JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF AGRICULTURE AND CO-OPERATIVES,
THE KINGDOM OF SWAZILAND

THE STUDY ON IMPROVEMENT OF RURAL ENVIRONMENT IN DEGRADED LAND IN THE KINGDOM OF SWAZILAND

Final Report

Annex

JANUARY 2003

KOKUSAI KOGYO CO., LTD.
SANYU CONSULTANTS INC.

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Abbreviations and Acronyms

CDC:	Community Development Committee
DPMO:	Deputy Prime Minister's Office
GIS:	Geographic Information System
GOS:	Government of Swaziland
JICA:	Japan International Cooperation Agency
MOAC:	Ministry of Agriculture and Co-operatives
NAP:	National Action Plan
NDS:	National Development Strategy
NGO:	Non-Governmental Organization
NLEP:	National Land and Environment Policy
PCM:	Project Cycle Management
PDM:	Project Design Matrix
PPMU:	Pilot Project Management Unit
RDA:	Rural Development Area
SEAP:	Swaziland Environment Action Plan
SFDF:	Swaziland Farmers' Development Foundation
SNL:	Swazi Nation Land
TA:	Target Area under the Study
TDL:	Title Deed Land

Currency Equivalents

Currency Unit:	Emalangeni (E)
1.0 E	0.127965 US$
US$ 1.00	7.8146 E (As of May 27, 2003)

Measurements

m:	Meter
Km^2:	Square Kilometer
ha:	Hectare (10,000 m^2)
m^2:	Square Meter
m^3:	Cubic Meter

Annex A

A Agriculture

A.1 Major Crops in the SNL Farms

Table A-1: Major crops in the SNL farms

Crop	1994/95		1995/96		1996/97	
	Area ha	Prod. MT	Area ha	Prod. MT	Area ha	Prod. MT
Maize	59,726	76,052	61,467	135,627	60,905	108,207
Ground nut	7,538	4,710	7,174	8,338	6,273	9,481
Seed cotton	24,489	3,720	14,620	8,400	35,120	10,528
Jugo beans	3,801	3,986	3,097	5,567	2,500	1,687
Sorghum	1,989	1,428	3,160	12,321	1,062	708
Beans	4,538	3,343	6,194	5,657	4,189	4,958
Sweet potatoes	2,527	12,153	3,507	18,003	3,638	11,506
Tobacco	414	632	598	42	168	707

Source: Annual Statistical Bulletin, 1997, Central Statistical Office

A.2 Major crops in the TDL, Planted area and Produced weight

Table A-2: Major crops in the TDL, planted area and produced weight

Crops	1993/94	1994/95	1995/96	1996/97	1997/98
Sugarcane(ha)	37,600	38,502	38,688	38,725	38,862
(MT)	3,647,244	3,797,749	3,404,093	3,693,967	3,886,710
Pineapple(ha)	601	786	386	184	NA
(MT)	19,700	19,656	11,578	8,439	NA
Cotton (ha)	2,349	12,000	31,000	29,000	NA
(MT)	7,000	6,200	14,000	16,197	NA
Tobacco (ha)	58	17	598*	168*	16
(MT)	41	17	10	16	18
Citrus (ha)	6,800	2,569	2,480	2,513	NA
(MT)	88,263	90,768	90,105	88,735	NA

Source: Annual Statistical Bulletin, 1997, Central Statistical Office
Note: * SNL farms were included.

A.3 Maize consumption, production, import

Table A-3: Maize consumption, production, import

	Consumption	Production	Import	Self-sufficiency
	MT	MT	MT	%
1990/91	101,539	89,639	11,900	88%
1991/92	122,920	59,320	63,600	48%
1992/93	123,671	92,971	30,700	75%
1993/94	94,215	83,815	10,400	89%
1994/95	113,357	83,657	29,700	74%
1995/96	159,390	149,190	10,200	94%
1996/97	133,114	119,028	14,086	89%
1997/98	NA	NA	23,215	NA
1998/99	NA	NA	30,764	NA
1999/00	NA	NA	24,794	NA
Average	123,717	99,979	24,320	81%

Source: Annual Report 2000, National Maize Corporation

A.4 Price of Maize in the Past Two Years

Table A-4: Price of maize in the past two years

Unit: Emalangeni/1MT

	1999/2000			2000/2001			2001/2002		
	Purchase price		Selling	Purchase price		Selling	Purchase price		Selling
	Local	Import	Bulk	Local	Import	Bulk	Local	Import	Bulk
Apr	700.00	890.00	1,061.50	800.00	841.00	1,050.00	857.00	682.50	1,050.00
May	700.00	890.00	1,061.50	800.00	830.00	1,050.00	857.00	801.58	1,050.00
Jun	700.00	890.00	1,061.50	800.00	783.50	990.00	900.00	870.71	1,050.00
Jul	714.57	890.00	990.00	857.00	785.00	990.00			
Aug	800.00	888.75	990.00	857.00	-	990.00			
Sep	800.00	877.50	990.00	857.00	-	990.00			
Oct	800.00	877.50	1,050.00	857.00	620.00	990.00			
Nov	800.00	803.75	1,050.00	857.00	687.00	970.00			
Dec	800.00	805.00	1,050.00	857.00	754.50	970.00			
Jan	800.00	805.00	1,050.00	857.00	833.63	970.00			
Feb	800.00	870.00	1,050.00	857.00	832.38	970.00			
Mar	800.00	822.50	1,050.00	857.00	796.50	1,050.00			

Source: National Maize Corporation, August, 2001
Note: Selling price is only in bulk to mills. Buying price is E63.00/70kg-bag from a farmer at present.

A.5 Buying Prices of Vegetables & Fruits at Encabeni Fresh Produce Market, 2000/2001

Table A-5: Buying prices of vegetables & fruits at Encabeni Fresh Produce Market, 2000/2001

Crops	Weight	Winter (Apr – Aug)	Summer (Sep – Mar)
Tomato	20kg	20.00	60.00
Cabbage	25kg	8.00	35.00
Spinach	1kg bundle	1.50	-
Carrot	10kg	8.00	25.00
Lettuce	Per head	0.50	2.50
Green beans	4.5kg	16.00	30.00
Green pepper	4.5kg	25.00	45.00
Pumpkin	34kg	18.00	48.00
Butter nut	10kg	10.00	68.00
Banana	20kg	23.00	17.00
Orange	7.5kg	5.50	5.50
Mango	4.5kg	-	18.00
Avocado	4.5kg	6.50	-

Source: NAMBOARD Note: Produces are bought on contract agreement base.

A.6 Interviews with Farmers in Target Area 1 (Kukhayeni Ikhundla)

Table A-6: Interviews with Farmers in the Target Area 1 (Kukhayeni Ikhundla)

No.	Loca-tion	Farm ha	farming family	Crops	ha	Planting season	Harvesting season	Yield 70kg	Home cons.	Selling price	Variety	Animals	heads	Seed	Fertilizer bag/50kg	Agri. chemicals	Plowing	Tilling & weeding	Employ labors	Farm income	Non-farm Income	Irrigation	Extension services	Famers' Association	Probelms
1	I-15	5	6/12	maize	5	Oct	Apr. May	30	20		hybrid	cattle	14	170/10kg	2-3-2-38	Cupper F.	oxen	hand hoe	none	M 940	none	no	go to ex.	Lozichem FA	1. finance of input
				ground nut	0.2	Nov	Mar	150				goat	6		6bags/50kg	6packs				L 11,990				(vegetables)	2. irrigation
				bean	1	Feb	May	40				pig	5		570	120	0	0	0						
												chicken	plenty						860	12,930	0				
2	I-14	8.5	1/3	maize	8	Sep	Jan	30	12		hybrid	goat	2	120/10kg	2-3-2-22	Cupper O.	hired trac.	hand hoe	30 m/d	M -305	1(GW)	pump	No	No	1. Irrigation (pump in disorder)
				cabbage	0.5	Feb	May, Jun					chicken	8	200/2kg	2-3-2-38	Oxichloride	E80/hr.		300	L 960		E2,000			2. Soil analysis
				tomato	0.5	May	Nov, Dec							320	725	120	640	0	2,105	655	20,300				
3	I-13	8	4/10	maize	4	Nov	May	22	15	E20/20L	hy. loca	cattle	10		2-3-2-22	Cupper F.	oxen and	hand hoe	30 m/d	M -398	1(pvt)	Watering	No	No	1. Drought
				sweet potato	0.2	Nov, Dec	Mar					goat	5		15bags	Cupper O.	hired trac.		E10/md	L 6,550		can			2. Soil degradation
				bean	0.5	Feb, Mar	May			E60/20L		chicken	10		1,098	120	200	0	300	+ vege					
				tomato		Feb	May												1,718	6,152	20,300				
				cabbage	1.5	Feb	Jun																		
				onion		Aug	Dec																		
				beet root		continuous																			
4	I-12	4	10/36	maize	3	Nov	Mar, Apr	50	60		hybrid	cattle	23		2-3-2-22	Cupper F.	hired trac.	hand hoe	50 m/d	M -306	7	No	No		1. Drought
				bean	0.5	Jan	Apr	50kg				goat	4		30bags		E80/hr		E15/md	L 13,130					2. Pests
				sweet potato	0.5	Nov	Apr	140kg				chicken	30				(RDA)								
		rotation		Irish potato	0.2	Nov	Jan	40kg							2,196	120	240	0	750						
				tomato	0.5	Nov	Jan	90kg											3,306	12,824	142,100				
				green pepper	0.2	Nov	Mar, Apr																		
5	I-11	8	10/10	maize	7.5	Nov	Apr	15		E86/50kg	hy. loca	cattle	9	98/10kg	22, 38	No	hired trac.	hand hoe	none	M -789	2(GW)	No	No	No	1. Finance of input
				bean	0.5	Feb	May	3		(buying)		chicken	20		10bags		E100/hr		0	L 5,040					2. Drought (No germination)
														98	841	0	750	0	1,689	4,251	40,600				3. Poor soils
6	I-10	1.5	5/17	maize	1	Oct	May	10	40	E75/70kg	hy. loca	cattle	10	105/10kg	2-3-2-22	Kombat	oxen	hand hoe	none	M -351	4	small irr.	No	Eleantunja FA	1. No tractor
				bean	0.5	Feb	Apr	2		(buying)		pig	4		10bags					L 14,050					2. Shed for farm input
				sweet potato		Dec	May					goat	10		68.95/50kg										3. Short of ex. services
				cabbage		Aug	Dec					sheep	7	12/100pl						13,699	81,200				4. Irrigation
				beet root	0.5	Sep	Nov					duck	4	12/100pl											5. Fencing (animal and stealing)
				spinach		Aug	Sep					chicken	50	141	690	120	0	0	0						
				green pepper		Oct	Dec							12/100pl					951						
7	I-9	5	2/3	maize	5	Nov	Apr	28	10	E60/50kg	hybrid	chicken	10	250/20kg	22, 38	Cupper F.	hired trac.	hand hoe	24x40	M -299	none	No	No	No	1. Quality of seed bad
															6bags	8pack/2kg	E120/hr		480	L 450					2. High input (tractor, fertilizer,
														250	505	144	600	0	1,979	151	0				labor cost)
8	I-7	3	3/8	maize	3	Oct	May	35			hybrid	cattle	18	85/10kg	2-3-2-22	Cupper F.	hired trac.	hand hoe	112m/d	M 49	3	No	No	No	1. Finance of input
				ground nut	###	Dec	Mar	2				pig	23		6bags	2pksx23	E120/hr		1,120	L 16,530					2. Drought
				bean	###	Jan	Mar	1.5				chicken	30	85	440	46	360	0	2,051	16,579	60,900				
9	I-8	4	6/7	maize	4	Nov	Mar	65	15	E50/70kg	hybrid	cattle	24	110/10kg	2-3-2-38	Cupper F.	hired trac.	hand hoe	none	M 2,748	4	No	Once in a	Shibane FA	1. Finance of input
				ground nut	0.2	Nov	Feb	5				goat	10		6bags	4pksx23	E110/hr		0	L 15,840			while		2. Irrigation
												chicken	40	110	510	92	440	0	1,152	18,588	81,200				3. Short of tractors
10	I-6	0.8	1/6	maize	0.7	Oct, Nov	Mar, Apr	2	12	E20/25kg	hy. loca	chicken	8	60/5kg	No	Cupper F.	hired trac.	hand hoe	none	M -63	none	No	yes	No	1. Lack of farm input
				sweet potato	0.1	Oct	Feb			(buying)						1pkx23	E100/hr		0	L 360					
														60	0	23	100	0	183	297	0				
11	I-5	5	5/15	maize	4.5	Oct	Apr, May	25	12	E75/70kg	local	cattle	9		2-3-2-22	Cupper F.	hired trac.	hand hoe	none	M 657	none	No	No	Forming FA	1. Finance of input
				sorghum	0.5	Sep, Oct	Apr	2.5	brewing			chicken	8		4bgs, manur	4pksx25	E100/hr		0	L 4,500					2. Soil erosion
				(pumpkin)										0	293	100	450	0	843	5,157	0				
12	I-4	4	13/16	maize	4	Oct	Apr, May	4		buying	hy. loca	pig	1	150/10kg	2-3-2-22	Cupper F.	hired trac.	hand hoe	none	M -644	1	No	No	No	1. Lack of farm input
												chicken	15		3bgsx75	3pksx23	E110/hr		0	L 975					2. Drought
														150	225	69	440	0	884	331	20,300				
13	I-2	1.2	5/5	maize	1	Oct	Apr	100		E75/70kg	local	cattle	9		2-3-2-22	Cupper F.	own trac.	hand hoe	none	M 5,440	none	No	Aware of	Vukani Kisile	1. Lack of rainfall
				bean	0.2	Jan	Apr	2		E70/25L		goat	12		7bags	6pksx23	E11,000sh			L 9,105			ex. serv.	Bomake Wo.	2. Inavailability of water
				sweet potato	0.1	Dec	Jun. Jul					duck	3			Liquid 1p		0	0					Association	
				Irish potato	-							chicken	27	0	515	45	(E30/L)		560	14,545	0				
14	I-1	2	6/6	maize	2	Nov	Apr	50		E15/25L	hybird	cattle	13	110/15kg	2-3-2-22	No	hired trac.	hand hoe	none	M 2,270	3	No	No	No	1. Drought
												goat	6		6bags/E60		E90/hr		0	L 9,130					2. Poor soils
												chicken	30	110	440	0	180	0	730	11,400	60,900				3. Lack of finance
15	I-3	1	7/7	maize	1	Sep	Mar	5		E80/70kg	hybrid	chicken	10	110/10kg	2-3-2-38	Cupper F.	hired trac.	hand hoe	none	M -133	none	No	Yes when	Loose Asso.	1. Timing of plow
										(buying)		egg E6/12pcs			2bags/E120	1pkx23	E110/hr		0	L 450			necessary	E5/mem.	2. Inavailability of water
														110	190	23	110	0	433	317	0			ferti. shed	

