mg/l)	1.50	0.20	0.17	0.71	0.25	0.26	0.28	0.94	0.36	0.22	0.55
N (mg/l)	50.0	7.2	8.2	0.2	0.6	8.7	0.6	1.3	14.5	1.2	0.5
P (mg/l)		not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected
Mg (mg/l)		74.5	2.5	27.5	5.5	40.5	22.5	21.0	78.0	36.0	40.5
Ca (mg/l)		97.4	29.5	50.7	17.2	100.7	80.2	67.1	125.2	103.9	101.5
K (mg/l)		not detected	15.4	0.9	9.0	not detected	2.3	not detected	0.03	11.8	30.5
Hg (mg/l)	0.001	0.10	0.08	0.10	0.09	0.09	0.10	0.11	0.11	0.11	not detected
Pb (mg/l)	0.01	0.5	0.5	0.6	0.4	0.5	0.6	0.5	0.7	0.5	0.5
Cr (mg/l)	0.05	2.9	3.2	3.2	3.5	3.0	2.9	2.4	2.4	2.8	2.1
Cd (mg/l)	0.003	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected
Cu (mg/l)	1.00	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected	not detected
BOD (mg/l)	5.0	1.6	0.04	0.08	not detected	not detected	not detected	0.92	1.8	not detected	0.08
COD (mg/l)	30.0	not detected	7.9	15.8	7.9	4.0	7.9	7.9	15.8	11.9	4.0
COLIFORM (MPN/100ml)	10	> 1,800	920	> 1,800	> 1,800	920	1,600	1,600	> 1,800	1,600	1,600
(CFU/ml)		3 x 10 ²	9 x 10 ²	9 x 10 ⁴	8 x 10 ²	7 x 10 ³	2 x 10 ²	1 x 10 ²	7 x 10 ²	2 x 10 ³	1 x 10 ⁴

(Note) TDS : Total Dissolved Solid, SS : Suspended Solid, EC : Electric Conductivity, DO : Dissolved Oxygen, Na : Sodium, F : Fluorine,
 N : Nitrogen, P : Phosphoric Acid, Mg : Magnesium, Ca : Calcium, K : Potassium, Hg : Mercury, Pb : Lead, Cr : Chromium,
 Cd : Cadmium, Cu : Copper, BOD : Biological Oxygen Demand, COD : Chemical Oxygen Demand

Table 3.1.7 Result of Water Quality Analysis OF Mercury and Lead

(Unit : mg/l)

Sampling Locations	Result of Analysis in Japan	
	February, 2000	
	Mercury (Hg)	Lead (Pb)
(River)		
Site 1. Mazoe tributary, near Mari Mari Ranch	0.00005	0.0017
Site 2. Umsweswe river, 1-2 km downstream of Vic	<0.00003	0.0026
Site 3. Upper Munyati river, 1 km upstream of Lucky Beanie	0.00004	0.0025
Site 4. Sebakwe river, 5-6 km upstream of confluence with Kwekwe river	<0.00003	0.0035
Site 5. Kwekwe river, 1-2 km upstream of confluence with Sebakwe river		
Site 6. Munyati river, causeway/bridge on Empress Mine road	0.00008	0.0048
Site 7. Ngondoma tributary, 1-2 km downstream of Kudu damsite	0.00007	0.0082
Site 8. Munyati river, just downstream of confluence with Mtanke river	0.00003	0.0045
Site 9. Munyati river, Renji bridge near Renji Camp	<0.00003	0.0017
Site 10. Munyati river, downstream of Copper Queen	<0.00003	0.0005
Site 11. Nyarupakwe Dam Site	<0.00003	<0.0002
(Well)		
Site 1. Sanyati-K21, BH village 24	<0.00003	0.0040
Site 2. Sanyati-K22, BH village 9	<0.00003	0.0072
Site 3. Sanyati-K23, BH village 25	<0.00003	0.0116
Site 4. Sanyati-K24, BH village 32	<0.00003	0.0057
Site 5. Muzvezve I-K17, BH village 2	<0.00003	0.0044
Site 6. Chisina I-GS 23 Vidco Batanai, BH Marundu	<0.00003	0.0021
Site 7. Chisina I-GS 24 Vidco Murumemkuru, BH Nyamatshemi	<0.00003	0.0014
Site 8. Chisina II-GS 24 Vidco Mhungu, BH St. Cuthberts School	0.00033	0.0029
Site 9. Makore I-GN 11 Vidco Kushinga, BH Makore School	<0.00003	0.0019
Site 10. Copper Queen Small Scale Commercial Farming Area, BH Ungwe School	<0.00003	0.0496

Note : WHO Standard (1993) Hg = 0.001 mg/l, Pb = 0.01 mg/l

Table 3.1.8 Demographic Conditions in the Wards Related to the Study Area in 1998

District/ Ward No.	Ward Name	1992 Figures Based on Census			Estimated 1998 Figures				Popul. Increase 92-98 (% p.a.)	Area b/ (ha)	Popul. Density in 1998 (prn/km ²)	
		Popu- lation (prn)	Hhold (No.)	Ave. Size of HH (prn)	Popu- lation a/ (prn)	Hhold a/ (No.)	Ave. Size of HH a/ (prn)	Farm Popul. c/ (prn)				Farm Hhold c/ (No.)
Kadoma												
K17	Muzvezve 1	NA	NA	NA	8,829	1,472	6.00	8,388	1,398	-	101,000	8.74
K20	Ward Twenty	NA	NA	NA	10,998	1,833	6.00	10,448	1,741	-	6,557	167.73
K21	Ward Twenty One	NA	NA	NA	5,708	951	6.00	5,423	903	-	6,173	92.47
K22	Ward Twenty Two	NA	NA	NA	5,757	960	6.00	5,469	912	-	8,589	67.03
K23	Ward Twenty Three	NA	NA	NA	13,474	2,246	6.00	12,800	2,134	-	10,123	133.10
K24	Ward Twenty Four	NA	NA	NA	9,867	1,645	6.00	9,374	1,563	-	13,458	73.32
	Sub-total or average	NA	NA	NA	54,633	9,107	6.00	51,901	8,652	-	145,900	37.45
Gokwe North												
GN11	Makore 1	9,159	1,431	6.40	10,721	2,117	5.06	10,185	2,011	2.66	13,452	79.70
GN12	Makore 2	6,148	1,027	5.99	7,197	1,528	4.71	6,837	1,452	2.66	16,186	44.46
	Sub-total or average	15,307	2,458	6.23	17,918	3,645	4.92	17,022	3,463	2.66	29,638	60.46
Gokwe South												
GS23	Chisina I	14,376	2,336	6.15	17,251	2,875	6.00	16,388	2,731	3.09	82,813	20.83
GS24	Chisina II	10,186	1,807	5.64	13,303	2,217	6.00	12,638	2,106	4.55	60,060	22.15
	Sub-total or average	24,562	4,143	5.93	30,554	5,092	6.00	29,026	4,838	3.71	142,873	21.39
	Total or Average	-	-	-	103,105	17,844	5.78	97,950	16,952	-	-	-
Kwekwe Rural												
KW6	Mabura	5,542	944	5.87	6,435	1,096	5.87	6,113	1,041	2.52	16,942	37.98
KW7	Sidakeni	5,529	1,106	5.00	6,419	1,284	5.00	6,098	1,220	2.52	14,296	44.90
	Total or Average	11,071	2,050	5.40	12,854	2,380	5.40	12,211	2,261	2.52	31,238	41.15

Source:

a/: Estimated by each Rural District Council as 1998 figures.

b/: AGRITEX in each district except for K17 which is estimated by the JICA Study Team based on 1/50,000 ward boundary map.

c/: Assumed that 95% of population and households in 1998 are engaged in agriculture.

Table 3.1.9 Summary Results of Household and Household Member Surveys (1/3)

<p>1. Household and Population</p> <p>The total population of the sample households is 2,543 with male and female ratio of about 50:50, and the average size of household is 7.1. As for the age group composition, about 40% of the population belong to the age group of less than 15 years old, while 5% belong to the age group of over 61 years old. The economically active population which belongs to the age group 16-60 years old is to be about 54% of the total population.</p> <p>Major ethnic groups are Zezuru and Karanga in the potential irrigation development area, and consist of 39% and 36% of the total sample households, respectively. It is said that Zezuru are the typical group in Mashonaland West province. Marriage between different Shona sub-tribes is common, and villagers consisting of three to four tribes support each other on special occasions, e.g. funerals and marriage. Because of such facts, it is considered that it is not necessary to pay to the tribal issue in a development planning. In general, however, mutual support relationships among neighbors are weak in the resettlement area compared to that in the communal area where household are more closely interrelated.</p> <p>As for the period of settlement, 37% of the sample households settled in their respective villages more than 30 years ago on average. The proportion of households settled more than 30 years ago is 49% in Gokwe North, 45% in the Gokwe South, and 28% in Kadoma district which shows comparatively lower percentage than the former two districts. In the resettlement area alone, although its sample size is considerably small, the result of analysis reveals that the households settled less than 20 years ago are 86% of the samples.</p>
<p>2. Education Status</p> <p>As a whole, about 24% of the household heads received no formal education, and about 19% did not complete primary school. Accordingly, it can be said that nearly half of the household heads are non-educated and/or did not complete primary school in the potential irrigation development area. On the other hand, the proportion of household heads who were educated beyond primary school is about 29%. However, the proportion of GCE-A level graduates (which correspond to high school graduates) is only 1.4% of the household heads.</p>
<p>3. Occupation</p> <p>85% of the heads of household are farmers followed by salary workers (6%) and in private business (3%). The proportion of farmers is slightly higher in Gokwe North district than that in other two districts. The household heads who have no job are small in proportion at only 3%. The occupation of 65% of household heads is farming, follow by salary workers, wage labors and jobless accounting for 8%, 2% and 9%, respectively.</p>
<p>4. Involvement in community organization</p> <p>Religious organization, farmers' group and ZFU are the major community organizations in the area, and their proportion of membership are 38%, 13% and 10% of the household heads, respectively. However, a fairly large proportion of the households heads (about 21%) do not belong to any community organization. Of the non-members, the greater proportion is male at 59% compared to 41% of the female population. The community organizations relevant to rural and agricultural development are generally inactive as indicated by the low membership rates indicated by the survey.</p>
<p>5. Cash Income Source</p> <p>Among several sources of income, "crops" is the most important cash income source of the households, followed by livestock, salary, wage and remittance. The importance of income from other sources than crop is low.</p>
<p>6. Fuel for Cooking/Heating</p> <p>Among several fuel sources, fuel wood is the most important for cooking and heating purposes in the area. Use of other sources such as crop residue and paraffin is not a common practice in the area. Almost all the households fetch their own fuel wood needs, and only 2% of the households buy their fuel wood.</p> <p>The distance or time required to get to fuel wood sources is about 54 minutes to the first source and 45 minutes to the second source on average. Although they are spending about one hour to get to fuel wood sources, only 9% of households answered that fuel wood was very difficult to obtain. Spending about one hour to fuel wood sources is likely to be common practice for most households in the area. The availability of fuel wood is lower in Gokwe North district where forests are scarcely expanded.</p>
<p>7. Food</p> <p>The proportion of households having sufficient production greater than their requirements is on average about 30% for cereals, 10% for vegetables and 3% for meat. Household needs are purchased or exchanged in about 36% of the households in cereals, 54% in vegetables and 79% in meat. Based on these figures, it appears that about one-third of the households have surpluses of cereals, vegetables cultivated in the area are mostly for home consumption (although these are produced insufficiently), and meats are insufficient in many households.</p>