Source: Hearing from farmers on 13, 14 and 15, February, 2001

A.7 Interviews with Farmers in the Target Area 2 (Shiselweni Inkhundla)

Table A-7: Interviews with Farmers in the Target Area 2 (Shiselweni Inkhundla)

No.	Loca-tion	Farm ha	farming family	Crops	ha	Planting season	Harvesting season	Yield 70kg	Home cons.	Selling price	Variety	Animals	heads	Seed	Fertilizer bag/50kg	Agri. chemicals	Plowing	Tilling & weeding	Employ labors	Farm income	Non-farm Income	Irrigation	Extension services	Famers' Association	Probelms
1	II-4	1	3/5	maize	0.8	Oct	Jun	20		buying	local	cattle	9	own	2-3-2-22	cutworm	Own oxen	oxen/hand	none	M 464	none	small res.	yes, started	Chinese maize	1. tractor not in time
				beans	0.2	Oct	Jan	3.5		E85/70kg		goat	11		8bags, pvt	E50+/0.5L				L 10,515		pipe from		project	2. Short of finance
				small garden		Feb	May					pig	7									stream			3. winter plowing
				onion, sugar cane, lemon								duck	6	0	586	150	0	0	0						
				banana, avocado, papaya								chicken	15						736	10,979	0				
2	II-7	0.5	3/6	maize	0.5	Nov	Apr	5		buying	local	chicken	20	own	2-3-2-22	no	hired oxen	handhoe	none	M -47	none	no	no	no	1. No means of plowing
		widow with		mixed pumpkin											2bgs, CCU		E200/0.5ha		0	L 900					2. No source of income
		grand children												0	147	0	200	0	347	853	0				
3	II-3	2	4/12	maize	2	Nov	Jun	2		buying	local	pig	1	E35/	no	no	hired oxen	handhoe	no	M -115	3(SA)	no	no	no	1. Lack of farming means
				mixed pumpkin						E80-100	hybrid	chicken	7	5kg			E200/2ha		0	L 615					
										/70kg	CG4141			35	0	0	200	0	235	500	60,900				
4	II-2	3	8/16	maize	2.6	Nov	Apr	12		buying	hybrid	cattle	12	E75-80	2-3-2-22	Stockborer	hired tractor	oxen/hand	no	M -1,373	store	no	no	Qhubekani	1. no tractor
				bean	0.4	Nov	Feb	0		E70-80	CG4141	poultry asso.		/10kg	E75/50kg	E10/kgx16	E800/all			L 5,520	leased			Women Asso.	2. farm input
							because of hail			/70kg				x 7bgs	x 7bgs	Cutworm	(plow & plant)			+ poultry				poultry	
														CCU	manure	E10/kgx6			0					sewing	
														560	513	220	800	0	2,093	4,147				Irina Dlamini	
5	II-9	2.5	12/45	maize	2.5	Oct	May	5		buying	local	cattle	10	own	no fert.	Stockborer	own oxen	oxen/hand	no	M 235	1(SA)	Small	no	no	1. no tractor
				mixed bean and		Oct	Feb	15kg		maize meal		goat	16		cattle	Liquid				L 10,250		reservoir			2. fertilizer expensive
				cow pea		Oct	May	5kg		E65/50kg		donkey	2		manure	E65/0.5L			0			from str.			
				vegetables						(from SA)		chicken	10	0	0	65	0	0	65	10,485	20,300				
6	II-8	4.5	5/23	maize	3	Nov	Apr	30		buying	local	chicken	27	E90/10	2-3-2-22	no	lea tra 85x4hr	oxen/hand	no	M 1,060	2(teacher	no	no	no	1. tractor not in time
				head man was sick							hybrid	(meat)								L 1,215	police)				2. finance on fertilizer
														180	220	0	340	0	740	2,275	40,600				
7	II-1	1.5	2/8	maize	1.5	Nov	Apr	12		buying	hybrid	cattle	4	E97/10	2-3-2-38	Stockborer	hired tractor	hand hoe	no	M 126	1(town)	no	no	no	1. lack of capital for input
										maize meal	CG4141	duck	2	kgx2bgs	E95x2bgs	Liquid 0.5L	E60/hrx2.5hrs		0	L 2,615					2. cash not in time
										E80/50kg		chicken	15	194	190	60	150	0	594	2,741	20,300				
8	II-5	1	3/12	maize	1	Nov	Jun	10		buying	local	cattle	7	own	no fert.	no	own oxen	oxen/hand	no	M 600	2(1SA,	no	no	no	1. hired tractor difficult
				ground nut	small	Nov	Apr	1		E100/70kg		goat	1		manure				0	L 3,790	1 in town)				2. lack of input
				jugo bean	small	Nov	Jul	no				chicken	6	0	0	0	0	0	0	4,390	40,600				3. too old
9	II-10	6	5/8	maize	2	Oct,Nov	Apr, May	9		buying	local	cattle	4	E95/10	2-3-2-22	Stockborer	hired tractor	oxen/hand	no	M -1,132	2(town)	no	yes	no	1. too much rain, drought
				(bean)	2	Mar	Jun			E100/70kg	hybrid	goat	7	kgx4bgs	E85/50kg	E65/0.5L	E120/hrx2.5h			L 4,255			ex. worker		
											CG4141	chicken	7	CCU	x 4bgs	x 10			0				comes.		
														380	342	650	300	0	1,672	3,123	40,600				
10	II-6	10	6/17	maize	7	Oct,Nov	Apr,May	50		E65-70/70	local	cattle	20	E80-90	2-3-2-38	E110/L	own tractor	tractor/	no	M -920	2(town)	no	no	no	no problems
				sweet potato	1	Dec	Jun	-		kg	hybrid	goat	15	10kg x	E94/50kg	x 2L		hand hoe		L 20,100					
				jugo bean	1	Dec	May	10kg		NMC	CG4141	sheep	10	10bgs	x 30bgs		maize sheller								
				ground nut	1	Dec	May	2kg			R0413	pig	2	CCU	CCU		truck		0						
												chicken	40	850	2,850	220	0	0	3,920	19,180	40,600				

Source: Hearing from farmers on 28th February and 1st March, 2001.

A.8 Interviews with Farmers in the Target Area 3 (Ngwempisi Inkhundla)

Table A-8: Interviews with Farmers in the Target Area 3 (Ngwempisi Inkhundla)

No.	Loca-tion	Farm ha	farming family	Crops	ha	Planting season	Harvesting season	Yield 70kg	Home cons.	Selling price	Variety	Animals	heads	Seed	Fertilizer bag/50kg	Agri. chemicals	Plowing	Tilling & weeding	Employ labors	Farm income	Non-farm Income	Irrigation	Extension services	Famers' Association	Probelms
1	III-7	4	4/10	maize	3	Nov	May	15	19	E57/50kg	local	cattle	2	E20/20L	2-3-2-22	Kombat	hired trac.	hand hoe	none	M 167	1	no	no	no	1. expensive input (tractor,
				bean	0.9	Nov	Jan			buying		chicken	15		3bags	E8/kg	E110/hr			L 1,595					hybrid seed, fertilizer)
				jugo bean		Nov	Jan								Manure		3,3/4								2. timing of plow not good
				sweet potato	0.1	Nov	Mar												0						3. drinking water too far
				pumpkin		Dec	Mar,May							20	220	80	413	0	733	1,762	20,300				
2	III-4	3.5	5/14	maize	3.5	Nov	May	54		selling	hybrid	cattle	7	E90/10kg	-38, manur	Cutworm	hired trac.	handhoe	none	M 1,136	4	no	once/mon	Chinese maize	1. expensive input
											R0413	duck	6	3bags	E98, 8bags	6bags	E120x5.5hr		0	L 4,150			not enough	project	2. selling price too low
											local	chicken	14	270	784	390	660	0	2,104	5,286	81,200				3. drinking water too far
3	III-13	5	7/20	maize	4.4	Nov	May	20		enough	hybrid	cattle	8	E90/10kg	2-3-2-38	Cutworm	hired trac.	oxen/	none	M -900	5	none	yes, often	Chinese maize	1. drought
				ground nut	0.2	Dec	Apr	too much			6479	goat	30	2bags	E90, 11bag	5bags/1kg	E100/hr	handhoe		L 13,580	1/Mbabane		ex worker	project	2. expensive input
				sweet potato	0.2	Dec	Jun	rain			local	chicken	20			Stbre20/50(	5hrs		0		4/SA		lives near		3. drinking water too far
				jugo bean	0.2	Dec	Jun							180	1,045	375	500	0	2,100	12,680	101,500				
4	III-3	4	6/6	maize	4	Nov	May	50	25	25bags	hybrid	cattle	2	E90-95	2-3-2-38	Stockborer	own trac.	oxen/	none	M 290	none	no	yes		1. birds, too much rain, spoiled
				bean	0.02	Jan	Mar		spoiled		Pioneer	goat	6	4bags	E100, 4bag			handhoe		L 13,580					2. drought
											R0413	chicken	15				lease 85/hr								3. high input
																			0						4. drinking water
														380	400	130	0	0	910	13,870	0				(paid but not realized)
5	III-2	2	5/5	maize	2	Oct	May	20		enough	hybrid	cattle	9	Malkerns	manure	herbicide	hired trac.		none	M 2,440	3(teacher	no	comp. on	Poultry raising	1. Tractor (timing of plow)
											local	chicken	20	(Re. cent)		Beledex pls	pick-up		0	L 3,395	hospital)		dairly pro.	(Livestock	2. budget allocation in the
														200	0	200	160	0	560	5,835	60,900			Association)	family
6	III-12	10	8/27	maize	10	Oct	Apr	60		Buying	hybrid	cattle	14	CCU	2-3-2-38	Cutworm	oxen	oxen/	none	M 1,640	none	no	go to train.	Chinese maize	1. drought
				mixed with pumpkin						(E65/70)	R0143	goat	8	E95/10kg	6bgs, manu	6bags/1kg	hired trac.	handhoe		L 9,870					2. disease on maize
											local	chicken	14	2bags	E90/bag	Stkbr 2bg/kg			0						3. tractor not in time
												horse	1	190	540	430	800	0	1,960	11,510	0				4. drinking water
7	III-5	4.5	8/11	maize	4.5	Nov	May	80	40	40bags	local	cattle	10	2bgs/10kg	2-3-2-38	Cutworm	oxen	oxen/	none	M 3,006	2	no	yes,	no	No problems
										E60/70kg	hybrid	goat	8	2bgs/10kg	6bags	8bgs/0.5kg	hired trac.	handhoe		L 9,850			ex worker		
											R0413	pig	2		no manure	Stkbr1bg/5l	E80/hrx3hrs		0						
											CG4141	chicken	50	374	560	620	240	0	1,794	12,856	40,600				
8	III-6	2.5	5/8	maize	2.5	Oct	Apr	60	45	15bgs	local	cattle	18	own	2-3-2-22	Kombat	oxen	oxen/	none	M 2,102	2(1SA)	no	no	no	1. cutworm
										E60/70kg		goat	26		15bgs	20bgs/1kg	own trac.	handhoe		L 15,680					2. drought
										NMC		pig	4		E70/50kg		7,500/sec								3. farm input expensive
												goose	5		cattle man.		hand		0						4. witch weed
												chicken	20		1,098	400	0	0	1,498	17,782	40,600				5. drinking water
9	III-10	4	2/13	maize	4	Nov	Apr	60	20	40bgs	hybrid	cattle	11	3bgs/10kg	22, 38	herbicide	hired trac.	oxen	none	M 1,715	5	no	used to	Sugmam Poult	1. poor land (drought)
										E60/70kg	R0413	goat	5	E95/10kg	12bgs		E110/hr			L 6,660			but now no	Association	2. seed no good
										NMC	PEN6549	chicken	15	CCU			4hrs							38 members	3. land small
															440+570				0					E100/year	4. tractor expensive
														285	1,010	150	440	0	1,885	8,375	101,500				5. drinking water
10	III-15	3.5	4/40	maize	3.5	Nov	Apr	22		Buying	hybrid	cattle	22		2-3-2-38	yes	hired trac.	handhoe	none	M 475	7	to the		Intamakuphila	1. drought
										E100/70kg		goat	5		4bgs, manu		E90/hr	herbicide	0	L 11,680		garden		Association	2. input expensive
												chicken	14	0	380	150	315		845	12,155	142,100			vegetables	3. tractor not in time
11	III-9	3	6/15	maize	3	Nov	May	50	enough		local	cattle	12	7bgs/10kg	2-3-2-22	Stockborer	hired trac.	oxen	none	M 1,119	none	to the	used to	Emoula'mehlo	1. drought
											hybrid	goat	11		8bgs, pvt	Liquid	E100/hr	handhoe	0	L 9,800		garden	but now no	Farmers' Asso	2. fencing materials
											CG4141	pig	6		manure		5hrs		0					vegetables	3. input expensive
												chicken	7	665	586	130	500	0	1,881	10,919	0			15 mbs NAMB	4. tractor not in time
12	III-8	3	7/11	maize	2.9	Oct	May	10	enough		hybrid	cattle	9	3bgs/10kg	2-3-2-22	Kombat	hired trac.	oxen/hoe	none	M -703	1(pulp co)	no	no	no	1. grey leaf spot
				bean	0.1	Jan	May	2		rice	CG4141	goat	14	E99.10	7bgs, manu	1bg/5kg(G)	E80/hrx2hrs		0	L 8,140					2. wild pig
				ground nut	smal	Dec	Apr			E29/10kg		chicken	30		E86/50kg	E27	oxen		0						3. poor soil
				jugo bean	smal	Dec	May							298	602	243	160	0	1,303	7,437	20,300				
13	III-11	6	4/12	maize	4	Nov	May	20	24	buying	local	cattle	3	2bgs/10kg	2-3-2-22	no	hired oxen	oxen/	none	M 623	1	no	no	no	1. witch weed
				mixed pumpkin						4bgsxE80	hybrid	goat	3	E90	2bgs, manu		E50/dayx5	handhoe		L 2,580					2. stock borer
				ground nut	1	Dec	Feb	1			CG4141	chicken	15		E60+/bag				o						3. drought, hail
				bean	1	Jan	Mar							180	147	0	250	0	577	3,203	20,300				
14	III-1	1	2/5	maize	1	Nov	May	10		buying	hybrid	chicken	15	1bag/10kg	2-3-2-38	Kombat	hired trac.	handhoe	none	M 41	1	no	no	no	1. drought
											PEN6549			E100+	3bgs	7bgsx10.50	E100/hrx1		0	L 600					2. drinking water
														100	285	74	100	0	559	641	20,300				(with animals)