Table 3.1.9 Summary Results of Household and Household Member Surveys (2/3)

<p>8. Health and Sanitation</p> <p>Malaria is the most popular disease, and nearly 50% of children and adults had an occurrence during the last 12 months. The rates of occurrence in other diseases are comparatively small. For children, 4% for diarrhea, 2% for skin disease, and 2% for respiratory disease, and for adults 6% for respiratory disease, 4% for diarrhea, 2% for eye disease and 2% for pneumonia. On the other hand, about 37% of children and 24% of adults had "no disease" during the last 12 months.</p> <p>To the question about a treatment when they had slight illnesses, 76% of households selected the answer of "go to a clinic/hospital within the ward". In case of severe illnesses, 55% selected the answer of "go to a clinic/hospital outside the ward". The proportion of households whose answers were "no medical treatment" is small at 6% in case of slight illnesses, and 3% in severe illnesses. It can be said that the people in the area depend mainly on medical services available in and around the area when they fall sick.</p>
<p>9. Family planning</p> <p>As for the survey results on the status of family planning, 73% of the households indicated that they had been visited by a family planning health worker in their area. The availability of the workers is much higher in Gokwe North where 97% cited that they were receiving the health workers. In Gokwe South, only 51% had been visited by the health personnel. In general, however, the services of family planning are being strengthened in the area through the development of clinics and/or health centers.</p>
<p>10. Agricultural Supporting Services</p> <p>The proportion of households who receive the services in every year is 80% in AGRITEX extension, 50% in financial support, and 60% in veterinary service. It can be evaluated that the AGRITEX extension service is more densely provided than other two services in the area. Among the districts, the AGRITEX service seems to be inactive in Gokwe North district. Similarly, the financial service is weakly provided in Gokwe North and Gokwe South districts, and the veterinary service is low in Gokwe South.</p> <p>The proportion of households who answered that the services are difficult to access is 27% in the AGRITEX service, 38% in financial service, and 35% in veterinary service. Among the three districts, the services are difficult to access in the districts where the respective services are weakly provided as evaluated in the above.</p>
<p>11. Role of Male and Female</p> <p>In the household member survey, male and female household members over 16 years of age were asked the frequency of their participation in eight major categories of activities. These eight categories include (i) home activities, (ii) farming activities, (iii) raising of livestock, (iv) keeping of poultry and other small animals, (v) forestry and bush activities, (vi) communication, and (vii) religious/cultural activities. In all, these eight categories subsume 48 items of activities.</p> <p>Home activities include fetching drinking water, cooking, washing, sweeping the house, house repair, child/elderly care, kitchen gardening and shopping in the market. The survey result shows that women play a more dominant role in fetching drinking water, cooking, washing, sweeping the house, and sewing and knitting. In contrast, the percentage of men who "usually participate" in house repair is greater than that of women. Both men and women are usually engaged in kitchen gardening, shopping in the market and child/elderly care.</p> <p>In the farming activities, the proportion of men "usually engaged" is generally higher than that of women in many activities. However, women are also engaged in these activities with considerably high engagement rates except for plowing, repairing of farm and protecting against wild animals. It is clear that women are also playing an important role in many farming activities in addition to home activities most of which are undertaken by women. Because of the survey results showing considerably high engagement rate of men in selling crops and shopping in the market, it is considered that men tend to manage the household economy in the Study Area.</p> <p>In livestock raising, the proportion of men "usually engaged" is higher than that of women in all activities. Men and women who "usually engage" in selling dairy products are very small in percentages (6% in men and 4% in women). Thus it is considered that there are limited number of households selling dairy products such as milk in the study area.</p> <p>In contrast to the raising of large livestock, women dominate in the raising of poultry and other small animals. The main activities included in forestry/bush activities are collecting fuel wood, timber harvest and selling fuel wood. Both men (59%) and women (58%) play a near equivalent part in collecting fuel wood. However, more men (50%) than women (12%) are engaged in timber harvesting. Engagement rates in selling fuel wood are very small both in men and women showing that most of households in the Study Area consume their own harvested fuel wood.</p> <p>Men's involvement is higher than women's in all communication activities. However, women also "usually participate" to a certain extent in these activities, e.g. 50% in getting information from radio (households having TV are negligible small) and 37% in attending community meetings. The participation rates are low both in men and women in political discussion with others and getting information from newspapers.</p> <p>In religious and cultural activities, women's participation is higher in worship ceremony and festival preparation. While men dominantly engage in other activities such as sport events and games.</p>

Table 3.1.9 Summary Results of Household and Household Members Surveys (3/3)

<p>12. Activities that People Want to Make Easy</p> <p>In the household member survey, adult members (over 16 years old) were asked which activity they want to lighten their workload among their daily activities.</p> <p>For men, major activities they want to lighten the workload are all farming related activities such as plowing and weeding except for collecting of fuel wood. These are also similar in women except for fetching drinking water, because this is largely done by women. It is clear that most of men and women want to make easy their farming activities which consume more labor and time than other activities. Further, both men and women want to make easy the fetching of water.</p>
<p>13. People's Present Concerns</p> <p>The overall results on the degrees of people's concerns in connection with various economic, political and cultural issues show that the people strongly concerned about "cash income", "irrigation", "food availability" and "crop productivity". The scores of all these items are ranked from 1st to 4th both for men and women. The next higher scores are shown in the items of "motorable roads", "electricity", "health", "communication facility", and "drinking water". The items having large differences between men and women are "health" and "sanitation". In these items, women's scores are higher than men's.</p>
<p>14. People's Participation to Collective Action</p> <p><i>a. People's Experience in Collective Action</i></p> <p>The people's collective action taken in the past on the above mentioned items was also asked to the household members. As a result, more than 60% of men and women have equally taken actions in the past on their concerns of "food availability", "cash income" and "crop productivity". And more than 50% of men and women have also equally taken actions with "sanitation", "drinking water availability", "labor force availability", "religious beliefs" and "meeting on community development". In "land slide/soil erosion", 57% of men and 46% of women have taken actions. In other items of concerns, such percentages are all less</p> <p><i>b. Willing to Take Actions/Participate</i></p> <p>The household members were asked whether they were willing to take actions/participate in improvement/development of the above items. As a result, more than 90% of men and women are equally willing to take actions with regards to improving their "cash income". More than 80% of both genders were also willing to take action in "food availability" and "crop productivity". More than 70% of both genders were also interested in "irrigation", "land slide/soil erosion", "electricity supply", "sanitation", "health", "fuel wood availability", "drinking water availability" and "communication facility". There are small differences between men and women in their willingness for improvement/ development of their rural economy and social infrastructure.</p>
<p>15. Preference for Irrigated Land</p> <p>In the household member survey, a question was asked on whether they would like to have land within the irrigation command area. Their answers are summarized in the table below, 79% of men, 74% of women and 77% of both genders showed a willingness to have irrigated land.</p> <p>The household members whose answers were "yes" in the above question were further asked about their preference in crops that they want to cultivate in the irrigated land. As a result, 49% of people indicated maize and 32% cotton for summer crops, and 36% of them prefer vegetables, 18% wheat, 17% beans, and 13% maize for winter crops.</p> <p>To the household members who liked to have irrigation land, further question was asked whether they would still like land even if they have to pay for water charges. The results of this question reveal that about 94% maintained that they would still like land even if they were to pay for water charges. Only 4% would not like land if water charges are levied.</p> <p>In the same manner, a further question whether they would still like irrigation land even when they may have to organize a water user group for routine operation and maintenance of irrigation system. To this question, 91% of all the respondents who would like irrigation land said that they would like to participate in a water user group if group work for operation and maintenance does not disturb the farming activities. About 6% did not like to have irrigation land if they have to do group work for the operation and maintenance.</p> <p>The other question whether they still would like land even if this entails resettlement in a location nearby the irrigation area. The results clarify that only about 19% maintained that they would like irrigation land even if they have to pay for the cost of resettlement. About 55% of the respondents are willing to resettle provided the government assists them to cover the costs of resettlement. A further 20% said that they would rather not have land in the irrigation area if this entails resettlement. About 6% could not answer at the time of interview. The answers of this question are different between men and women. The percentage of respondents who answered that they would rather not have irrigation land are larger in women (22%) than men (17%).</p> <p>The reasons why some people (about 23% of household members) do not want to have irrigation land were also asked in the survey. The major reasons given by the respondents are labor shortage in irrigated farming (22%), too old (19%), and sufficient income with present farming (12%). Other reasons given for not wanting irrigation land include lack of interest in irrigation (7%), ill health (3%), exacting labor demands of irrigation (3%), etc.</p>

Table 3.1.10 Livestock Population in the Study Area ^{1/}

District	Ward No.	Type of Settlement	Area (ha)	Grazing Land		Livestock Population (No.)				LU 3/	Stocking Rate (ha/LU)	No. of Household	LUs per Household	Grazing Area per Household (ha)
				2/	3/	Cattle	Goat	Donkey	Sheep					
Kadoma	K 17	R	92,637	86,000	8,379	3,880	536	303	5,767	14.9	1,437	4.0	59.8	
	K 20	C	6,557	3,148	1,847	3,844	102	46	1,558	2.0	1,525	1.0	2.1	
	K 21	C	6,173	2,963	2,262	2,783	52	158	1,683	1.8	791	2.1	3.7	
	K 22	C	8,589	4,123	2,370	1,310	16	25	1,565	2.6	798	2.0	5.2	
	K 23	C	10,123	4,859	3,226	2,472	60	102	2,229	2.2	1,868	1.2	2.6	
	K 24	C	13,458	6,460	2,630	2,557	99	94	1,903	3.4	1,368	1.4	4.7	
	Sub-total 4/		137,537	107,553	20,714	16,846	865	728	14,705	7.3	7,787	1.9	13.8	
	Sub-total 5/		44,900	21,553	12,335	12,966	329	425	8,938	2.4	6,350	1.4	3.4	
Gokwe North	GN 11	C	13,452	8,871	3,589	1,350	130	80	2,374	3.7	2,117	1.1	4.2	
	GN 12	C	16,186	9,200	3,381	6,015	132	330	2,742	3.4	1,528	1.8	6.0	
	Sub-total		29,638	18,071	6,970	7,365	262	410	5,116	3.5	3,645	1.4	5.0	
Gokwe South	GS 23	C	51,694	29,052	6,982	3,636	210	202	4,699	6.2	2,336	2.0	12.4	
	GS 24	C	21,266	11,951	6,439	1,194	142	138	4,082	2.9	1,949	2.1	6.1	
	Sub-total		72,960	41,003	13,421	4,830	352	340	8,781	4.7	4,285	2.0	9.6	
	Total 6/		240,135	166,627	41,105	29,041	1,479	1,478	28,602	5.8	15,717	1.8	10.6	
	Total 7/		147,498	80,627	32,726	25,161	943	1,175	22,835	3.5	14,280	1.6	5.6	

Source: AGRITEX

1/: Livestock population in the 10 project related wards

4/: Livestock population in the 6 project related wards in Kadoma district

5/: Livestock population in the 5 project related communal wards in Kadoma district, excluding a resettlement area ward of K 17

6/: Total livestock population in the 10 project related wards

7/: Total livestock population in the 9 project related communal wards in the Study Area, excluding a resettlement area ward of K 17

2/: LUs = Livestock Units

3/: R = resettlement area; C = communal area

Table 3.1.11 List of Major Research Institutes and Stations in Zimbabwe

Name of Station/ Institute	Major Objective Crops/ Activities	Location	Responsible Organization	Natural Region	Remarks
Public Sector					
Research on Crops					
1. Horticultural Research Center (HRC)	Horticultural crops	Marondera, Mashonaland East Province	DR&SS, MOLA	IIa	Under No.1
2. Nyanga Experimental Station	Potatoes and fruit trees	Nyanga, Manicaland Province	DR&SS, MOLA	I	Under No.1
3. Chipinge Research Station	Coffee and tea	Chipinge, Manicaland Province	DR&SS, MOLA	I	
4. Cotton Research Institute (CRI)	Cotton	Kadoma, Mashonaland West Province	DR&SS, MOLA	III	
5. Crop Breeding Institute (CBI)	Breeding of food crops	Harare	DR&SS, MOLA	IIa	
6. Agronomy Research Institute	Food crops	Harare	DR&SS, MOLA	IIc	
7. Plant Protection Research Institute	Plant health & quarantine	Harare	DR&SS, MOLA	IIc	
8. Chiredzi Research Station	Agronomy in NR IV and V	Chiredzi, Masvingo Province	DR&SS, MOLA	V	Under No. 6
9. Kutsaga Research Station	Flue cured tobacco	Harare	Tobacco Research Board	IIa	Parastatal
10. Banket Research Station (out station of No. 9)	Burley tobacco	Banket, Mashonaland West Province	Tobacco Research Board	IIa	Parastatal
11. Hatcliffe	Irrigation, soil conservation, etc.	Harare	AGRITEX, MOLA		
Research on Livestock					
1. Makoholi Research Station	(Suitable animals	Mashvingo, Masvingo Province	DR&SS, MOLA	IV	
2. Grasslands Research Station	Beef production	Marondera, Mahonaland East Province	DR&SS, MOLA	IIa	
3. Henderson Research Station	Poultry feeds	Mazowe, Mashonaland Central Pro.	DR&SS, MOLA	IIa	
4. Matopos Research Station	Milk production	Matopos, Matabeleland South Province	DR&SS, MOLA	IV	
5. Pig Industry Bord	Pig	Aecturus, Mahonaland East Province	Pig Industry Bord	IIa	Parastatal
Private Sector and Others					
Research on Crops					
1. Chiredzi Sugar Research Station	Sugar cane	Chiredzi, Masvingo Province	Cane Growers Association	V	
2. Export Agents (e.g. Hortico and Can Pak)	Suitability test of export crops	Several locations, e.g. Harare, Chegutu			
3. Seed Suppliers (e.g. Seed Coop)	Demonstration of crops	Several locations, including Kadoma			
4. Agro Chemical Companies (e.g. ZFC)	Farm trials on chemicals	Several locations, e.g. Harare, Kwekwe			
5. Research Stations under ART	Food crops (only trials)	Harare	Agri. Research Trust		CFU
6. University of Zimbabwe	Food crops, soils, economy, etc.	Harare		IIa	
Research on Livestock					
1. Irvines	Poultry	Harare		IIa	
2. Henderson Research Station	Poultry feeds	Mazowe, Mashonaland Central Pro.		IIa	
4. University of Zimbabwe	Small stock feeds	Harare		IIa	

Source: Zimbabwe's Smallholder Agricultural Sector Development Strategy and Action Plan, 1997 - 2020
and Zimbabwe's Agricultural Policy Framework, 1995 - 2020

Table 3.1.12 Number of Extension Staff and Available Transportation Means in the Districts Related to the Study Area

Staff	Grade	(Unit)	Kadoma	Gokwe North	Gokwe South	Total or Average	Kwekwe
Extension Staff							
DAEO	University graduate	(person)	1	0	1	2	1
	Diploma holder	(person)	0	0	0	0	0
	Certificate holder	(person)	0	0	0	0	0
	Sub-total	(person)	1	0	1	2	1
AEO 1/	University graduate	(person)	0	0	0	0	0
	Diploma holder	(person)	5	3	2	10	4
	Certificate holder	(person)	0	0	0	0	0
	Sub-total	(person)	5	3	2	10	4
AES 1/	University graduate	(person)	0	0	0	0	0
	Diploma holder	(person)	0	0	0	0	0
	Certificate holder	(person)	4	3	8	15	2
	Sub-total	(person)	4	3	8	15	2
AEW 1/	University graduate	(person)	0	0	0	0	0
	Diploma holder	(person)	0	0	1	1	0
	Certificate holder	(person)	32	36	45	113	25
	Sub-total	(person)	32	36	46	114	25
No. of FAEOs (AEO+AES+AEW)		(person)	41	42	56	139	31
No. of Farm Household per FAEO		(person)	673	805	925	814	891
No. of Farm Household in 1998		(No.)	27,589	33,821	51,784	113,194	27,636
Vehicles/bicycles							
Car		(No.)	2	2	2	6	3
Motorcycle		(No.)	24	31	39	94	13
Bicycle		(No.)	12	8	15	35	17
Total		(No.)	38	41	56	135	33

Source: Respective District Office of AGRITEX; as of January 1999

1/: Former position titles of extension staffs (FAEOs)

Table 3.2.1 Case Study on Kudu Dam Scale and Irrigation Development Area

項 目	Case					
	1	2	3	4	5	6
(1) Scale of Kudu Dam						
a) Dam Height (m)	72.7	72.7	62.7	62.7	59.7	53.7
b) Storage Capacity (MCM)	1,551.4	1,551.4	972.6	972.6	828.6	580.6
c) Embankment Volume (m3)	9,557,000	9,557,000	6,068,000	6,068,000	5,237,000	3,842,000
(2) Irrigation Area						
a) Communal & Resettlement Area						
Gravity Irrigation Area(ha)	8,992	8,992	8,992	8,992	8,992	8,992
Pump Irrigation Area(ha)	5,508	9,215	288	7,008	4,238	0
b) Small Scale Commercial Farm(ha)	6,000	0	3,840	0	0	0
c) Large Scale Commercial Farm(ha)	4,500	6,793	2,880	0	0	0
Total(ha)	25,000	25,000	16,000	16,000	13,230	8,992
(3) Construction Cost						
a) Financial Cost(1,000Z\$)						
i) Kudu Dam	2,881,800	2,881,800	2,084,030	2,084,030	1,973,880	1,598,702
ii) Main Irrigation Canal	2,126,065	1,879,363	1,910,136	1,792,020	1,709,043	1,613,547
iii) Communal & Resettlement Area	1,102,799	1,486,474	644,294	1,258,049	971,354	620,448
iv) Small Scale Commercial Farm	483,000	0	309,120	0	0	0
v) Large Scale Commercial Farm	517,500	781,195	331,200	0	0	0
Total	7,111,164	7,028,832	5,278,780	5,134,099	4,654,277	3,832,697
(Z\$/ha)	284,447	281,153	329,924	320,881	351,797	426,234
(US\$/ha)	7,968	7,875	9,242	8,988	9,854	11,939
b) Economic Cost(1,000Z\$)	5,688,931	5,623,066	4,223,024	4,107,279	3,723,422	3,066,158
(Z\$/ha)	227,557	224,923	263,939	256,705	281,438	340,987
(US\$/ha)	6,374	6,300	7,393	7,191	7,883	9,551
(4) Benefit						
a) Financial Benefit(1,000Z\$)	678,800	678,800	434,432	434,432	359,221	244,148
(Z\$/ha)	27,152	27,152	27,152	27,152	27,152	27,152
(US\$/ha)	761	761	761	761	761	761
b) Economic Benefit(1,000Z\$)	867,210	867,210	555,014	555,014	458,927	311,918
(Z\$/ha)	34,688	34,688	34,688	34,688	34,688	34,688
(US\$/ha)	972	972	972	972	972	972
(5) IRR(%)	10.2	10.3	8.8	9.1	8.3	6.7
B/C(Discount Rate = 10%)	1.02	1.03	0.88	0.91	0.82	0.68