Source: Hearing from farmers on 23rd, 26th, 27th February, 2001.

A.9 Farmers Interview in the Pilot Project Chiefdoms

Table A-9: Farmers Interview in the Pilot Project Chiefdoms

No	Target Area	Chiefdom	Series	Farm ha	Fallow	house hold	Farming /family	Crops	ha	Plant month	Harvest month	Yield bag/70kg	Sell or Buy	Variety	Animals	heads	Seed	Fertilizer	Agri. chemicals	Plow	Labor	Crop gross income	Farm input	Farm net income	Non-farm income	Extension services	Association	Future crops	Future animals	Problems
1	TA1	Eni	En-1	3	1 grazing	2	5/12	maize	2	Nov	May	50	sell	Native	Cattle	15	own	2-3-2-38 5 bags	5 bottles	oxen	none	M50x60 3,000	fert 475 chem 325 800	M 2,200 L 11,340 13,540	1 pvt 20,300	no	Mahlavuza Poultry Asso 100/memship	spinach banana	more cattle	Witch weed Finance for farming
								ground nut	s					Hickery	Goat	4														
								sweet potato	s					King	Duck	9														
								vegetables	8x20						Chicken	60														
2	TA1	Eni	En-2	2.1	1	1	8/10	maize	1	Nov	May	10	Buy	CGII295	Cattle	4	CCU	LAN 5bag CCU	G.3 bags CCU	oxen	none	M 10x60 600	fert 350 seed 97 chem 60	M 93 L 3,715 3,808	none (lay-off) 0	no	Poultry Asso as above	beans and vegetables small pond	No	erosion no land availabe finance
								sweet potato	s						Goat	4														
								ground nut	s						Chicken	15														
3	TA1	Eni	En-3	3.7	0.2	2	3/9	maize	3.5	Nov	May	60	sell	Ford Se.	Cattle	7	own	2-3-2-38 6bags	G.6 bags CCU	Leased trac.	56 manday	M 60x60 3,600	fert 570 chem 120 plow 500	M 1,850 L 4,750 **6,600**	Police 20,300	no	Nsenga F.A. 1974, inactive			Fencing
														Native	Chicken	30														
4	TA1	Eni	En-4	1.7	0	1	2/5	maize	1.7	Nov	May	3	buy	Late	Donkey	5	own	none	1 bottle CCU	Leased oxen	none	M 3x60 180	chem 65 plow 200 265	M -85 L 1,180 1,095	none 0	no	no			No tractor
								sweet potato	s					Swati	Chicken	4														Finance for farming
								ground nut	s																					
5	TA1	Eni	En-5	1.7	0.4	1	4/10	maize	1.3	Nov	May	15	Buy	Native	Cattle	3	own	none	none	Leased trac.	none	M 15x60 900	plow 200 200	M 700 L 2,580 3,280	gourd, coo 4,320	no	no			Finance for farming
								sweet potato	s						pig	4													Fencing
6	TA1	Engcayni	Ec-1	7	0	1	9/17	maize	6	Nov	Mar	50	sell	PNR654	Cattle	20	Chinese P.	2-3-2-38 11 bags	Capflorin	own ox	none	M 50x60 3,000	Chinese P total 1,485	M 1,515 L 20,450 21,965	1 soldier 20,300	no	no	vegetables (irrigated)		No shed for storage
								ground nut	0.5	Nov	Feb	6	NMC		Goat	30														
								Jugo beans	0.5	Jan	Apr	2			Chicken	50		urea 6 bags												
7	TA1	Engcayni	Ec-2	5	3	2	5/11	maize	1.1	Nov	Apr	8	buy	Native	Chicken	20	own	-22, 3 bags -38, 2 bags	Stockborer 250ml L	leased trac	none	M 8x60 480	fert 410 chem 65 plow 400 875	M -395 L 900 505	none 0	Yes, but not often	no	vegetables	cattle goat	Financial
								Jugo beans	0.3	Jan	May	1																	
								sweet potato	0.3	Oct	Feb-Apr																		
								cassava	0.3	2 years																			
8	TA1	Engcayni	Ec-3	4	0	1	10/10	maize	3.5	Nov	Mar	12	enough	Hybrid	chicken	15	Ngawane Meals (a sort of credi			leased trac	none	M 12x60 720	Ngawane Meals (credit)	M 720 L 675 1,395	none 0	Yes, but not often	no			Witch weed Stockborer
								beans	s	Feb	May																		
								Jugo beans	s	Nov	Feb																		
								vegetables	s	spinach, cabbage, tomato, sugar cane, arrow root, People come to buy.																			
9	TA1	Engcayni	Ec-4	8	0	2	10/16	maize	7	Nov	Mar	28	enough	PNR654	Cattle	15	Chinese Project, RDA			Leased trac.	none	M 28x60 1,680	Chinese P total 1,485	M 195 L 12,585 12,780	RSA court president 80,000	Yes	WA (schooling)			Financial
								Jugo beans	0.3	Dec	Apr				Goat	12													Drinking water
								beans	0.2	Feb	May				Pig	5													
								ground nut	0.3	Nov	Mar				Chicken	7													
															Duck	6													
10	TA1	Engcayni	Ec-5	3	0	1	7/11	maize	2.5	Nov	Apr	40	enough	Hybrid	Pig	2	Chinese Project			Leased trac.		M 40x60 2,400	Chinese P total 1,485	M 915 L 1,500 2,415	none 0	Yes	no	vegetables		Planting
								beans	0.5	Feb	May			Native	Chicken	20													Irrigation
11	TA1	Engcayni	Ec-6	5	0	1	1/3	maize	5	Nov	Apr	60	stored	Hybrid	cattle	7	Chinese Project			Leased trac.	none	M 60x60 3,600	Chinese P total 1,485	M 2,115 L 3,670 5,785	none 0	Yes	No	Potato		Planting
								sweet potato	s	Nov	Apr			Native	Chicken	10													
12	TA-1	Nkiliji	Nk-1	2.5	0	1	6/10	maize	2.5	Nov	Apr	10	buy	R201	Chicken	15		Urea	Cupper F.	lea, trac	none	M 10x60 600	fert 80 chem 20 plow 300	M 200 L 675 875	none 0	no	WA(funeral)	beans	no	Financial
13	TA-1	Nkiliji	Nk-2	2	0	1	7/8	maize	2	Nov	May	15	buy	Hybrid	cattle	6	CCU	-22, 7bags CCU	Cupper F. pvt.	lea, trac	50 manday	M 15x60 900	ft515, sd97 ch20, pl20(lb500, 133	M -432 L 2,850 2,418	pvt. Manz 20,300	no	Mhlambanyor FA(vege, pla)	Happy Khoza (ch)	poultry	Stockborer Extension service
														Native	chicken	2														
14	TA-1	Nkiliji	Nk-3	5	2	1	2/4	maize	2.5	Dec	Apr	10	enough	Panner	Cattle	2	CCU	-38, 6 bags	Sanbvala-rate	own trac	360manda	M 10x60 600	ft570, sd97 ch65,lb360 4,332	M -3,732 L 2,180 -1,552	none 0	No	no	ground nut Jugo bean	broiler	Financial Fencing Extension service
								beans	0.5	Apr	Jun			6549	Chicken	28														
								potato+sw po		Jan-Apr-Aug																				
15	TA-1	Nkiliji	Nk-4	4	1	3	6/12	maize	2.5	Oct	Mar	50	sell	R201	cattle	15		-38, 15bag	Decis Farm chem	own trac	none	M 50x60 3,000	fert 1,425 sd97, ch65 1,587	M 1,413 L 7,800 9,213	1 mbamba 20,300	no	no	no	dairy cow broiler	Financial
								sweet potato	s	Feb	Aug				Chicken	20													
								ground nut	s	Sep	Feb																			
16	TA-1	Nkiliji	Nk-5	1.5	0.5	1	2/6	maize	1	Oct	Feb	5	buy	Ro 213	none			Chinese P.	fail to repa	leased tr	24 manday	M 5x60 300	fail to repay		none 0			Gnut, Jbean Soy bean		Fencing Financial

Continued

No	Target Area	Chiefdom	Series	Farm ha	Fallow	house hold	Farming /family	Crops	ha	Plant month	Harvest month	Yield bag/70kg	Sell or Buy	Variety	Animals	heads	Seed	Fertilizer	Agri. chemicals	Plow	Labor	Crop gross income	Farm input	Farm net income	Non-farm income	Extension services	Association	Future crops	Future animals	Problems
17	TA2	Zikhotheni	Zk-1	3.4	0.8	1	5/13	maize	2.1	Oct	May	50	sell	Native	Cattle	30	own	2-3-2-22	L. 1 l	leased	20 manday	M 50x60	fert 1,098	M 1,137	4 (1RSA)	No	Zikhotheni FA			Fencing
								cotton	1.3	Nov	MayJul				Goat	7		15 bags		trac		3,000	ch65, pl500	L 17,700			Richard Musane			Stockborer
								beans	s	Mar	May				Pig	3		CCU					labor 700				Grazing Comm			irrigation
								ground nut	s	Nov	Feb				Chicken	20							1,863	18,837	81,200		agreed, no pra			drinking water
18	TA2	Zikhotheni	Zk-2	5	0	1	7/7	maize	4	Oct	Apr	60	sell	CG4141	Cattle	9	CCU	-22, 10bag	Stockborer	leased	70 manday	M 60x60	fert 1,207	M 1,036	WVI	No	No	Fruit trees		Drought
								beans	0.5	Feb	May				Goat	3		-38, 5bags	CCU	trac		3,600	sd97, ch60	L 6,575				(mango, orange)		Finance
								ground nut	0.5	Nov	Mar				Chicken	25		LAN 7bags		own ox			pl500, lb70	+ vege						
								vegetables	s						Duck	3		pvt					2,514	7,611	20,300					
19	TA2	Zikhotheni	Zk-3	5.7	3	1	5/12	maize	2.8	Oct	May	25	enough	Native	Cattle	8	own	2-3-2-22				M 25x60	fert 146	M 1,289						
								beans	0.5	Feb	May				Goat	1		2 bags	L. 1 l	own ox	none	1,500	chem 65	L 20,340	none	No	No			Stockborer
								Jugo beans	0.5						Sheep	38													Financial
								ground nut	s						Chicken	18													
															Duck	7							211	21,629	0					
20	TA3	Macudvulwin	Mc-1	3	0.5	1	5/5	maize	2.2	Nov	Apr	14	enough	CG4141	Goat	2	pvt	2-3-2-22	no	own	none	M 14x60	fert 440	M 303	pvt	No	No	Maize	Cattle	Financial
								sweet potato	0.1	Dec	May			Native	Chicken	15		6 bags		help each		840	seed 97	L 1,275						Water stagnants
								potato	0.1	Nov	Apr									other										
								Jugo beans	0.1	Dec	May												537	1,578	20,300					
21	TA3	Macudvulwin	Mc-2	3.5	0	2	6/15	maize	3.5	Oct	Apr	10	buy	CG4141	Cattle	9	pvt 2 bags	2-3-2-22	none	own ox	9 manday	M 10x60	fert 220	M 193	4 forest,	No	No	Sweetpotato	chicken	Financial
															Goat	4	90ES/10kg	3 bg, CCU			Es 10/day	600	sd97, lb90	L 5,520	Malkerns			potato	pig	Much water
															Chicken	4		70Es/50kg					407	5,713	81,200					
22	TA3	Macudvulwin	Mc-3	2	0	1	7/10	maize	1.4	Oct	Apr	50	sell	CG4141	Cattle	11	CCU	-38, 4bags	none	leased f	20 manday	M 50x60	fert 673	M 1,830	1 prizon of	No	No	potato		Financial
								sweet potato	0.2	**Nov**	**May**		67.5/70kg		Goat	32		Es 98/50kg		RDA	Es 10/day	3,000	seed 97	L 15,710				beans		Poor soil, partly stony
								Jugo beans	0.2	Oct	Apr		NMC		Pig	2		-22, 4bags		own ox			plow 200							
								ground nut	0.2	Oct	Mar				Chicken	8		Es 65/50kg					labor 200							
								pumpkin	mx	Oct	Dec-Mar				Duck	2		CCU					1,170	17,540	20,300					
23	TA3	Macudvulwin	Mc-4	3.9	1.5	1	12/16	maize	2.3	Nov	Apr,Ma	60	sell	PNR709	Cattle	25	PNR100/1	-38, 9bags	Gr. 2kg	lea trac	42 manday	M 60x60	fert 855	M 1,581	1, Town	No	Timeleni PA			Too much water
								sweet potato	s	Dec	May			CG4141	Goat	15	CG85/10k	Es95/50kg	pvt	own ox	Es 15/day	3,600	seed 194	L 18,600	council		Bhelina Maseko			Financial
								beans	s	Oct	Feb				Pig	1	CCU	CCU					chem 40							
								Jugo beans	s	Nov	May				Goose	1							plow 300							
								ground nut	0.2	Oct	Mar				Chicken	50							labor 630							
								spinach, cabbage, lettuce, beet root, carrot															2,019	20,181	40,600					
24	TA3	Macudvulwin	Mc-5	3.4	0.7	1	7/10	maize	2.7	Nov	May	15	enough	Native	Cattle	10	own	-22, 4 bags	Gr. 2 pack	own ox	none	M 15x60	fert 293	M 567	1, RSA	No	No	maize		Financial
								sweet potato	0.3	Dec	Jun				Goat	10		CCU	pvt			900	chem 40	L 5,800						Rocky
								beans	s	Nov	Mar				Chicken	20							333	6,367	20,300					

A.10 List of Associations in the Target Areas

(1) Associations in Kukhanyeni Inkhundla (TA1)

① Nsenga Farmers Association

Activities: Vegetables with irrigation, Warehouse is under construction. Market: NAMBOARD,

Chairman: Willie Vilakati Water is brought to a reservoir through open ditch.

Water is distributed by a pump, which is out of order at present.

② Lozicheme Farmers Association

5 ha in total, allocated already by chief and fenced already by net. Pump has been requested to

Inkundla, but not yet realized. Planned for vegetable growing, but food crops are grown,

Is not irrigated. Members: 14

③ Nyakeni 2 Women Association

Activities: Vegetables (carrot, spinach, beet root, cabbage, onion, cocoyam) with pump irrigation

Established in 1995, Chairperson: Elizabeti Dlamini, Members: 10 person x 11 plots (small)

Market: Middle men/women from Manzini, no problem of selling, E5.00/month/member

④ Eleantunja Farmers Association

Activities: Vegetables, Members: 8 persons, Annual fee: E10.00,

Plan: Drawing water from a stream where people taking drinking water

Water volume: 2.5L/minute (estimated), 70 people using the water

⑤ Shibane Farmers Association

Established in 1999, yet to start projects. Members: 30, Membership: E70.00

Plan: Vegetables to the local market and animal feed.

⑥ Vukani Kisile Bomake

Established in 1982, Activities: Maize, Sweet potato, Irish potato, Beans

Vegetables expected to be grown when water is drawn to the farm.

Members: 24, Annual fee: E50.00

⑦ Mangcineni Farmers Association

Established in 1997, Membership: E200.00, Annual fee: E20.00

Activities: Bee keeping, Fish, Chicken for egg and meat, Pig, Vegetables, Fruits

⑧ Phapahmani Bomake

⑨ Philisani Bomake

⑩ Lundvondvolo Farmers Association

⑪ Bhekinkosi Dairy Farmers

⑫ Volamehlo Farmers Association

⑬ Phambili Bobabe
⑭ Bhekinkosi Youth Garden
⑮ Mkhulamini Pigs Association
⑯ Maliyadhima Pigs Association
⑰ Shibani Bomake
⑱ Vulamehlo Farmers Association
⑲ Eni Association
⑳ Mzamo Association

(2) Associations in Shiselweni Inkndla (TA2)

① Senabelap Farmers Association
Farming, Active, Established in 1984, Members: T 100, M 70, F 30
Chairman: Bernard Nxumalo, Membership: Es 100, Annual: Es 30
Short of fertilizers

② Buhle Benkosi Farmers Association
Growing maize, beans and potatoes, Gaining, Established in 2000,
Members: T 14, M 8, F 6, Chairman: J. M. Ndlangamandla,
Membership: Es 50, Annual: Es 100,
Income to mouth, nothing left in a bank account.

③ Zamani Madoda Farmers Association (Zikhotheni)
Vegetable growing, Active, Established in 1999, Members: T 10, M 7, F 3
Chairman: Ntshangase, Membership: Es 50, Annual: none,
At present, there are problems.

④ Simunye Bomake Women's Association (Zikhotheni)
Poultry, Active, Established in 1994 (7 years), Members: T 7, F7
Chairperson: Masomalenhle Mavuso, Membership: Es 150, Annual: none
Chicken house needed.

⑤ Chubekani Hhuhhuma/Mabonabulawe Poultry Association
Earning, Established in 1995, Members: T 20, M 5, F 15
Chairperson: Mrs. Irgne Dlamini, Membership: Es 50, Annual: Es 100
Money for buying feed.

⑥ Phikelelani Bomake
Sewing, Not very active, Established in 1999, Members: T 15, F 15
Chairperson: Ndlangamandla, Membership: Es 15, Annual: 5
Place (house) for sewing needed.

(3) Associations in Ngwempisi Inkhundla (TA3)

① Phaphamani Farmers Association
Established more than 10 years ago. Water is introduced through an open ditch 1.5 km away from the land at a small up-stream. Members are 24 persons.

1,000㎡/person (10a)
5 hectares are irrigated. Chairman: Mphiaa Dlamini
Membership: E 100.00, Annual fee: E30.00, Water charge: E2.50/month
Cabbage, spinach, carrot, lettuce, tomato, beet root. Rainy season: maize
Problem: no market (competition with SA produces) and transportation
The association has been requesting MOAC to intake water from a river, the Mhlatane.

② Ndlaveli Women Association
Established in 1998. 12 members. 14 pieces of land/person. Water about 2 km away through pipe. Chairperson: Joel Dlamini, Membership: Es 300, Annual: Es 15.
Cabbage, spinach, carrot, beet root, onion, garlic, green pepper, lettus, butter nut
Buyers: middle men from Mankayane, Marketing is better in the dry season, but difficult.

③ Manti Etfu Association
Activities: garden, Established in January 2000, Members: 30, male 10, female 20,
Chairman: Albert Bhembe, Membership: E100.00, Annual fee: E50.00
Problems: Water for irrigation.

④ Bunye Bunamandla Bomake
Activities: poultry, Established in 1999, Members: 10, all female,
Chairperson: Fiteile Motsa, Membership: E100.00, Annual fee: 20.00
Problems: Finance to improve the association

⑤ Ncimeleni
Activities: Poultry, Established in 1996, Members: 18, male: 6, female: 12
Chairperson: Jane Maseko, Membership: E100.00, Annual fee: 160.00

⑥ Sitselo Semacudvulwini
Activities: Plant trees, Established in 2000, Members: 13, male 7, female 6,
Chairman: Thembisile Dlamini, Membership: E50.00
Important issue: Planting fruit trees.

⑦ Elubhaceni Women Association
Activities: poultry and bee keeping, Established in 1998, Members: 15, male 5, female 10
Chairperson: Prisilla Dlamini, Membership: E20.00, Annual fee: E120.00
Need: Roofing for poultry house

⑧ Bunye Bunmadla Association
Activities: Selling fertilizers and seed, Established in 1993, Members: 4, all male,
Chairman: Almon Zitsalala, Membership: E50.00, Annual fee: E5.00

⑨ Mthunjwa Association
Activities: Drinking water project, Established in November 2000,
Members: 20, male 7, female 13, Chairman: Steven Matenanya, Membership: E100.00

A.11 Constitution of Zikhoteni Community Garden Association

Section 1 - Name and Office

Section 1A – Name

The name of the Association shall be "Zikhotheni Community Garden Association".

Section 1B – Office

The office of the Association shall be situated at Zikhotheni.

Section 2 – Objectives

The objectives for which the Association is established are;

(a) To fight against poverty,

(b) To prevent erosion and deforestation,

(c) To empower women,

(d) To practice modern agricultural practice and farming approaches,

(e) To organize a market for members,

(f) To seek for financial assistance from Development and Financial institution for members, and

(g) To do all such other things as may be necessary for incidental to any of the aforesaid objects, or which according to the Association can be combined effectively and conveniently to further the objects of the Association.

Section 3 – Status of Association

(a) The Association shall be a corporate having a separate legal persona with perpetual succession.

(b) All title deeds transfers, mortgages and other securities shall be granted, made and taken in the name of the Association.

(c) The Association shall be capable of performing any legal act, and of suing and being sued in any court of law in its own name, and shall power to enter into contract.

Section 4 – Membership

(a) Membership is only open to Zikhotheni residents.

(b) To be a member, one should apply, then pay a joining fee of E60.00.

(c) A building fund of E500.00 is to be paid by those applicants who did not take part in the project implementation phase.

(d) Membership will not be gender biased, and all applicants must be over age of 18 and have sound mind.

(e) Application of membership shall be made to the Committee through its secretary and the Committee shall discuss such application and will recommend to a General Mass Meeting for approval.

(f) No person shall be admitted as a member if he/she is a member of another

organization whose interests may conflict with those of the Association.

(g) Failure to abide by principles of the Association will mean de-membership/terminated.

(h) Every member has got to pay his subscription fee every 12th month.

Section 5 – Termination of Membership

Membership shall be terminated by anyone of the followings:

(a) Resignation after a member has paid all subscriptions due by him/her to the Association.

(b) Expulsion from the Association for the following reasons:

① Failure to pay any sum of money due to the Association for a period of months or such other period which may be agreed by and in general meeting after considering the money owned.

② Any offence involving dishonesty on the part of the member or resulting in his imprisonment for six months or more.

③ Any action which the general meeting holds to be contrary to the interest to of the Association.

④ Failure to revive membership with the Association for two years in succession.

(c) Insanity

(d) Death

(e) Dissolution of Association

Section 6 – Executive Committee

(a) The executive committee shall be elected in a duly Constituted Meeting.

(b) The term of office of the Executive Committee shall be one (1) year.

(c) Election of Executive Committee shall be conducted on secret ballot, but nomination shall be shown of hands.

(d) The following shall form the Executive Committee.

① Chairperson

② Vice chairperson

③ Secretary

④ Vice secretary

⑤ Treasurer

⑥ Two additional members

(e) If for any reasons the annual general meeting cannot be held, the existing committee shall hold office until the election that should be held not less than four (4) months after financial year.

Section 7 – Duties of Executive Committee

A. Chairperson;

(a) Shall subject to this Constitution, preside over all meetings of the Association,

(b) Principally be responsible for the general running and well being of the Association,

(c) Represent the Association where and whenever necessary,

(d) Prepare and present annual report,

(e) Sign all cheques together with Secretary and Treasurer,

(f) In case there is a tie in voting, chairperson shall cast his/her vote, and

(g) Sign all legal documents of Association.

B. Vice Chairperson;

(a) Shall act for chairperson when absent, and

(b) Shall assist the chairperson in his duties.

C. Secretary;

(a) Together with chairperson, shall prepare notices of meetings,

(b) Shall record proceedings of meetings (minutes) and ensure that they are signed,

(c) Supervise administration of office,

(d) Shall obtain and deliver due receipts,

(e) Shall conduct any business and correspondents of the Association, and sage-guard legal documents,

(f) Ensure fining dishonest members,

(g) Shall perform all other duties assigned by the chairperson,

(h) Shall sign cheques together with chairperson and treasurer, and

(i) Shall be P. R.O. for the Association.

D. Vice Secretary;

(a) Act as secretary in secretary's absence, and

(b) Shall assist secretary where and whenever necessary.

E. Treasurer;

(a) Shall control and handle all finances and properties of the Association,

(b) Present to the Executive Committee the financial report every month,

(c) Shall prepare audited annual financial statement of account and balance sheet,

(d) Shall hand over all books of accounts to auditors,

(e) Shall sign cheques with chairperson and secretary,

(f) Shall bank all money collected and withdraw, and

(g) Shall receive money and issue receipt to secretary.