Table 3.2.2 Monthly Labor Requirements of Crops

Crops	Practices	(man-day/ha)												Total
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Family labor balancing														
Maize	Plowing/harrowing										0.4	0.4		0.8
	Seeding										2.2	2.2		4.4
	Top dressing,1	1											1	2.0
	Weeding	5.7	5.6	5.6								5.6		22.5
	Spraying	2	1.9											3.9
	Irrigation	2	2	2							2	2	2	12.0
	Harvesting			5	5									10.0
	Threshing					7.5	7.5							15.0
	Sub-total	10.7	9.5	12.6	5.0	7.5	7.5	0.0	0.0	0.0	4.6	10.2	3.0	70.6
Cotton	Plowing/harrowing									0.4	0.4			0.8
	Seeding									1.5	1.5			3.0
	Basal dressing									1.5	1.5			3.0
	Top dressing,1											1.5		1.5
	Weeding	6	6	6	6								6	30.0
	Spraying	2	2	2	2	1.6					2	2	2	15.6
	Irrigation	2	2	2	2	2					2	2	2	16.0
	Sub-total	8.0	8.0	8.0	8.0	1.6	0.0	0.0	0.0	0.0	5.4	5.4	9.5	53.9
	Groundnuts	Plowing/harrowing									0.7			
Seeding										7.2				7.2
Basal dressing										0.41				0.41
Weeding		5	4.5									5	5	19.5
Irrigation		2	2							2	2	2		10.0
Spraying		2.9	3									2.9	2.9	11.7
Harvesting				3	3									6.0
Shelling						15	14							29.0
Sub-total		9.9	9.5	3.0	3.0	15.0	14.0	0.0	0.0	0.0	10.3	9.9	9.9	84.51
Wheat	Plowing/harrowing									0.8				0.8
	Seeding					0.5								0.5
	Basal dressing					1								1.0
	1st top dressing						0.5							0.5
	Weeding						15	15	15					45.0
	Irrigation					2	2	2	2					8.0
	Spraying						3.9	3.9						7.8
	Harvesting										10			10.0
	Drying										10			10.0
Threshing											12		12.0	
Sub-total	0.0	0.0	0.0	0.0	4.3	21.4	20.9	17.0	20.0	12.0	0.0	0.0	95.6	
Tomato	Plowing	0.20	0.17											0.37
	Harrowing	0.15	0.15										0.3	0.6
	Transplanting												15.8	15.8
	Basal dressing												3.7	3.7
	1st top dressing	10.9												10.9
	Weeding	8	8	8	1.3									25.3
	Spraying	7.8	7.8	7.8										23.4
	Irrigation	3	3	3	2									11.0
	Harvesting			67.5	67.5									135.0
Sub-total	30.1	19.1	86.3	70.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.8	226.07	
Cabbage	Plowing			0.1	0.1	0.1								0.3
	Harrowing			0.1	0.1	0.1								0.3
	Seeding		1	1	0.8									2.8
	Transplanting			23.2	23.2	23.2								69.6
	Basal dressing			0.4	0.4	0.3								1.1
	1st top dressing				3	3	2.9							8.9
	Weeding			5	5	5	5	4.6						24.6
	Irrigation		3	3	3	3	3	2						17.0
	Spraying			5.9	5.9	5.9	5.7							23.4
Harvesting					14	14	14.6						42.6	
Sub-total	0.0	4.0	38.7	41.5	54.6	30.6	21.2	0.0	0.0	0.0	0.0	0.0	190.6	
Paprika	Plowing/harrowing										0.8			0.8
	Seeding										4.5			4.5
	Basal dressing										2			2.0
	1st top dressing											2.0		2.0
	2nd top dressing		2									2.0		4.0
	Weeding	5.6	5.6	5.7								5.6		22.5
	Irrigation	3	3	2								3	3	14.0
	Spraying		3.9										3.9	7.8
	Harvesting			15	15									30.0
Sub-total	8.6	14.5	22.7	15.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	16.5	87.6	
Dry beans	Plowing/harrowing											0.8		0.8
	Seeding											4.5		4.5
	Basal dressing											2		2.0
	1st top dressing												2.0	2.0
	Weeding	7	8.5										7	22.5
	Spraying	3.9	3.9									3.9	3.9	15.6
	Irrigation	2	2									2	2	8.0
	Harvesting			10	12									22.0
	Sub-total	12.9	14.4	10.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2	14.9	77.4
Baby corn	Plowing/harrowing									0.4	0.4			0.8
	Seeding									2.2	2.2			4.4
	Top dressing	1											1	2.0
	Weeding	5.7	5.6	5.6								5.6		22.5
	Spraying	2	1.9											3.9
	Irrigation	2	2	2							2	2	2	12.0
	Harvesting			5	5									10.0
	Threshing					7.5	7.5							15.0
	Sub-total	10.7	9.5	12.6	5.0	7.5	7.5	0.0	0.0	0.0	4.6	10.2	3.0	70.6

Table 3.2.3 Financial Crop Budget Without Project Condition (1/3 : Maize)

(unit:kg,man-day, Z\$)

Particulars	Materials			Labor			Animal/Machine			Total Value	Remarks
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value		
1. Production Cost											
1) Land preparation											
-Plowing				0.8	38.5	30.8	1.6	546	874	904.4	
2) Nursery preparation											
3) Seeding											
-Seed preparation											
-Seeding	25	28.50	713	4.48	38.5	172				885	
4) Transplanting, if any											
5) Fertilizing											
-Basal Compound D	40	7.90	316							316	
-Top/side dressing											
1st Ammonium Nitrat	40	8.30	332	1.5	38.50	57.8				389.8	
6) Earthing											
7) Weeding				22.5	38.50	866	0.3	833	250	1116	
8) Spraying of agrochemical											
-Thiodan	1.6	402	643	1.56	38.50	60.1				703.3	
9) Irrigating											
10) Harvesting											
-Harvesting				1.6	38.50	61.6				61.6	
-Drying											
-Threshing				2.4	38.50	92.4				92.4	
-Hauling											
11) Miscellaneous Bags(piece)	16	7.80	125							124.8	
Bag transport	16	####	176							176	
2. Others											
3) Administration costs											
Total			2305			1341			1124	4769	
3. Gross Income				Unit yield (ton/ha)			Unit Price			Gross Income	
				0.80			Z\$ 6400 /ton			Z\$ 5120 /ha	
4. Net Income											
Z\$			351	/ha							

Table 3.2.3 Financial Crop Budget Without Project Condition (2/3 : Cotton)

(unit: kg, man-day,Z\$)

Particulars	Materials			Labor			Animal/Machine			Total	
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value	Value	Remarks
1. Production Cost											
1) Land preparation											
-Plowing				0.4	38.5	15.4	1.6	546.0	873.6	889.0	
2) Nursery preparation											
3) Seeding											
-Seed preparation											
-Seeding	25.0	16.70	417.5	6.0	38.5	231.0				648.5	
4) Transplanting, if any											
5) Fertilizing											
-Basal Compound L	60.0	13.10	786.0			0.0				786.0	labor incl.
-Top/side dressing											
1st Ammonium Nitrate	30.0	8.30	249.0	1.0	38.5	38.5				287.5	
6) Earthing											
7) Weeding			0.0	30.0	38.50	1155	0.45	833.0	374.9	1529.9	
8) Spraying of agrochemical											
-Marshal(litre)	0.3	552	165.5	4.7	38.50	181.0				346.4	
-Carbryl	1.2	375	450.0	4.7	38.50	181.0				631.0	
-Synthetic Pyretheroid(litre)	0.6	619	371.3	4.7	38.50	181.0				552.2	
9) Irrigating											
10) Harvesting											
-Harvesting (z\$/kg)			0.0	600	0.45	270.0				270.0	
-Hauling											
11) Miscellaneous											
bags,bale	3.6	60.00	216.0							216.0	
transport/bale	3.6	160.0	576.0							576.0	
2. Others											
3) Administration costs											
Total			3231			2253			1248	6732	
3. Gross Income				Unit yield (kg/ha)			Unit Price			Gross Income	
				600			Z\$ 14.9 /kg			Z\$ 8940	
4. Net Income	Z\$	2208 /ha									

Table 3.2.4 Financial Crop Budget With Project Condition (1/9 : Maize)

(unit:kg,man-day, Z\$)

Particulars	Materials			Labor			Animal/Machine			Total Value	Remarks
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value		
1. Production Cost											
1) Land preparation											
-Plowing				0.8	38.5	31	1.6	546	874	905	
2) Nursery preparation											
3) Seeding											
-Seed preparation											
-Seeding	25	28.5	712.5	4.4	38.5	169				882	
4) Transplanting, if any											
5) Fertilizing											
-Basal Compound D	450	7.9	3555							3555	
-Top/side dressing											
1st Ammonium Nitrat	500	8.3	4150	2.0	38.5	77				4227	
6) Earthing											
7) Weeding				22.5	38.5	866	0.3	833	250	1116	
8) Spraying of agrochemical											
-Thiodan	4	402	1608	3.9	38.5	150				1758	
-(specify)											
-(specify)											
9) Water Charge/Irrigating	4	310	1240	12.0	38.5	462				1702	
10) Harvesting											
-Harvesting				10.0	38.5	385				385	
-Drying											
-Threshing				15.0	38.5	578				578	
-Hauling											
11) Miscellaneous Bags(piece)	100	7.8	780							780	
Bag transport	14	11.0	154							154	
2. Others											
3) Administration costs											
Total			12200			####			1124	16042	
3. Gross Income				Unit yield (ton/ha)			Unit Price			Gross Income	
				6.0			Z\$ 6.4 /kg			Z\$ 38400	
4. Net Income											
	Z\$		22358	/ha							