F. Two Additional Members;

(a) Shall represent the interest of all the entire membership of the Executive Committee, and

(b) Perform any other duties assigned to them by the Executive Committee.

Section 8 – Entitlement to a Fund

(a) An expelled member shall be entitled to any fund of the value of his/her funds from the Association with the exception of joining fee, building fund and

subscription fee.

Section 9 – Funds

(a) The fund of the Association shall be composed of:

① Joining/Membership fee E60.00
② Annual Subscription fee E30.00
③ Building fund E500.00
④ Plot fee E50.00
⑤ Loan from Financial Institutions
⑥ Grants/Donations
⑦ The unallocated surplus of previous years

(b) Funds shall be used solely in pursuance of the objectives the Association.

(c) No member shall be eligible for election to the Committee unless holds fully paid qualification as per (a) ① and ② of this clause.

(d) Standard book-keeping has to be practice/professional accounting procedure are to be practiced.

Section 10 – Banking Account

(a) The Association may open savings, current and call account or any other deposit account with the Development Bank of Swaziland, "Swazi Bank".

(b) Cheques shall be signed in accordance with this Constitution. (Section 12)

Section 11 – Financial Year

The financial year for the Association shall be from the first day of June to the last day of May each year.

Section 12 – Signatories

(a) Cheques, all charges or other instruments used on behalf of the Association except in case of receipts shall bear signatories of chairperson, secretary and treasure of the Association.

Section 13 – Meetings

Section 13 A. Executive Committee Meeting;

(a) Be held once every month.

(b) Two third (2/3) of Executive Committee members shall form a quorum.

(c) In case of chairperson's absence, vice chairperson takes over.

(d) Each member shall have one vote, if tie, the chairperson shall have casting vote.

(e) Seven days notice shall be given.

Section 13 B. Extraordinary Meeting

(a) Presence of two third (2/3) of members will suffice to form a quorum.

(b) Four (4) days notice shall be given of the intention to hold an extraordinary meeting.

(c) Chairperson may call meeting or members in case of urgent issues pertaining the Association.

Section 13 C. Annual General Meeting

(a) The Annual General Meeting of the Association shall be held in respect of any financial yea not later than a month after the end of financial year.
- Provided that the Executive Committee may recommend, for a good reason that Annual General Meeting held at a later date.

(b) The chairperson of the committee or the vice may summon the General Meeting.

(c) At least 14 days notice shall be given of the intention to hold the Annual General Meeting.

(d) The presence of two third (2/3) of the total members shall be necessary for any transaction or any business at the General Meeting.

(e) The Annual General Meeting shall deal with the following:

(f) Annual report by chairperson,

① An audited financial report,

② Election of new executive,

③ Budget of the following year, and

④ Other business.

Section 14 Powers and Duties of Executive Committee

The Committee shall exercise all the powers of the Association except those reserved for the General Meeting, subject to the any regulations or restrictions duly laid by the Association in a General Meeting, in the Constitution in particular they shall have the power:

(a) To confirm the minutes of previous meetings,

(b) To ensure that business is conducted in accordance with the Constitution of the Association,

(c) Ensuring maintenance of accurate accounts of all money received and spent,

(d) Shall frame rules and regulations for approval of general meeting for orderly conduct of business,

(e) Shall liaise with government ministries and examine loan applications, and

(f) Ensure that loans are used for the purpose approved for and not misused.

Section 15 – Committee's Conduct of Affairs

In their conduct of affairs of the Association, the Committee shall exercise the prudence and diligence of ordinary men of business, and shall be responsible for any loss, sustained through acts contrary to the law of the Association.

Section 16 – Auditors

(a) Neutral persons or auditors will be hired to audit the books of the company. The name of the auditor(s) will be decided at the Annual General Meeting.

(b) They have to certify that the accounts of the Association represent a true and fair

view of the financial position of the Association according to the information and explanation given and the books and records produced.

Section 17 – Disputes

(a) Any disputes shall be referred to the Disciplinary Committee.

(b) The Committee shall formulate rules of conduct and penalties for any infringement of the Constitution.

Section 18 – Amendment of Constitution

No alteration shall be made to this Constitution except at the General Meeting called especially to consider such amendment.

(a) The amendment shall then be carried by majority of the total number of members of the Association present.

Section 19 – Dissolution and Liquidation

The Association can only be dissolved by resolution passed by two third (2/3) of the total number of members present at the General Meeting especially for that purpose. Upon dissolution of the Association, the members in accordance with the Constitution after liabilities have been settled.

A.12 Constitution of Mhlatane Community Garden

Section 1 - Name and Office

The name of the Association shall be "Mthumjwa Community Garden Association".

Section 2 – Office and Address

2.1 Macudvulwini next to Mthunmjwa River

2.2 P. O. Box 26, Mankayane

Section 3 – Aims and Objectives

3.1 Aims

The aims of this Association is creating job opportunities for members, thereby fighting poverty.

3.2 Objectives:

To plant and produce fruits and vegetables in every vegetable planting season.

To farm poultry and pig throughout a year thereby creating self-employment job.

To buy farming equipment and provide farming services to nearby communities.

To buy a farm within 25 years of the operation.

To create hundred job opportunities before 2020.

Section 4 – Membership

(i) Membership is open to all residents within the Mthumjwa and Jobe communities, provided they;

- Pay a joining fee of E100.00 (Joining fee E20.00 and Development fund E80.00).
- Must pay E500.00 as building fund if one did not contribute physical labor at the implementation of JICA projects
- Must be over the age of 18, whether man or woman.
- Apply for membership, through the Secretary in writing, and such application is forwarded to the Executive and finally to the general meeting for approval.
- Shall abide by the constitution of the Association, which is the supreme law of the Association.

Section 5 – Status of Association

(d) The Association shall be a corporate having a separate legal persona with perpetual succession.

(e) All title deeds transfers, mortgages and other securities shall be granted, made and taken in the name of the Association.

(f) The members of Association shall be jointly and separately liable for the debts of the Association

(g) The Association shall be capable of performing any legal act, and of suing and being sued in any court of law in its own right and name, and shall power to

enter into contract.

(h) Any legal process may be served upon the Association by delivery thereof to its chairperson or secretary or at its own office to the person in-charge thereof.

Section 6 – Requirement for Admission – As a Member

Every member on admission shall:

(a) Sign his/her name in presence of two witnesses that is a token of his/her acceptance of the Association.

(b) Pay such membership fee, building fund as decided from time to time by the General Meeting of members.

(c) Nominate a person to who if any interest in the capital of the Association shall be paid in the event of his/her death.

Section 7 – Termination of Membership

Membership shall be terminated by anyone of the followings:

(f) Resignation after a member has paid all subscriptions due by him/her to the Association together with any amount or sum of money (if any) that he/she owes to the Association.

(g) Expulsion from the Association for the following reasons:

⑤ Failure to pay any sum of money or assets due to the Association for a period of six (6) months or such period as the General Meeting may agree upon.

⑥ Any offence involving dishonesty on the part of the member or resulting in his imprisonment for six months or more.

⑦ Any action that the General Meeting holds to be contrary to the interest to of the Association.

⑧ Failure to revive membership with the Association for two years in succession.

(h) Insanity

(i) Death

(j) Dissolution of the Association

(k) Voluntary resignation

Section 8 – Executive Committee

(f) The executive committee shall be elected in a duly Constituted Meeting.

(g) The term of office of the Executive Committee shall be one (1) year.

(h) Election of Executive Committee shall be conducted on secret ballot, but nomination shall be shown of hands.

(i) The following shall form the Executive Committee.

⑦ Chairperson

⑧ Vice chairperson

⑨ Secretary

⑩ Vice secretary

⑪ Treasurer

⑫ Two additional members

(j) If for any reasons the annual General Meeting cannot be held, the existing committee shall hold office until the election that should be held not less than four (4) months after financial year.

Section 9 – Duties of Executive Committee

A. Chairperson;

(h) Shall subject to this Constitution, preside over all meetings of the Association,
(i) Primarily be responsible for the general running and well being of the Association,
(j) Represent the Association where and whenever necessary,
(k) Prepare and present annual report,
(l) Sign all cheques together with Secretary and Treasurer,
(m) In case there is a tie in voting, chairperson shall cast his/her vote, and
(n) Sign all legal documents of Association.

B. Vice Chairperson;

(c) Shall act for chairperson when absent, and
(d) Shall assist the chairperson in his duties.

C. Secretary;

(j) Together with chairperson, shall prepare notices of meetings,
(k) Shall record proceedings of meetings (minutes) and ensure that they are signed,
(l) Supervise administration of office,
(m) Shall obtain and deliver due receipts,
(n) Shall conduct any business and correspondents of the Association, and sage-guard legal documents,
(o) Ensure fining dishonest members,
(p) Shall perform all other duties assigned by the chairperson,
(q) Shall sign cheques together with chairperson and treasurer, and
(r) Shall be P. R.O. for the Association.

D. Vice Secretary;

(c) Act as secretary in secretary's absence, and
(d) Shall assist secretary where and whenever necessary.

E. Treasurer;

(h) Shall control and handle all finances and properties of the Association,
(i) Present to the Executive Committee the financial report every month,
(j) Shall prepare audited annual financial statement of account and balance sheet,
(k) Shall hand over all books of accounts to auditors,
(l) Shall sign cheques with chairperson and secretary,
(m) Shall bank all money collected and withdraw, and
(n) Shall receive money and issue receipt to secretary.

F. Two Additional Members;

(c) Shall represent the interest of all the entire membership of the Executive Committee, and

(d) Perform any other duties assigned to them by the Executive Committee.

Section 10 – Entitlement to a Fund

(e) An expelled member shall be entitled to any fund of the value of his/her funds from the Association with the exception of joining fee, building fund and subscription fee.

Section 11 – Funds

(a) The fund of the Association shall be composed of:

①	Joining/Membership fee	E20.00
②	Development fund	E80.00
③	Annual Subscription fee	E30.00
④	Building fund	E500.00
⑤	Plot fee	E50.00
⑥	Loan from Financial Institutions	
⑦	Grants/Donations	
⑧	The unallocated surplus of previous years	

(f) Funds shall be used solely in pursuance of the objectives the Association.

(g) No member shall be eligible for election to the Committee unless holds fully paid qualification as per (a) ① and ② of this clause.

(h) Standard book-keeping has to be practice/professional accounting procedure are to be practiced.

Section 12 – Banking Account

(c) The Association may open savings, current and call account or any other deposit account with the Development Bank of Swaziland, "Swazi Bank".

(d) Cheques shall be signed in accordance with this Constitution. (Section 12)

Section 13 – Financial Year

The financial year for the Association shall be from the first day of June to the last day of May each year.

Section 14 – Signatories

(b) Cheques, all charges or other instruments used on behalf of the Association except in case of receipts shall bear signatories of chairperson, secretary and treasure of the Association.

Section 15 – Meetings

Section 15 A. Executive Committee Meeting;

(f) Be held once every month.

(g) Two third (2/3) of Executive Committee members shall form a quorum.

(h) In case of chairperson's absence, vice chairperson takes over.

(i) Each member shall have one vote, if tie, the chairperson shall have casting vote.

(j) Seven days notice shall be given.

Section 15 B. Extraordinary Meeting

(d) Presence of two third (2/3) of members will suffice to form a quorum.

(e) Four (4) days notice shall be given of the intention to hold an extraordinary meeting.

(f) Chairperson may call meeting or members in case of urgent issues pertaining the Association.

Section 15 C. Annual General Meeting

(g) The Annual General Meeting of the Association shall be held in respect of any financial yea not later than a month after the end of financial year.

- Provided that the Executive Committee may recommend, for a good reason that Annual General Meeting held at a later date.

(h) The chairperson of the committee or the vice may summon the General Meeting.

(i) At least 14 days notice shall be given of the intention to hold the Annual General Meeting.

(j) The presence of two third (2/3) of the total members shall be necessary for any transaction or any business at the General Meeting.

(k) The Annual General Meeting shall deal with the following:

(l) Annual report by chairperson,

⑤ An audited financial report,

⑥ Election of new executive,

⑦ Budget of the following year, and

⑧ Other business.

Section 16 Powers and Duties of Executive Committee

The Committee shall exercise all the powers of the Association except those reserved for the General Meeting, subject to the any regulations or restrictions duly laid by the Association in a General Meeting, in the Constitution in particular they shall have the power:

(g) To confirm the minutes of previous meetings,

(h) To ensure that business is conducted in accordance with the Constitution of the Association,

(i) Ensuring maintenance of accurate accounts of all money received and spent,

(j) Shall frame rules and regulations for approval of general meeting for orderly conduct of business,

(k) Shall liaise with government ministries and examine loan applications, and

(l) Ensure that loans are used for the purpose approved for and not misused.

Section 17 – Committee's Conduct of Affairs

In their conduct of affairs of the Association, the Committee shall exercise the prudence and diligence of ordinary men of business, and shall be responsible for any loss, sustained through acts contrary to the law of the Association.

Section 18 – Auditors

(c) Neutral persons or auditors will be hired to audit the books of the company. The name of the auditor(s) will be decided at the Annual General Meeting.

(d) They have to certify that the accounts of the Association represent a true and fair view of the financial position of the Association according to the information and explanation given and the books and records produced.

Section 19 – Disputes

(c) Any disputes shall be referred to the Disciplinary Committee.

(d) The Committee shall formulate rules of conduct and penalties for any infringement of the Constitution.

Section 20 – Amendment of Constitution

No alteration shall be made to this Constitution except at the General Meeting called especially to consider such amendment.

(b) The amendment shall then be carried by majority of the total number of members of the Association present.

Section 21 – Dissolution and Liquidation

The Association can only be dissolved by resolution passed by two third (2/3) of the total number of members present at the General Meeting especially for that purpose. Upon dissolution of the Association, the members in accordance with the Constitution after liabilities have been settled.

Section 22 – Payment to Committee Members

No members of the Committee shall receive payment of any kind, for service given without the approval of the Executive Committee, provided that reasonable out-of-pocket expenses incurred on the business undertaken on behalf of the Association may reimburse to the maximum amount shown in the receipt, as passed by the General Meeting.

Section 23 – Business Payment

All business shall be conducted on cash basis and no credit shall be allowed, save as provided in this Constitution.

Section 24 – Security of Goods

Provided that the Association has funds available, it may make advances to members upon the security of goods delivered to the Association by members for marketing, on amount of money which shall not exceed seventy-five percent (75%) of local value of the goods as estimated by the Executive.

Section 25 – Application of Loan

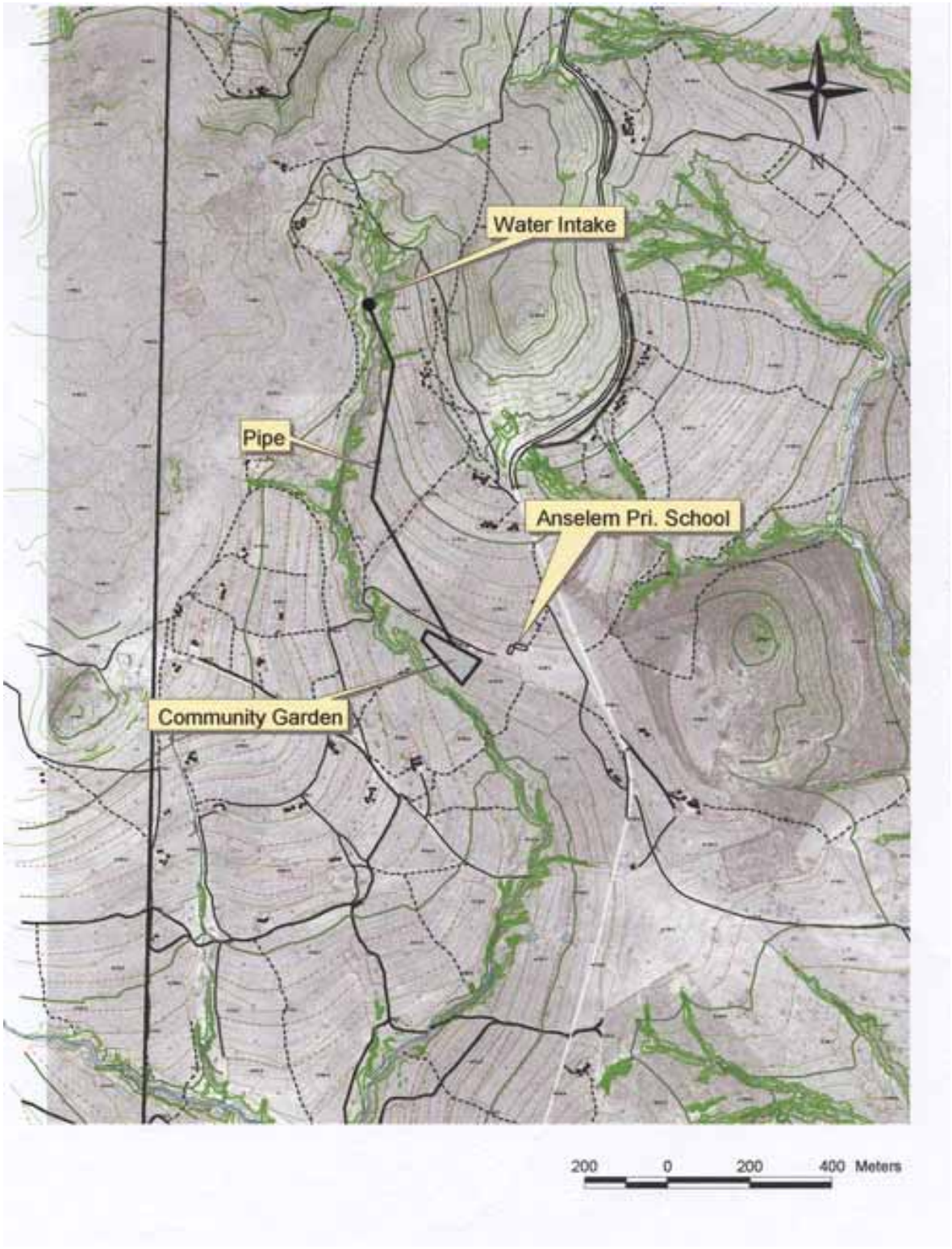
Application for loans shall be made in writing in accordance with procedures laid down by the Committee from time to time, and shall state the purpose of the loan, the security proposed, the name of two guarantors, the period of the loan and terms of repayment requested.

Section 26 – Approvals of Loans

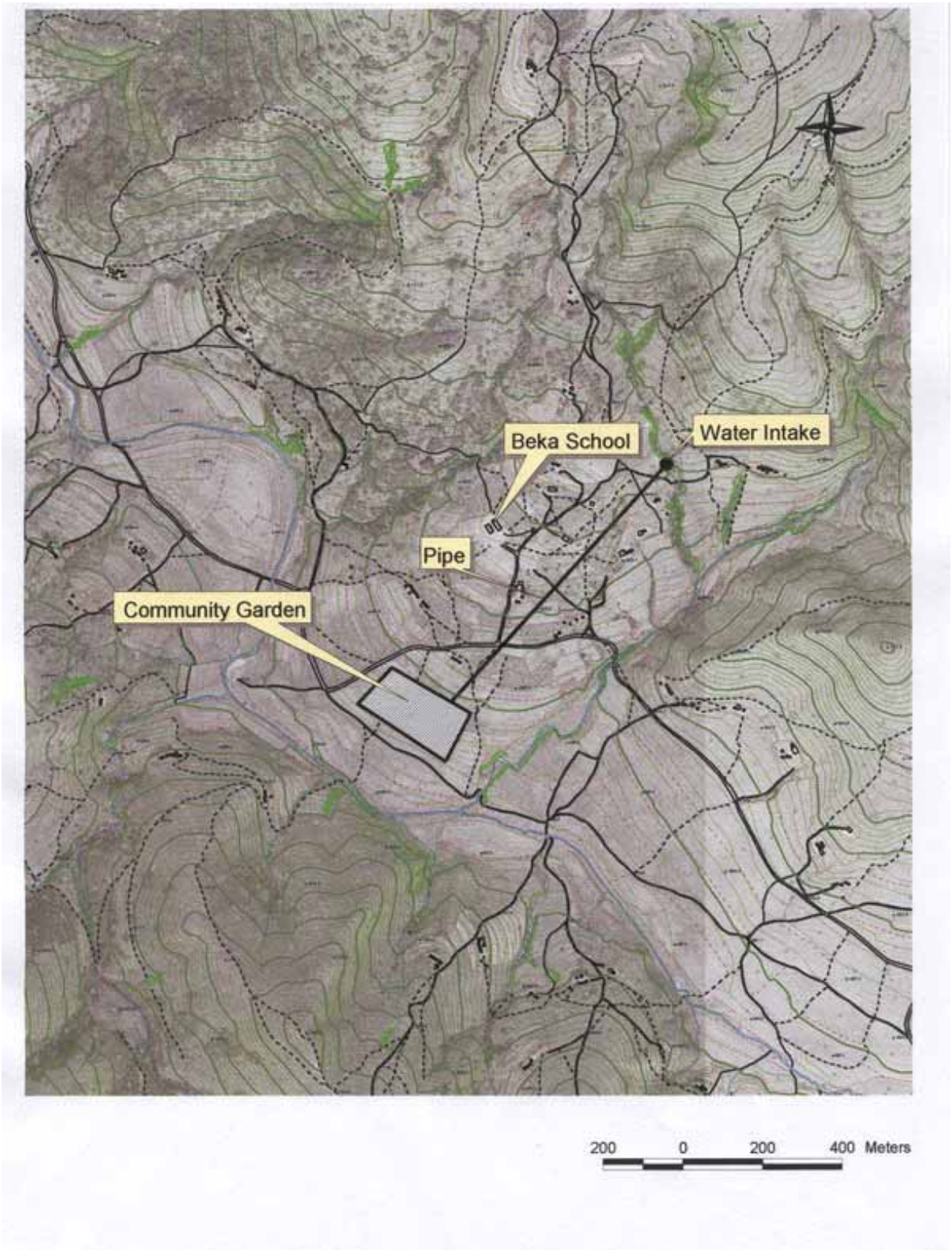
(a) No loan shall be granted unless the majority of the Committee and all members present at the meeting when application is considered approval.

(b) Before approval of loan the Committee shall satisfy itself that indeed the loan is for productive purpose.

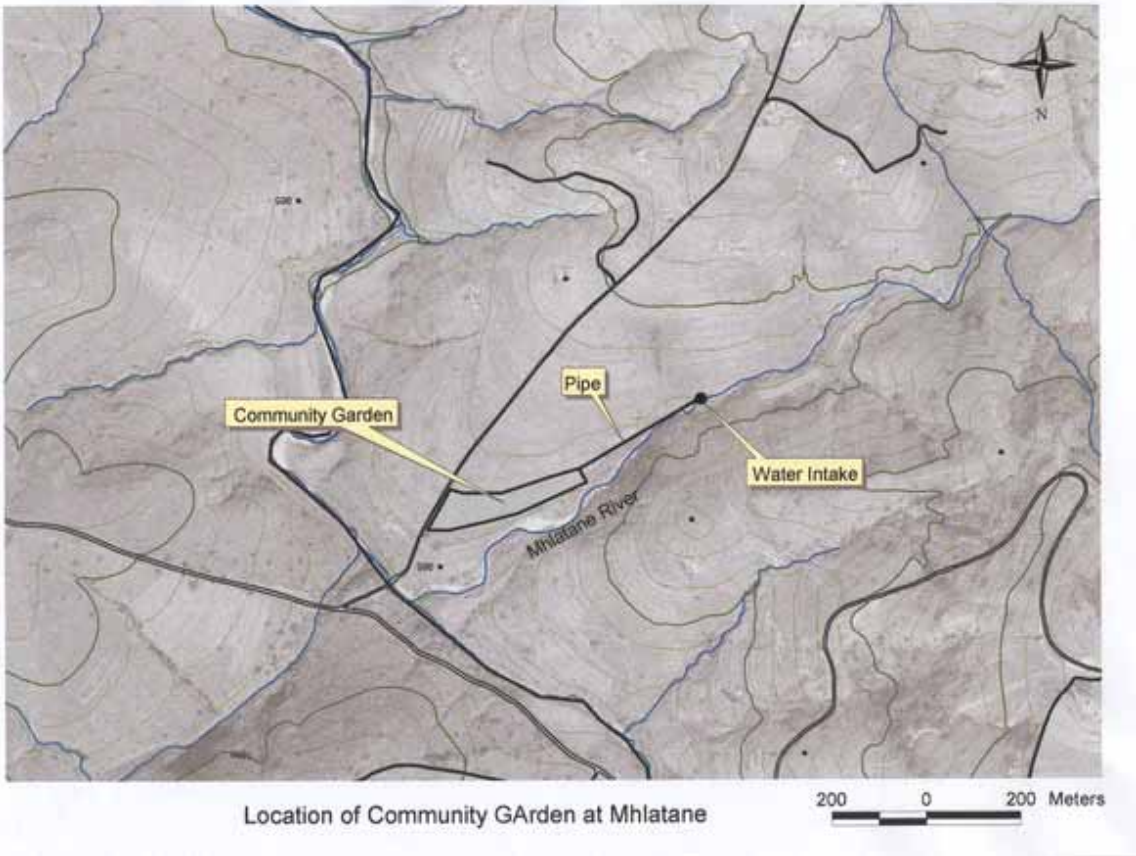
A.13 Location of Zikhoteni Community Garden



A.14 Location of Mbeka Community Garden



A.15 Location of Mhlatane Community Garden



Annex B

B Agro-Forestry and Community Forestry

B.1 Energy Consumption and supply in Target Areas

B.1.1 Firewood consumption in sampled chiefdoms

Firewood harvesting for domestic purpose has rightly been identified as one of the major causes of land degradation in the Target areas. In fact, study by FAO has indicated that in Africa, approximately 90 % of all trees cut are for firewood purposes. This also applies to Swaziland where large proportion of people in rural areas continues to rely on firewood. To get an idea of firewood consumption for planning purposes, a study of firewood consumption was undertaken among households in the nine chiefdoms, which were earlier selected for further investigation.

Hence, on the whole 147 households in Target Areas were visited and interviewed on firewood consumption. In addition, information on use of kerosene and Liquefied Petroleum Gas (LPG) was obtained. For each Target Area, a random sampling of 15 households of pre-selected chiefdom was undertaken, with the assistance of local enumerators who had been given initial training on sampling methodology. The survey indicated that 87 % of the households regularly use firewood for domestic cooking. Survey data on other forms of energy, namely kerosene and LPG indicated that 85% and 44% of households use these other forms of energy respectively.