Table 3.2.4 Financial Crop Budget With Project Condition (2/9 : Cotton)

(unit: kg, man-day,Z\$)

Particulars	Materials			Labor			Animal/Machine			Total Value	Remarks
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value		
1. Production Cost											
1) Land preparation											
-Plowing				0.8	38.5	31	1.6	546	874	905	Ox drawn
2) Nursery preparation											
3) Seeding											
-Seeding	25.0	16.7	418	3.0	38.5	115				533	
4) Transplanting, if any											
5) Fertilizing											
-Basal	Compound L	250.0	13.1	3275	3.0	38.5	115				3390
-Top/side dressing											
1st	Ammonium Nitrate	100.0	8.3	830	1.5	38.5	58				888
6) Earthing											
7) Weeding											
				30.0	38.5	1155	0.45	833	375	1530	
8) Spraying of agrochemical											
-Marshal(litre)		0.5	552.0	276	7.8	38.5	300				576
-Carbryl		2.0	375.0	750	3.9	38.5	150				900
-Synthetic Pyretheroid(litre)		1.0	619.0	619	3.9	38.5	150				769
9) Water Charge/Irrigating											
		4.0	310.0	1240	16.0	38.50	616				1856
10) Harvesting											
-Harvesting	(z\$/kg)				2500	0.45	1125				1125
11) Miscellaneous											
	bags,bale	9.0	30.0	270							270
	transport/bale	14.0	160.0	2240							2240
2. Others											
3) Administration costs											
Total			9918		3815			1249		14982	
3. Gross Income											
			Unit yield (ton/ha)			Unit Price			Gross Income		
			2.5			Z\$ 14.9 /kg			Z\$ 37250		
4. Net Income											
Z\$		22268 /ha									

Table 3.2.4 Financial Crop Budget With Project Condition (3/9 : Groundnuts)

(unit: kg, man-day,Z\$)

Particulars	Materials			Labor			Animal/Machine			Total Value	Remarks
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value		
1. Production Cost											
1) Land preparation											
-Plowing				0.4	38.5	15	1.6	546	874	889	
-Harrowing				0.3	38.5	11				11	
-Seeding kg	100.0	35.0	3500	7.2	38.5	277				3777	
4) Transplanting, if any											
5) Fertilizing											
-Basal S.S.P	300.0	11.7	3510							3510	labor catered
-Top/side dressing											
1st Gypsum	100.0	2.1	210	0.41	38.5	16				226	
6) Earthing											
7) Weeding				19.5	38.5	751	1.70	833	1416	2167	
8) Spraying of agrochemical											
-Innoculant bottle	2.0	10.0	20	3.9	38.5	150				170	
-Dimethoate litre	0.9	225.0	202	3.9	38.5	150				352	
-Thiram, 80WP bag	0.1	105.0	10	3.9	38.5	150				160	
9) Water Charge/Irrigating	4.0	310.0	1240	10.0	38.5	385				1625	
10) Harvesting											
-Harvesting (z\$/kg)				6.0	38.5	231				231	
-Drying											
-Shelling				29.0	38.5	1117				1117	
-Hauling											
11) Miscellaneous packing, bag	50.0	7.8	390							390	
transport	14.0	11.0	154							154	
2. Others											
3) Administration costs											
Total			9236			3253			2290	14779	
3. Gross Income				Unit yield (ton/ha)		Unit Price				Gross Income	
				2.5		Z\$ 10.0 /kg				Z\$ 25000	
4. Net Income											
	Z\$		10221	/ha							

Table 3.2.4 Financial Crop Budget With Project Condition (4/9 : Wheat)

(unit: kg, man-day,Z\$)

Particulars	Materials			Labor			Animal/Machine			Total Value	Remarks
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value		
1. Production Cost											
1) Land preparation											
-Plowing				0.8	38.5	31	1.6	546	874	905	
2) Nursery preparation											
3) Seeding											
-Seed preparation											
-Seeding	130.0	18.0	2340	0.5	38.5	19				2359	
4) Transplanting, if any											
-Transplanting											
5) Fertilizing											
-Basal Compound D	550.0	7.9	4345	1.0	38.5	39				4384	
-Top/side dressing											
1st Ammonium nitrate	400.0	8.3	3320	0.5	38.5	19				3339	
Muriate of Potash	100.0	11.6	1160							1160	
6) Earthing											
7) Weeding				45.0	38.5	1733				1733	
8) Spraying of agrochemical											
-Demeton-S-Methyl 25EC	0.4	163.8	66	3.9	38.5	150				216	
-Aldrin	2.0	354.0	708	3.9	38.5	150				858	
9) Water Charge/Irrigating	4.0	310.0	1240	8.0	38.5	308				1548	
10) Harvesting											
-Harvesting (z\$/kg)				10.0	38.5	385				385	
-Threshing				12.0	38.5	462				462	
-Drying				10.0	38.5	385				385	
11) Miscellaneous											
packing, bag	42.0	7.8	328							328	
transport	1180	0.18	212							212	
2. Others											
3) Administration costs											
Total			13719			3681			874	18274	
3. Gross Income			Unit yield (ton/ha)			Unit Price			Gross Income		
			4.2			Z\$ 7.6 /kg			Z\$ 31920		
4. Net Income	Z\$	13646 /ha									

Table 3.2.4 Financial Crop Budget With Project Condition (5/9 : Tomato)

(unit: kg, man-day,Z\$)

Particulars	Materials			Labor			Animal/Machine			Total Value	Remarks
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value		
1. Production Cost											
1) Land preparation											
-Plowing				0.37	38.5	14	26.0	22.0	572	586	
-Harrowing				0.3	38.5	12	9.5	22.0	209	221	
2) Nursery preparation											
3) Seeding											
-Seed preparation											
-Seeding	0.15	5530	829							829	
4) Transplanting, if any											
-Transplanting				15.8	38.5	608	12.3	10.0	123	731	
5) Fertilizing											
-Basal Compound S	800.0	12.8	10240	3.70	38.5	142	0.5	10.0	5	10387	
Pottasium sulphate	1000	17.7	17700							17700	
Lime	1000	2.1	2100							2100	
-Top/side dressing											
1st Ammonium nitrate	100.0	8.3	830	10.9	38.5	420	1.65	10.0	16	1266	
K2O											
6) Earthing											
7) Weeding				25.3	38.5	974				974	
8) Spraying of agrochemical											
-Mancozeb 80 WP	15.0	367.0	5505	7.8	38.5	300				5805	
-Makathion 25WP	2.0	477.0	954	7.8	38.5	300				1254	
-Carbaryl	0.8	375.0	300	7.8	38.5	300				600	
9) Water Charge/Irrigating	6.0	310.0	1860	11.0	38.5	424	4.4	10.0	44	2328	
10) Harvesting											
-Harvesting (z\$/kg)				135	38.5	5198				5198	
-Threshing											
-Drying											
11) Miscellaneous											
packing, bag	42.0	11.0	462							462	
transport	75000	0.37	27750							27750	
2. Others											
3) Administration costs											
Total			68530			8692			969	78191	
3. Gross Income				Unit yield (ton/ha)			Unit Price			Gross Income	
				75.0			Z\$ 3.8 /kg			Z\$ 285000	
4. Net Income	Z\$	206809 /ha									

Table 3.2.4 Financial Crop Budget With Project Condition (6/9 : Cabbage)

(unit: kg, man-day,Z\$)

Particulars	Materials			Labor			Animal/Machine			Total Value	Remarks
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value		
1. Production Cost											
1) Land preparation											
-Plowing				0.3	38.5	12	28.6	22.0	629	641	
-Harrowing				0.3	38.5	12	10.5	22.0	231	243	
2) Nursery preparation											
3) Seeding											
-Seed preparation											
-Seeding	0.45	1500	675	2.8	38.5	108				783	
4) Transplanting, if any											
-Transplanting				69.6	38.5	2680				2680	
5) Fertilizing											
-Basal Compound S	1000	12.80	12800	1.1	38.5	42	9.9	10.0	99	12941	
-Top/side dressing											
1st Ammonium nitrate	200.0	8.30	1660	8.9	38.5	343	1.65	10.0	16	2019	
6) Earthing											
7) Weeding				24.6	38.5	947				947	
8) Spraying of agrochemical											
-Mancozeb 80 WP	0.85	367	312	7.8	38.5	300				612	
-Dimethoate	2.5	225	562	7.8	38.5	300				862	
-Cosan WP	4.5	140	630	7.8	38.5	300				930	
9) Water Charge/Irrigating	10.0	310	3100	17.0	38.5	655				3755	
10) Harvesting											
-Harvesting (z\$/kg)				42.6	38.5	1640				1640	
11) Miscellaneous											
transport	50	600	30000							30000	
2. Others											
3) Administration costs											
Total			49739			7339			975	58053	
3. Gross Income											
				Unit yield (ton/ha)		Unit Price		Gross Income			
				50.0		Z\$ 3.0 /kg		Z\$ 150000			
4. Net Income	Z\$	91947 /ha									

Table 3.2.4 Financial Crop Budget With Project Condition (7/9 : Drybeans)

(unit: kg, man-day,Z\$)

Particulars	Materials			Labor			Animal/Machine			Total Value	Remarks
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value		
1. Production Cost											
1) Land preparation											
-Plowing				0.8	38.5	31	1.6	546	874	905	
2) Nursery preparation											
3) Seeding											
-Seed preparation											
-Seeding	100	72.0	7200	4.5	38.5	173				7373	
4) Transplanting, if any											
5) Fertilizing											
-Basal Compound D	500	7.9	3950	2.0	38.5	77				4027	
-Top/side dressing											
1st Ammonium nitrate	100.0	8.3	830	2.0	38.5	77				907	
6) Earthing											
7) Weeding				22.5	38.5	866	0.3	833	250	1116	
8) Spraying of agrochemical											
-Carbyrl 85WP	1.00	375.0	375	3.9	38.5	150				525	
-Malathion 50 EC	1.25	108.0	135	3.9	38.5	150				285	
-Benomyl 50WP	1.5	138.6	208	3.9	38.5	150				358	
-Dicofol,25% WP	1.0	215.0	215	3.9	38.5	150				365	
9) Water Charge/Irrigating	4.0	310.0	1240	8.0	38.5	308				1548	
10) Harvesting											
-Harvesting (z\$/kg)				10.0	38.5	385				385	
-Threshing				10.0	38.5	385				385	
-Drying				2.0	38.5	77				77	
11) Miscellaneous transport to market	20	11.0	220							220	
bags	20	7.8	156							156	
2. Others											
3) Administration costs											
Total			14529			2979			1124	18632	
3. Gross Income				Unit yield (ton/ha)		Unit Price				Gross Income	
				2.0		Z\$ 20.0 /kg				Z\$ 40000	
4. Net Income	Z\$		21368			/ha					

Table 3.2.4 Financial Crop Budget With Project Condition (8/9 : Paprika)

(unit: kg, man-day,Z\$)

Particulars	Materials			Labor			Animal/Machine			Total Value	Remarks
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value		
1. Production Cost											
1) Land preparation											
-Plowing				0.8	38.5	31	1.6	546	874	905	
2) Nursery preparation											
3) Seeding											
-Seed preparation											
-Seeding	10.0	84.0	840	4.5	38.5	173				1013	
4) Transplanting, if any											
5) Fertilizing											
-Basal Compound D	750.0	7.9	5925	2.0	38.5	77				6002	
-Top/side dressing											
1st Ammonium nitrate	75.0	8.3	623	2.0	38.5	77				700	
2st Ammonium nitrate	75.0	8.3	623	4.0	38.5	154				777	
6) Earthing											
7) Weeding				22.5	38.5	866	0.3	833	250	1116	
8) Spraying of agrochemical											
-Carbyrl 85WP	30.0	375.0	11250	3.9	38.5	150				11400	
-Dithane M4S	48.0	260.0	12480	3.9	38.5	150				12630	
9) Water Charge/Irrigating	4.0	310.0	1240	14.0	38.5	539				1779	
10) Harvesting											
-Harvesting (z\$/kg)				30.0	38.5	1155				1155	
-Threshing											
-Drying											
11) Miscellaneous transport to market	3.0	250.0	750							750	
bags	30.0	7.8	234							234	
2. Others marketing costs, 13% of gross income										11700	
1) Interests											
2) Tax											
3) Administration costs											
Total			33965			3372			1124	50161	
3. Gross Income			Unit yield (ton/ha)			Unit Price			Gross Income		
			3.0			Z\$ 30.0 /kg			Z\$ 90000		
4. Net Income	Z\$	39839	/ha								

Table 3.2.4 Financial Crop Budget With Project Condition (9/9 : Babycorn)

Particulars	Materials			Labor			Animal/Machine			Total Value	Remarks
	Qty	Price	Value	Qty	Price	Value	Qty	Price	Value		
1. Production Cost											
1) Land preparation											
-Plowing				0.8	38.5	31	1.6	546	874	905	
2) Nursery preparation											
3) Seeding											
-Seed preparation											
-Seeding	40.0	151.0	6040	4.5	38.5	169				6209	
4) Transplanting, if any											
5) Fertilizing											
-Basal Compound D	600.0	7.9	4740							4740	
Manure											
-Top/side dressing											
1st Ammonium Nitrate	300.0	8.3	2490	2.0	38.5	77				2567	
Muriate of potash	50.0	11.6	580							580	
K2O											
6) Earthing											
7) Weeding				22.5	38.5	866	0.3	833	250	1116	
8) Spraying of agrochemical											
-Thiodan, 1%	14.0	402.0	5628	3.9	38.5	150				5778	
-Atrazin, litre	2.0	203.7	407	3.9	38.5	150				557	
-Lasso, litre	3.5	236.3	826	3.9	38.5	150				976	
9) Water Charge/Irrigating	3.2	310.0	992	12.0	38.5	462				1454	
10) Harvesting											
-Harvesting				10.0	38.5	385				385	
11) Miscellaneous											
Transport to market	1.0	250.0	250							250	
2. Others											
1) Marketing cost 10% of gross income										6000	
Total			21953			2440			1124	31517	
3. Gross Income											
			Unit yield (ton/ha)			Unit Price				Gross Income	
			1.0			Z\$ 60 /kg				Z\$ 60000	
4. Net Income											
	Z\$		28483	/ha							

Table 3.2.5 Rural Road Rehabilitation Plan

District	Type of Road (4 types)	Road length to be improved (km) and change of road type	Road length to be constructed (km)	No. of benefited household	No. of benefited population	Remarks
Kadoma	① Wide Tarred					
	② Narrow Tarred					
	③ Gravel or Earth		(156)			
	④ Track	97 km ④ to ③		9,260	57,003	
Gokwe North	① Wide Tarred					
	② Narrow Tarred					
	③ Gravel or Earth		(71)			
	④ Track	54 km ④ to ③		4,346	27,013	
Gokwe South	① Wide Tarred					
	② Narrow Tarred					
	③ Gravel or Earth		(69)			
	④ Track	98 km ④ to ③		6,846	42,198	
Kwekwe	① Wide Tarred					
	② Narrow Tarred					
	③ Gravel or Earth					
	④ Track	30 km ④ to ③		3,208	17,328	
Kadoma to Gokwe North						
Total		279 km	(***296)	23 660	143 542	
	Narrow Tarred					
	Gravel or earth					

Note : ***296 km shows the length of operation/maintenance roads to be constructed along the proposed main irrigation canals. Accordingly, this road will be excluded from the road improvement plan under the rural infrastructure improvement plan for the whole study area.

Table 3.2.6 Construction and Rehabilitation Plan of Boreholes

Ward Name	Farm Type	Nos. of Existing Boreholes ①	*Nos. of Boreholes to be Rehabilitated ① x 20 %	Population ②	Availability of Boreholes ③ = ②/①	**Recommended Nos. of Boreholes ④ = ②/250	Required Nos. of Boreholes ⑤ = ④ - ①	Remarks
Makore I (GN 11)	Communal	37	7	10,721	290	43	6	
Makore II (GN 12)	-do-	31	6	7,197	232	29	0	
Chisina I (GS 23)	-do-	36	7	17,251	479	69	33	
Chisina II (GS 24)	-do-	21	5	13,303	554	53	29	
Mabura (KW 6)	-do-	33	7	6,435	195	26	0	
Sidakeni (KW 7)	-do-	20	4	6,419	320	26	6	
Sanyati Communal (K20, K21, K22, K23 and K24)	-do-	156	31	45,804	293	183	27	
Sachuru (K28)	Resettlement	55	11	9,203	167	37	0	
Nyaurungwe, Gokwe District	-do-	(Not known)	-	4,819	-	19	-	
Muzveze I (K17)	-do-	59	12	8,829	150	35	0	
Total		(392)	(90)	(29,981)		520	(101)	

Note: 1) * Rehabilitation of boreholes: It mainly includes rehabilitation of hand pumps attached on the top of boreholes.

2) ** 250 persons per borehole proposed by NRWSSP (National Rural Water Supply and Sanitation Program).

3) Figures given in each column of the above Table were worked out using 1998 basis information.

4) Rehabilitation ratio of 20 % was used based on the field survey.

Table 3.2.7 Proposed Programs for Strengthening Agricultural Support Services under the Project (1/2)

Program	Program Descriptions	Location, Target Area / Group, Program Requirements, Program Components	Responsible Agency
1. Establishment of Irrigated Agriculture Extension Centers (IAECs)			
1-1. Establishment of IAEC, Seke	<ul style="list-style-type: none"> - Establishment of IAEC in the proposed irrigated area of the dam, the right bank of the Munyati River - To establish a nucleus place for irrigated agricultural extension - To establish an office/place to accommodate field extension officers and a place for farmer training & meeting 	<p>In the proposed irrigated area of the Seke dam</p> <p><i>Components</i> IAEC Building (300 m²): 1 unit (4 office rooms, 1 lecture room, 1 lecture/meeting, 2 stores) Generator & electricity supply: 1 set Water supply facility: 1 set Training equipment: 1 set Office facilities & equipment: 1 set</p>	LMRBA
1-2. Establishment of IAEC, Nyarupakwe	<ul style="list-style-type: none"> - Establishment of IAEC in the Nyarupakwe Pilot Project Area by expanding AEC established under the Pilot Project, the left bank of the Munyati River - To establish a nucleus place for irrigated agricultural extension - To establish an office/place to accommodate field extension officers and a place for farmer training & meeting 	<p>In the irrigated area of the Nyarupakwe Pilot Project</p> <p><i>Components</i> IAEC Building (150 m²): 1 unit (1 office room, 1 lecture/meeting room, 1 store) Generator & electricity supply: 1 set Water supply facility: 1 set Training equipment: 1 set Office facilities & equipment: 1 set</p>	LMRBA
2. Adaptive Trials			
	<ul style="list-style-type: none"> - Adaptive trials on variety, crops, cultivation method, irrigation methods, water management, range improvement etc. - To test field adaptability of technologies developed by research institutions & stations 	<p>1 trial site per 1,000 ha of irrigated area in communal & resettlement areas Trial for 3 seasons Range improvement (1 ha): 1 trial site per ward; trial for 3 years</p>	LMRBA/ DR&SS/ AGRITEX
3. Extension Programs			
3-1. Field Programs		Selected farmer fields	LMRBA/ AGRITEX
Small-scale Demonstrations	<ul style="list-style-type: none"> - Demonstration on: - New crops & variety - Recommended practices, fertilization etc. - Irrigation method & water management 		
Field crops: 1.0 ha			
Vegetables: 0.5 ha			
Large-scale Demonstrations (25 ha)	<ul style="list-style-type: none"> - Demonstration on water management at out-let committee block 		LMRBA/ AGRITEX