Table B-1 indicates that average per capita firewood consumption in the three target areas varies from 409 to 631 kg per annum with an overall average of 527 kg. Consumption observed in other African countries indicates a per capita of approximately 690 kg per annum. Hence the observed per capita consumption in Swaziland generally agrees with that obtained in other countries even though it is 24% lower than that of other countries' consumption. Lower consumption rates per households or per person are often associated with acute scarcity of firewood. It can therefore be concluded that in the Target area, there is acute scarcity of firewood. In fact, 78% of respondents said they experienced firewood problem.

The other major observation in the survey is that considerable number of households (61%), regularly buy firewood for their use. Average firewood expenditure per household ranged from E 354 to E1225 per annum with an overall average of E763 per household per annum. If efforts to eradicate poverty are to be tackled properly, the issue of sustainable firewood supply must be addressed to ensure that the limited family income spent on firewood purchase is minimized and used for other developmental households needs.

Table B-1: Firewood consumption in the three Target areas

Chiefdom Name	HseSize Average	Total Hseholds	Fwcons kg/hse/yr	Fwcons kg /.capita	Population	Chiefdom cons Tons/yr	Fwexp E/hse/yr
Target Area 1							
Nkiliji	6.8	250	2,842	417	1,704	711	585
Eni	6.9	59	2,924	425	406	173	207
Ngcayini	6.8	81	2,627	385	552	213	270
Average	6.8		2,798	409			354
Target Area 2							
Manyandzeni	8.1	300	4,061	500	2,435	1,218	1,440
Ezikhoteni	6.8	721	3,200	469	4,918	2,307	767
Mahagane	6.8	357	5,183	760	2,435	1,850	1,467
Average	7.3		4,148	576			1,225
Target Area 3							
Mgazini	6.8	595	1,749	256	4,058	1,041	1,365
Macudvulwini	6.8	595	6,856	1,005	4,058	4,079	0
Average	6.8		4,303	631			683
Overall Average	7.0		3,680	527			763
Total 9 Chiefdoms		20,566				11,592	110,052

B.1.2 Firewood Consumption in Target Area

Using the observed firewood consumption rates, a conservative annual firewood requirement for the sampled 8 chiefdoms is 11,592 tonnes. When all the chiefdoms in the target areas are taken into account, annual consumption in TA1, TA2, and TA3 are 8,193, 9,191, and 18,928 tonnes respectively. Grand total annual firewood consumption for the three areas therefore amounts to 36,312 tonnes. Detailed consumption of firewood at chiefdom level is indicated in

Table B-2.

Table B-2: Population and fuelwood consumption projection 2000 to year 2020 tonnes/year

TAs	Chiefdom Names	No. of Homesteads	No. of HH	Population 1997	Population 2000	Firewood consumption per annum (tonnes/yr)				
						2000	2005	2010	2015	2020
(TA-1)	Eni	50	59	375	406	166	190	217	248	283
	Moyeni	81	96	607	657	269	307	351	401	458
	Butfongweni	63	75	472	511	209	239	273	312	356
	Maliyaduma	160	190	1,199	1,299	531	607	693	792	905
	Ngwazini	192	228	1,439	1,558	637	728	832	950	1,086
	Mbeka	65	77	487	528	216	247	282	322	368
	Nswaceni	51	61	382	414	169	193	221	252	288
	Mkhulamini	320	381	2,398	2,597	1,062	1,214	1,387	1,584	1,810
	Sankolweni	47	56	352	381	156	178	204	233	266
	Ngcayini	68	81	510	552	226	258	295	337	385
	Ntunja	58	69	435	471	193	220	251	287	328
	Nkiliji Royal	210	250	1,573	1,704	697	796	910	1,040	1,188
	Nyakeni	740	880	5,545	6,006	2,456	2,806	3,206	3,663	4,185
	Bhekinkosi	280	333	2,098	2,273	929	1,062	1,213	1,386	1,584
	Nsenga	83	99	622	674	276	315	360	411	469
	Sub-total	2,468	2,935	18,492	20,031	8,193	9,360	10,694	12,217	13,958
(TA-3)	Bhadzeni II Royal Kraal 2	230	274	1,723	1,867	1,178	1,346	1,537	1,757	2,007
	Dladleni	68	81	510	552	348	398	455	519	593
	Lushikishini	758	902	5,680	6,152	3,882	4,435	5,067	5,789	6,614
	Macudvulwini	500	595	3,746	4,058	2,561	2,926	3,342	3,819	4,363
	Mahhashini	44	52	330	357	225	257	294	336	384
	Bhadzeni I	250	297	1,873	2,029	1,280	1,463	1,671	1,909	2,181
	Mgazini	500	595	3,746	4,058	2,561	2,926	3,342	3,819	4,363
	Khabonina	200	238	1,499	1,623	1,024	1,170	1,337	1,527	1,745
	Ngcoseni	246	293	1,843	1,997	1,260	1,439	1,644	1,879	2,146
	Velezizweni	900	1,070	6,743	7,305	4,609	5,266	6,016	6,874	7,853
	Sub-total	3,696	4,396	27,693	29,997	18,928	21,625	24,707	28,227	32,249
(TA-2)	Manyandzeni	300	357	2,248	2,435	1,402	1,602	1,831	2,091	2,389
	Mchinsweni	300	357	2,248	2,435	1,402	1,602	1,831	2,091	2,389
	Mabona	635	755	4,758	5,154	2,969	3,392	3,875	4,427	5,058
	Dumenkungwini	125	149	937	1,015	584	668	763	871	996
	Zikhotheni	606	721	4,541	4,918	2,833	3,237	3,698	4,225	4,827
	Sub-total	1,966	2,338	14,731	15,956	9,191	10,501	11,997	13,706	15,659
Total		8,130	9,669	60,916	65,985	36,312	41,486	47,397	54,151	61,867

Table B-3 indicates total consumption of firewood in the various Target areas based consumption at chiefdom level. Projection of consumption to year 2020 is based on the estimated population growth at the rate of 2.7 %. Consumption is projected to year 2020

using the same growth rate as that of population. Population is estimated to grow at 2.7% between the five years intervals.

Table B-3: Projected firewood consumption in the Target Areas in tonnes.

Target areas	Yr 2000	Yr 2005	Yr 2010	Yr 2015	Yr 2020
TA 1	8,193	9,360	10,694	12,217	13,958
TA2	9,191	10,501	11,997	13,706	15,659
TA3	18,928	21,625	24,707	28,227	32,249
Total	36,312	41,486	47,397	54,151	61,867

Gross total firewood consumption of 36,312 tonnes per year increases to 61,867 tonnes per year by 2020.

Other than firewood, households were also asked if the used kerosene and LPG and how much each of the quantity. It was observed that 81 % of households used Kersone, mainly for lighting. As for LPG, 43 % of households use it mainly for cooking. Per capita use of the two energy types is indicated in table B-4. It would appear that TA-3 consumption of these other forms of energy is higher than in other TAs. One of the possible reasons is that the people may have higher income than in other TAs.

Table B-4: Mean annual consumption of Kerosene and LPG in the target areas.

Target Area	Kerosene (Litres/person/year)	Lpg (Kg/person/year)
TA1	16.5	18.9
TA2	16.5	17.5
TA3	38.6	54.2
Overall per capita	25.5	37.3

B.2 Sustainable firewood supply

Survey of major vegetation types in the Target Areas indicated that an average yield of wattle trees was low and ranged from 4m3/ha/yr to 9 m3/ha/yr. On the other hand, yield of eucalyptus woodlots was slightly higher with an average yield ranging from 13m3/ha/yr to 24m3/ha/yr/. Detailed yield of the various woodlots is indicated in Tables 4 to 5. In addition to the woodlots, considerable firewood is obtained from the remnant natural vegetation and also from agricultural residue during harvest time. During the survey, 47 percent of all households surveyed indicated that they use crop residue. Ideally crop residue is better recycled back to the land for soil fertility.

Table B-5: Yield of Wattle Woodlots in Target Area

Target Area	Wd No	n	Girth cm	Ht m	Vol m3/ha	Yield m3/ha/yr
T1	Wd1	47	30.3	15	73	9
T2	Wd 1	87	38	14	60	7.4
T2	Wd2	30	36	8	29	3.7
T2	Wd3	15	25	8	8	0.9
Average			33	10	32	4.0
T3	Wd 1	31	34	8	39	4.9
T3	Wd2	42	31	8	60	7.5
T3	Wd3	61	17	8	16	2.0
Average			27	8	39	4.8

Table B-6: Yield of Eucalyptus Woodlots in the Target Areas

Target Area	Wd No	N	Dbh cm	Ht m	Vol m3/ha	Yield m3/ha/yr
T1	Wd 1	113	12.5	15	274.1215	34
T1	Wd 2	87	11.5	16	183.3	23
T1	Wd 3	64	14.0	20	179.8	22
T1	Wd4	73	13.7	22	137.7	17
Average		84	13	18	194	24
T2	Wd 1	38	12.0	15	79.11	10
T2	Wd 2	26	17.5	15	125.2	16
Average		32	15	15	102	13
T3	Wd 1	79	10.5	18	159.6	20

B.3 Energy balances in the Target Areas

Taking into account consumption of firewood and its supply from the major vegetation types, energy balances have been computed for the three Target Areas as per table 6. The energy supply is based on sustainable annual production of the different vegetation types. Balances are obtained by getting the difference between supply and the observed consumption. In case A, balances are computed on the assumption that the various woodlots are used for firewood. Case B assumes that only about 35% of yield (these are branches, tops and other logging by product) is devoted to firewood and the rest is used for poles and other purposes. This is the most likely scenario.

Table B-7: Energy balances in the Three Target Areas

Forest types	Area of major vegetation	Annual Productivity m3/ha/yr	Annual Supply m3/yr	Observed Consumption m3/yr	Balances: (Deficits) Case A: m3/yr	Balances: (Deficits) Case B: m3/yr
TA1						
C1	292	9.2	2,673			
C2	7	24.2	162			
C3	86	5.0	430			
O1	20,168	0.2	3,025			
Subtotal	20,553		6,290	11,470	(5,180)	(7,302)
TA2						
C1	65	4.0	263			
C2	62	12.8	786			
C3	-	4.0	-			
O1	12,444	0.2	1,867			
Subtotal	12,571		2,916	12,867	(9,952)	(10,633)
TA3						
C1	910	4.8	4,389			
C2	1	19.9	22			
C3	1,491	7.0	10,435			
O1	28,499	0.2	5,130			
Subtotal	30,901		19,976	26,500	(6,524)	(16,174)
Grand Total	64,025		29,181	50,837	(21,655)	(34,109)

Notes:

C1: Wattle forestry and woodlots
C2: Eucalyptus woodlots
C3: Mixed forestry of wattle and natural vegetation
O1: Other formations grazing and fields
Balances Case A: Assumes eucalyptus and wattle woodlots are all used for firewood
Balances Case B: Assumes eucalyptus and wattle woodlots are used mainly for poles and only about 35 % of volume is available for firewood, the most likely event

One major conclusion is that all the three Target Areas are in serious energy deficits as indicated in Table 6. Overall deficit is 34,109 cubic metres and when computed on per capita basis, the deficits are 255, 467, and 377 kg respectively. When the per capita consumption of 409, 576, and 631 kg for TA-1, TA-2, and TA-3 respectively are taken as the required demand, percentages of deficits to the required firewood are as indicated in Table 7. According to FAO classification, any deficit more than 35 % is considered acute scarcity situation. All the TAs are in acute scarcity, the most severe situation being in TA2 at 81% followed by TA1 at 62% and TA3 is relatively better off due to its more extensive forests.

Table B-8: Severity of firewood shortages in the Target Areas

Target area	Consumption kg/person/yr	Deficit Kg/person/yr	Deficit Percentage (%)
TA1	409	255	62
TA2	576	467	81
TA3	631	377	60
Overall	527	362	69

B.4 Model of Financial Analysis of Tree Nursery Production

An integrated tree nursery is a major component, which has been proposed in each of the Target Area. Besides provision of seedlings for planting as per the Master Plan components, the nurseries are profitable and cost effective income generating activities as the following financial analysis has indicated for the period 2004 to 2020, using the costs obtained from the pilot nursery.

Table B-9: Model of Financial analysis of Tree Nursery Production

Nursery annual seedlings production			200,000 units		Rates per unit	Small plants E1.05	Large plants E2.5
Year	Building Cost E	Tools & equip E	Consumable Material E	Labour E	Total cost E	Annual Revenue E	Annual Margin E
2004	477,514	7,606	35,859	19,267	540,245	239,000	(301,245)
2005			35,859	19,267	55,126	239,000	183,874
2006			35,859	19,267	55,126	239,000	183,874
2007			35,859	19,267	55,126	239,000	
2008		7,606	35,859	19,267	55,126	239,000	176,269
2009			35,859	19,267	55,126	239,000	183,874
2010			35,859	19,267	55,126	239,000	183,874
2011			35,859	19,267	55,126	239,000	183,874
2012		7,606	35,859	19,267	62,731	239,000	176,269
2013			35,859	19,267	55,126	239,000	183,874
2014			35,859	19,267	55,126	239,000	183,874
2015			35,859	19,267	55,126	239,000	183,874
2016			35,859	19,267	55,126	239,000	183,874
2017			35,859	19,267	55,126	239,000	183,874
2018			35,859	19,267	55,126	239,000	183,874
2019			35,859	19,267	55,126	239,000	183,874
2020		7,606	35,859	19,267	62,731	239,000	176,268
Building cost		477,514				IRR	61%
Tools/equipment		7,606				NPV	E774,844
Shade Material		25,880				PMT	E 67,070
Consumables		15,000					
Total nursery cost		526,000					

Notes:

1. The above costs are based on the pilot project nursery. Cost of buildings and fencing amounts to E 477,514.40. and occurs only at the beginning.
2. The building can be give a life span of 30 years while Tools and Equipment would be 5 years.
3. Consumables are used annually and are directly proportion to the seedling production per annum.
4. Labour is most demanded in winter when farming activities are very low and can be done at family level. It is part time labour in most cases.
5. Water cost is assumed at rural flat rate, which goes to minor repairs of gravity fed water system.
6. Selling price of small seedling uses the currently low price at E1.05 per unit for 90% production. There is scope for better prices comparing selling prices in other countries, which are in order of E 3.
7. The bigger seedlings for sale for fruits and ornamental trees can fetch a price of E2.5 for the 10% production.