Table 3.2.7 Proposed Programs for Strengthening Agricultural Support Services under the Project (2/2)

Program	Program Descriptions	Location, Target Area / Group, Program Requirements, Program Components	Responsible Agency
3. Extension Programs - continued 3-2. Farmer Training Programs	<ul style="list-style-type: none"> - Farmer training course on special subjects on farming practice: Representative of WUAs water management, group dynamics & farmer organization, range management etc. (1 day/4 hours; 25 farmers/course) (3 days/12 hours; 25 farmers/course) 		LMRBA/ AGRITEX
3-3. Study Tour	<ul style="list-style-type: none"> - Study tour to advanced irrigation scheme & farming areas, marketing facilities etc. 	Representative of WUAs	LMRBA/ AGRITEX
4. WUA/IMC Formation Guidance	<ul style="list-style-type: none"> - Supporting formation of WUA & IMC through <ul style="list-style-type: none"> - Awareness program - WUA/IMC formation guidance - Workshops for formation of WUA/IMC - "Learning by Doing" under Project Office support - Study tour of representatives of the WUA - To support formation and establishment of WUA & IMC at tertiary block level 	Beneficiary groups of irrigation development (1 WUA/100ha) In total of 145 WUAs in communal & resettlement area <i>Components</i> Awareness program WUA/IMC formation guidance Workshop (1 day) Study tour	LMRBA/ AGRITEX
5. Farmer Organizations Formation Guidance	<ul style="list-style-type: none"> - Supporting strengthening/formation of farmers groups of the grazing area development pilot scheme 	Beneficiary groups of 10 project related target wards (10 beneficiary groups) <i>Components</i> Awareness program Farmer to farmer guidance Strengthening guidance (1 day) Formation guidance Workshop (1 day)	LMRBA/ AGRITEX

Source: Program costs estimated based on current costs for similar programs implemented by AGRITEX

Table 3.2.8 Resettlement Scenarios

Figure 3.2.8: Resettlement Scenarios	FSL dam res ht.	Number VIDCOs affected ¹	Number requiring resett ² (persons) ²	Negative impacts additional to resettlement requirements indicated in previous col (VIDCOs/HHs)	Positive impacts from potential employment ³
1. Full Buffer Zone extended natural and recreation area 2-3 km surrounding dam reservoir with limited access rights	950m	(8)	>3,500+ [+100]	Grazing/watering losses: Ny, Ba, Ko, Ku, Mu, Ka (dam access loss), G; Vil.16	Mu, Si1
	940m	(8)	>3,500+ [+50]	Grazing/watering losses: Ny, Ba, Ko, Ku, Mu, Ka, Gw; Vil.16	Mu, Si1
2. Resettlement Scenario 1 with natural area creation 3 evacuated VIDCOs (Ba, Ku, Ko) normal access rights, minimal requirement for <i>ad hoc</i> compensation	950m	3	3,100 [+100]	Arable and gr. losses: ?Mu <10 HHs	Ny, Ch, Mu, S1
	940m	3	3,100 [+50]	Arable and gr. losses: ?Mu ?5 HHs	Ny, Ch, Mu, Si1, Vil16
3. Resettlement Scenario 2 with minimal natural area creation 2 evacuated VIDCOs (Ba and Ku), normal access, additional <i>ad hoc</i> compensation	950m	2	2,250 [+100]	Arable and gr. losses: ?Mu ?<10 HHs Move/compensate: Ko ?10 HHs	Ko, Ny, Ch, Mu, S1, Vil.16
	940m	2	2,250 [+50]	Arable losses: ?Mu ?5 HHs Move/compensate: Ko ?no HHs	Ko, Ny, (Ch), Mu, (S1), Vil16
4. Restricted or Minimal Resettlement normal access and appropriate <i>ad hoc</i> compensation	950m	(2)	1,750 [+100]	(factored into resettlement requirement)	Ny, Ku Ch, Mu, Si1, Vil.16
	940m	(1)	750 [+50]	(factored into resettlement requirement)	Ny, (Ch), Mu, Si1, Vil16; Ny ⁵

¹ Affected VIDCOs are: Ba=Batanai, Ku=Kubatana, Ko=Kotonika, Ny=Nyikyavatemala, Mu=Muchakata, Ka=Kasawi, Gw=Gwanzura, Vil.16=Muzveze I (Ward 17).

² Ward population or in the case of "Restricted Resettlement" actual estimated numbers; figure below "[+(no.)]" is estimate for Ward 17, Kadoma.

³ Bold indicates more significant likely beneficiary VIDCO communities.

⁴ There will probably be an additional number from Muchakata.

⁵ Indicates land conceded by those resettled from Batanai.

Table 3.3.1 Project Works of Kudu Dam Irrigation Project

Work Item	Description	Work Item	Description
I. Water Resources Development (Construction of Kudu Dam)		III. Livestock Development	
(1) Main Dam		(1) Water Trough (unit)	72
(a) Dam Type	Zoned Fill Dam	(2) Fully Fenced Gazing Blocks (block)	10
(b) Dam Height (m)	72.7		
(c) Dam Crest Length (m)	860.0	IV. Rural Infrastructure Improvement	
(d) Dam Crest Width (m)	8.0	(1) Rural Road Improvement (km)	279
(e) Embankment Volume (m ³)	7,003,000	(2) Borehole Improvement	
(2) Saddle Dam		(a) Rehabilitation (nos.)	90
(a) Dam Type	Zoned Fill Dam	(b) New Construction (nos.)	101
(b) Dam Height (m)	30.0	(3) Improvement of Communication System	L.S
(c) Dam Crest Length (m)	875.0		
(d) Dam Crest Width (m)	8.0	V. Agricultural Support Services Strengthening	
(e) Embankment Volume (m ³)	2,554,000	(1) Agricultural Extension Center (unit)	2
(3) Spillway		(2) Agricultural Support Services Program	L.S
(a) Design Flood Discharge			
- For Services Spillway	6,000	VI. Pilot Project	
(m ³ /s)	(250 year flood)	(1) Water Resources Development	} Details are shown in Table4.5.1
- For Emergency Spillway	12,122	(2) Irrigation Development	
(m ³ /s)	(2000 year flood)	(3) Livestock Development	
(b) Type of Spillway	Ungated Ogee Type	(4) Rural Infrastructure Improvement	
(c) Overflow Crest Length (m)	300.0	(5) Institutional Strengthening	
(d) Overflow Depth (m)	6.12	(6) Agricultural Support Services Strengthening	
(4) Outlet Works			
(a) Type	Intake Tower		
(b) Outlet Capacity (m ³ /s)	31.5		
(c) Tunnel Diameter (m)	2.5		
(d) Tunnel Length (m)	560.0		
II. Irrigation Development			
(1) Irrigation Area (ha)	25,000		
- Communal & Resettlement Area (ha)	14,500		
- Small Scale Commercial Farm (ha)	6,000		
- Large Scale Commercial Farm (ha)	4,500		
(2) Main Irrigation Canal			
(a) Canal Type	Trapezoidal Concrete Lining Canal		
(b) Canal Length (km)	177.9		
(3) Secondary Irrigation Canal			
(a) Canal Type	Trapezoidal Concrete Lining Canal		
(b) Canal Length (km)	100.0		
(4) Related Structures			
(a) Diversion Structure (nos.)	363		
(b) Siphon (nos.)	3		
(c) Aqueduct (nos.)	25		
(d) Cross Drain (nos.)	317		
(e) Bridge (nos.)	39		
(f) Pump Station (nos.)	88		

Table 3.3.2 Project Cost

Work Item	Work Q'ty		Amount(x1,000Z\$)	Remarks
I. Kudu Dam				
1. Stripping & Clearing	600,000	m ²	27,600	
2. Soft Excavation	2,520,600	m ³	428,502	
3. Hard Excavation	1,224,400	m ³	306,100	
4. Embankment	9,557,000	m ³	955,700	
5. Grouting	4,500	nos.	21,150	
6. Concrete	162,000	m ³	648,000	
7. Steel Work		L.S	3,020	
8. Miscellaneous			119,504	Σ(1-7)x5%
9. Engineering Services			376,436	Σ(1-8)x15%
10. Resettlement Cost		L.S	266,000	
11. Administration Expenses			157,601	Σ(1-10)x5%
12. Contingencies			330,961	Σ(1-11)x10%
T o t a l			3,640,574	
II. Irrigation and Drainage				
1. Main Irrigation Canal	178	km	1,275,000	
2. Seconadary Irrigation Canal	100	km	208,000	
3. Related Structures				
(a) Diversion Structure	363	nos.	115,000	
(b) Siphon	3	nos.	118,000	
(c) Aqueduct	25	nos.	510,000	
(d) Cross Drain	317	nos.	128,000	
(e) Bridge	39	nos.	28,000	
(f) Pump Station	88	nos.	400,000	
4. On-farm Facilities				
(a) Communal & Resettlement Area	14,500	ha	551,000	
(b) Small Scale Commercial Farm	6,000	ha	504,000	
(c) Large Scale Commercial Farm	4,500	ha	675,000	
5. Engineering & Administration			676,800	Σ(1-4)x15%
6. Contingencies			518,880	Σ(1-5)x10%
T o t a l			5,707,680	
III. Livestock				
1. Livestock Water Development Scheme		L.S	1,440	
2. Grazing Area Development Scheme		L.S	3,600	
3. Contingencies			504	Σ(1-2)x10%
T o t a l			5,544	
IV. Rural Infrastructure				
1. Road Improvement	279	km	106,020	
2. Construction and Improvement of Boreholes	191	nos.	110,960	
3. Improvement of Information Transmission Measures		L.S	9,120	
4. Engineering & Administration			33,915	Σ(1-3)x15%
5. Contingencies			26,002	Σ(1-4)x10%
T o t a l			286,017	
V. Agricultural Support Services				
1. Agricultural Extension Center	2	unit	11,020	
2. Extension Services		L.S	10,777	
T o t a l			21,797	
VI. Pilot Project				
1. Water Resources Development		L.S	118,862	
2. Irrigation Development		L.S	11,310	
3. Livestock Development		L.S	675	
4. Rural Infrastructure Development		L.S	63,650	
5. Institutional Strengthening			7,374	
5. Agricultural Support Services		L.S	1,807	
6. Engineering & Administration			30,552	Σ(1-5)x15%
7. Contingencies			23,423	Σ(1-6)x10%
T o t a l			257,653	
Grand Total			9,919,264	

Table 3.4.1 Cropwise Net Return With and Without Project Conditions

(At Financial Prices)

Crops	Without Project Conditions										With Project Conditions									
	Share to total area (a)	Cropped area (b)	Yield ton/ha (c)	Total prod. (d)=(b)*(c)	Price Z\$/kg (e)	Total amount (f)=(d)*(e)	Prod. cost (g)	Total prod. cost (h)=(b)*(g)	Net return (i)=(f)-(h)	Share to total area (a)	Cropped area (b)	Yield ton/ha (c)	Total prod. (d)=(b)*(c)	Price Z\$/kg (e)	Total amount (f)=(d)*(e)	Prod. cost (g)	Total prod. cost (h)=(b)*(g)	Net return (i)=(f)-(h)	Incremental net return (j)=(i)-(i)	
1 COTTON	0.52	13,000	0.60	7,800	14.90	116,220,000	6,732	87,516,000	28,704,000	0.700	17,500	2.50	43,750	14.90	651,875,000	14,982	262,185,000	389,690,000	360,986,000	
2 MAIZE	0.42	10,500	0.80	8,400	6.40	53,760,000	4,788	50,074,500	3,685,500	0.180	4,500	6.00	27,000	6.40	172,800,000	16,042	72,189,000	100,611,000	96,925,500	
3 WHEAT	0.00	0	0.00	0	7.60	0	0	0	0	0.630	15,750	4.20	66,150	7.60	592,740,000	18,274	287,815,500	214,924,500	214,924,500	
4 GROUNDNUTS	0.06	1,500	0.50	750	10.00	7,500,000	7,647	11,470,500	-3,970,500	0.050	1,250	2.50	3,125	10.00	31,250,000	14,779	18,473,750	12,776,250	18,746,750	
5 CABBAGE	0.00	0	0.00	0	3.00	0	0	0	0	0.035	875	50.00	43,750	3.00	131,250,000	58,063	50,796,375	80,453,625	80,453,625	
6 TOMATOES	0.00	0	0.00	0	3.80	0	0	0	0	0.035	875	75.00	65,625	3.80	249,375,000	78,191	68,417,125	180,957,875	180,957,875	
7 BABY CORN	0.00	0	0.00	0	60.00	0	0	0	0	0.035	875	1.00	875	60.00	52,500,000	31,517	27,577,375	24,922,625	24,922,625	
8 PAPRIKA	0.00	0	0.00	0	30.00	0	0	0	0	0.035	875	3.00	2,625	30.00	78,750,000	50,181	48,890,875	34,899,125	34,899,125	
Total	1.00	25,000	-	-	-	177,480,000	-	149,061,000	28,419,000	1.700	42,500	-	-	-	1,870,540,000	831,345,000	1,039,195,000	1,010,776,000		

Net Return	Incremental Net Return
Per ha Z\$	41,568
	40,431

(At Economic Prices)

Crops	Without Project Conditions										With Project Conditions									
	Share to total area (a)	Cropped area (b)	Yield ton/ha (c)	Total prod. (d)=(b)*(c)	Price Z\$/kg (e)	Total amount (f)=(d)*(e)	Prod. cost (g)	Total prod. cost (h)=(b)*(g)	Net return (i)=(f)-(h)	Share to total area (a)	Cropped area (b)	Yield ton/ha (c)	Total prod. (d)=(b)*(c)	Price Z\$/kg (e)	Total amount (f)=(d)*(e)	Prod. cost (g)	Total prod. cost (h)=(b)*(g)	Net return (i)=(f)-(h)	Incremental net return (j)=(i)-(i)	
1 COTTON	0.52	13,000	0.60	7,800	17.40	135,720,000	3,854	50,102,000	85,618,000	0.700	17,500	2.50	43,750	17.40	761,250,000	9,784	171,220,000	590,030,000	504,412,000	
2 MAIZE	0.42	10,500	0.80	8,400	7.50	63,000,000	2,724	28,602,000	34,398,000	0.180	4,500	6.00	27,000	7.50	202,500,000	11,439	51,475,500	151,024,500	116,626,500	
3 WHEAT	0.00	0	0.00	0	9.30	0	0	0	0	0.630	15,750	4.20	66,150	9.30	615,195,000	12,844	202,293,000	412,902,000	412,902,000	
4 GROUNDNUTS	0.06	1,500	0.50	750	9.30	6,975,000	4,232	6,348,000	627,000	0.050	1,250	2.50	3,125	9.30	29,062,500	9,567	11,958,750	17,103,750	16,476,750	
5 CABBAGE	0.00	0	0.00	0	2.80	0	0	0	0	0.035	875	50.00	43,750	2.80	122,500,000	40,104	35,091,000	87,408,000	87,409,000	
6 TOMATOES	0.00	0	0.00	0	3.50	0	0	0	0	0.035	875	75.00	65,625	3.50	229,687,500	55,481	48,545,875	181,141,625	181,141,625	
7 BABY CORN	0.00	0	0.00	0	55.80	0	0	0	0	0.035	875	1.00	875	55.80	48,825,000	23,764	20,793,500	28,031,500	28,031,500	
8 PAPRIKA	0.00	0	0.00	0	27.90	0	0	0	0	0.035	875	3.00	2,625	27.90	73,237,500	38,109	33,345,375	39,892,125	39,892,125	
Total	1.00	25,000	-	-	-	205,695,000	-	85,052,000	120,643,000	1.700	42,500	-	-	-	2,082,237,500	574,723,000	1,507,514,500	1,386,891,500		

Net Return	Incremental Net Return
Per ha Z\$	60,301
	55,476

Table 3.4.2 Economic Cost and Benefit Stream (EIRR)

(Unit: Z\$ 1000.0)

Year in Order	Year	Cost Stream				Benefit Stream	Net Benefit	Present Worth Value	
		Capital Cost	O&M	Replacement	Total			Discount Rate 10%	
								Cost	Benefit
1	2001	409846			409846	0	-409846	372587	0
2	2002	518922			518922	0	-518922	428861	0
3	2003	632912	7580		640492	0	-640492	481211	0
4	2004	994105	19494		1013599	6902	-1006697	692302	4714
5	2005	1168865	33506		1202371	7490	-1194881	746578	4651
6	2006	1184314	47718		1232032	7968	-1224064	695450	4498
7	2007	1274986	62997		1337983	8561	-1329422	686597	4393
8	2008	897860	73694		971554	186687	-784867	453237	87091
9	2009	449925	79129		529054	440853	-88201	224371	186965
10	2010	401954	83932		485886	618023	132137	187330	238275
11	2011	1724	83932		85656	796526	710870	30022	279178
12	2012		83932		83932	973697	889765	26743	310250
13	2013		83932		83932	1150868	1066936	24312	333365
14	2014		83932		83932	1328038	1244106	22102	349714
15	2015		83932		83932	1505156	1421224	20093	360322
16	2016		83932		83932	1505156	1421224	18266	327566
17	2017		83932		83932	1505156	1421224	16605	297787
18	2018		83932		83932	1505156	1421224	15096	270716
19	2019		83932		83932	1505156	1421224	13724	246105
20	2020		83932		83932	1505156	1421224	12476	223732
21	2021		83932	69943	153875	1505156	1351281	20793	203393
22	2022		83932		83932	1505156	1421224	10311	184902
23	2023		83932		83932	1505156	1421224	9373	168093
24	2024		83932		83932	1505156	1421224	8521	152812
25	2025		83932		83932	1505156	1421224	7747	138920
26	2026		83932		83932	1505156	1421224	7042	126291
27	2027		83932		83932	1505156	1421224	6402	114810
28	2028		83932		83932	1505156	1421224	5820	104373
29	2029		83932		83932	1505156	1421224	5291	94884
30	2030		83932		83932	1505156	1421224	4810	86258
31	2031		83932	69943	153875	1505156	1351281	8017	78417
32	2032		83932		83932	1505156	1421224	3975	71288
33	2033		83932		83932	1505156	1421224	3614	64807
34	2034		83932		83932	1505156	1421224	3285	58916
35	2035		83932		83932	1505156	1421224	2987	53560
36	2036		83932		83932	1505156	1421224	2715	48691
37	2037		83932		83932	1505156	1421224	2468	44264
38	2038		83932		83932	1505156	1421224	2244	40240
39	2039		83932		83932	1505156	1421224	2040	36582
40	2040		83932		83932	1505156	1421224	1854	33256
41	2041		83932	69943	153875	1505156	1351281	3091	30233
42	2042		83932		83932	1505156	1421224	1533	27485
43	2043		83932		83932	1505156	1421224	1393	24986
44	2044		83932		83932	1505156	1421224	1267	22715
45	2045		83932		83932	1505156	1421224	1151	20650
46	2046		83932		83932	1505156	1421224	1047	18772
47	2047		83932		83932	1505156	1421224	952	17066
48	2048		83932		83932	1505156	1421224	865	15514
49	2049		83932		83932	1505156	1421224	786	14104
50	2050		83932	69943	153875	1505156	1351281	1311	12822
		7935413	3765330	279772	11980515	59711229	47730714	5300668	5638421

EIRR 10.5%
 B/C 1.06 (Discount Rate 10%)
 B-C 337753 (Discount Rate 10%)