The above model indicates that a nursery is indeed a profitable operation. The above model took into account cost of fairly expensive initial infrastructure and yet showed an internal rate of return of 61% indeed a very good rate. Investment can be profitably made on nurseries. The Net Present Worth, NPV is good at **E 774,844**.

Table B-10: Detailed analysis of the various cost components.

For a nursery production of 200,000 seedlings the annual recurrent costs would be as:						
Items		Units	rate E	Total Cost E	Rate E	
Vinyl pots	0.5 litres	180,000	0.091	16,380	1.05	E 189,000
Vinyl pots	3.5 litres	20,000	0.3255	6,510	2.5	E 50,000
Fertilizer				3,500		
Chemicals				2,941		
Soils				2,500		
Water at flat rural rate		12	120	1,440		
Subtotal consumable				33,271		
Shade annual cost (5yrs)				2,588		
Total consumable				35,859		
Labour		Mandays				
Mixing soil		50				
Germination bed		60				
Pot filling		333				
Transplanting		200				
Maintenance		320				
Total labour		963	20	19,267		

The next table examines annual profitability of tree nursery when the cost of infrastructure is discounted over 30 years. If the building cost is discounted over the 17 years period, its annual cost will be E 67,070 per annum using an annual rate of 12%.. For annual profitability, the situation would look like the following table.

Table B-11: Annual Profitability of the Model Nursery in Emalangeni

Nursery annual seedlings production 200,000 units					Rates per unit	Small plants E1.05	Large plants E2.5
Year	Building Cost	Tools Equipment E	Consumable Material E	Labour E	Total annual cost E	Annual Revenue E	Annual Margin E
2004	67,070	7,606	35,859	19,267	129,801	239,000	109,199
2005	67,070		35,859	19,267	122,196	239,000	116,804
2006	67,070		35,859	19,267	122,196	239,000	116,804
2007	67,070		35,859	19,267	122,196	239,000	116,804
2008	67,070	7,606	35,859	19,267	129,801	239,000	109,199
2009	67,070		35,859	19,267	122,196	239,000	116,804
2010	67,070		35,859	19,267	122,196	239,000	116,804
2011	67,070		35,859	19,267	122,196	239,000	116,804
2012	67,070	7,606	35,859	19,267	129,801	239,000	109,199
2013	67,070		35,859	19,267	122,196	239,000	116,804
2014	67,070		35,859	19,267	122,196	239,000	116,804
2015	67,070		35,859	19,267	122,196	239,000	116,804
2016	67,070		35,859	19,267	122,196	239,000	116,804
2017	67,070		35,859	19,267	122,196	239,000	116,804
2018	67,070		35,859	19,267	122,196	239,000	116,804
2019	67,070		35,859	19,267	122,196	239,000	116,804
2020	67,070	7,606	35,859	19,267	129,801	239,000	109,199
					Average margin E		115,015

The above model indicates that on annual basis, investment on nursery is profitable with an average margin of E 115,015. This is the money, which should be shared as dividends and

some to go to the community kitty to be used or saved for another community project of their choice. In other countries, notably Kenya, very many low-resource people have resorted to nursery activities as an income generating venture. Discussion and observation of increasingly large number of such people indicates that the business is sustainable and profitable.

B.5 Integrated Nursery Guidelines

B.5.1 Background

The establishment of an integrated tree nursery in TA2 is meant to solve some of the problems, which have been identified by the community in several brainstorming workshops. There is conspicuous lack of trees and fruits in Shiselweni and the major reason given was that people have great difficulties in procuring tree seedlings and fruit trees for their fields and use in rehabilitation programme. The proposed nursery aims at producing both fruit and tree seedlings for the community. The nursery will also serve as a training area in some of technical issues such as grafting of seedlings and implementation of some of the agroforestry technologies, which are proposed.

B.5.2 Technical Aspect

The nursery will be located in Zikhoteni Chiefdom next to St Aselem School (Coordinates: South 27, 19978: East 031 42357 at the water tank) and will have a seedling capacity of about 160,000 seedlings per year. Initial stock of seedlings will be lower but this is expected to rise with demand and hence a larger nursery has been planned.

The nursery will obtain water from the adjacent stream. Water requirements for the nursery are approximately 15 m^3 per day and the proposed source has about 0.25litres per second or 20m^3 per day, which is generally enough for the nursery. In case of drought the water can be supplemented with the upper mainstream water.

B.5.3 Ownership and Management

Unlike the other tree nurseries in Swaziland that are owned and managed by the Government, this nursery will be managed and owned by the local community. The community has requested for the nursery and has also agreed to do cost sharing by provision of the necessary labour and subsequent maintenance. To make the nursery sustainable, a specific nursery committee is the process of being constituted. Division Forestry will initially assist by providing nursery technician for some initial months.

B.5.4 Detailed Planning.

a. Purpose

The proposed integrated tree nursery will produce tree and fruit seedlings, which will be used for afforestation and agroforestry purposes in Target Area 2. In addition, the nursery will serve as a training and demonstration centre for agroforestry technologies recommended as a package for soil fertility improvement.

b. Site

The nursery will be located in Target Area 2, at Zikhoteni Chiefdom, next to St Aselem School along Galilee/Jericho road and about 4.5 Km from Tarmac Road. The site has a gentle slope, covered with grass and is well drained into a permanent stream. Coordinates of the site selected are: South 27, 11, 56.9: East 031 25 29.2.

c. Area

The area reserved for nursery is 1 ha or 10,000 m2. Actual nursery will only occupy 3000 m2, which is about one third of the total area reserved for the nursery. The balance of the area will be used for demonstration of improved fallow and growth of recommended trees species. General layout will be as per figures 1 and 2.

d. Specification notes on the integrated tree nursery:

1. The area to be fenced off will be one ha, namely 100 metres by 100 metres as indicated on the ground by the elders.
2. The area to be used by the nursery will be 3,000 square metres and it is only this area that terraces will be made. The rest of the area will be used for demonstration of agroforestry technologies, training on grafting of fruit trees and tree seedlings, tree species trial, and improved fallow demonstration.
3. The main nursery area will be 75 metres by 40 metres. It will have four parallel terraces along the contour lines as indicated in Figure 1. It will be located at the bottom side of the main nursery compound for ease of irrigation.
4. The size of each seedbed will be 10 metres long and 1.2 metres wide.
5. Seedbeds to be lined up with bricks on the edges to support potted plants and seedbed soil.
6. Removable nursery bed shade will be constructed at one metre above seedlings level and will be made of 50% nets, and treated wooden posts.
7. Spacing between each row will 0.8 metres and across row will be 1.5 metres
8. Each terrace will accommodate three rows of seedbeds and initially each row will be made of three seedbeds as indicated.
9. Grass strips will separate the terraces and a few shade trees will be planted along the terraces.
10. Concrete water tank will be installed at the upper side of the nursery ground to be able to supply water to all parts of the nursery as well as the adjacent school.
11. The water tank will hold 70 cubic metres of water and will have a diameter of 6 metres and height of 2.5 metres. Wall thickness will be 25 cm and the inside will be plastered using cement sand, waterproof cement, and reinforced by chicken wire.
12. Nursery shed will be 450 m2 with 10 metres wide and 15 metres long. Posts will be made of concrete and 2.5 metres from ground level. Roof will be made of brick tiles. Removable nets on sides will be 80% shade.

13. Lighthouse with semitransparent shed will be constructed as indicated in figure 2 to cover ground area of 225m2 (15 metres x 15 metres). This will be made of wooden poles and semitransparent nets.

14. An office made of brick wall and roof will be constructed to accommodate office/classroom and storage area near the entrance. Total space will be 50 m2 or 5 metres x 10 metres. It will be partitioned into an office/cum classroom-5 metres x 6 metres and a store 5metres x 4 metres.

15. A compacted gravel nursery road of 3 metres wide running parallel to the terraces will be constructed and join the main road as indicated in Figure 1

e. Land preparation:

The site is gently sloping. For seedbed preparation and minimization of soil erosion, terraces will be made in the area actually occupied by the nursery and bands of grass strips will be left out. In addition, the terrace slope will be fortified by short tree species which will provide shade as well as acting as wind break.

f. Fence:

The total area of I ha will be fenced off. Initial fence will be made of barbed wire and standard chain link. Live fence will subsequently be established to protect seedlings from small animals. Within the nursery compound, the area reserved for seedling production will have a hedgerow fence.

g. Water Source:

Water will be obtained from the nearby spring whose water currently flows into the adjacent river. A four-inch pipe will be used to fee the water tank by gravity from a constructed weir, which, will also act as storage dam. One concrete water tank will be constructed in the nursery whose storage capacity will be 70 cubic metres.

Water requirements for the nursery are about 15 m3 per day and a water tank of about 70m3 is enough for almost seven days in case of break down. The proposed source has about 0.25litres per second or 20m3 per day assuming constant flow. The adjacent school will use the excess water, which will be very clean.

h. Tree Species to be grown:

The tree species to be grown in the nursery are those for afforestation, agroforestry and for rehabilitation purposes. Table 1 indicates the tentative tree species to be grown in the nursery.

Table B-12: Tree species to be grown in the integrated tree nursery

Rehabilitation	Woodlot	Agroforestry	Live fence
Acacia xanthophlloea	*Acacia mearnsii (wattle)*	*Calliandra calothyrsus*	*Dovyalis caffra*
Albizia falcata	*E. grandis*	*Parinari curatellifolia*	*Bauhinia rufescens*
Faidherbia albida	*Eucalyptus saligna*	*Sclerocarya birrea*	*Hakea saligna*
Podocarpus falcatus	*E. camadulensis*	*Gliricidium spium*	*Ziziphus mauritania*
Syzygium cordata	*Cassuarina equisetifolia*	*Leucaena leucocephala*	

Khaya anthotheca		*Sesbania sesban*	
Lonchocarpus capassa		*Cajanus calliandra*	
Robinia pseudoacacia			

In addition to the above tree seedlings, the nursery will produce fruit trees as a package to agroforestry. The fruits, which are again conspicuously missing and have markets, are improved mangoes, oranges, pears etc. Development of such fruits and tree seedlings will also be a kind of income generation for the community.

i. Nursery Practices:

The main purpose of the integrated tree nursery is to produce quality seedlings which will establish easily in the field and grow quickly. Site and the purpose for which tree seedlings are planted determine the choice of tree species. To get quality tree seedlings, best nursery practices need to be adopted.

j. Seeds procurement: Initially, seeds will be obtained from Malkerns Forest Research Station an institution, which in turn will obtain such seeds locally or through importation. Subsequently, seeds will be obtained from planted trees including demonstration trees at the nursery compound.

k. Containers to be use: Bare-rooted plants or plants in various containers can be used. For better survival, plants will be raised in black polysleeves (0.3 – 1.5 Litres) to minimize root coiling as well as allowing for air pruning (polyethylene bags can also be used but impede drainage as well as causing root coiling which ultimately impede tree growth in the field. Root trainers can also be used but are usually very expensive.

l. Soil to be used: The soil to be used or the substrate should have right physical properties (water holding capacity, porosity, plasticity, and low bulk density) and chemical properties (fertile, optimum pH, high cation exchange capacity) to allow early vigorous growth of plants in the nursery. As a rule of thumb, the nursery soil should have a mixture of: topsoil, fine gravel; well-decomposed organic matter such as manure or compost). The soil at the nursery site is sandy and what is needed is topsoil and well decomposed organic matter. Recommended ratio of soil mixture should be: For heavy clayey) soils: 1:2:2; for medium (loamy) soils 1:1:1 and for light (sandy) soils 1:0:1.

m. Fertilizer: Like agricultural crops, tree seedlings require fertilizer if the soil that used is not fertile enough (fertility test of substrate being used should be undertaken to determine level of fertilizer application). Healthy plants have higher growth survival in field and grow much faster. Plants require both macro nutrient and micro nutrients to grow well: The macro nutrients needed are nitrogen (N), phosphorus (P), potassium (P), calcium (Ca), magnesium (Mg), sulphur (S) while micro nutrients consist of: Iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), boron (B), and chlorine (CI). Initially, small quantities of NPK fertilizer will be applied to the seedlings in the nursery. Fertility thresholds for most agroforestry tree species have not been determined. As a safety net, fertilizer requirements for P, K, Ca is 25, 10, 40 ppm respectively for eucalypts and other species.

n. Maintenance operations: For efficient seedling production, these include:

- Soil mixing and filling of polysleeves. One person should fill 400 pots in a day. For small size seeds, seeds should be germinated in seedbeds and subsequently pricked out onto pots.
- Watering should be done twice daily unless there is rain- in the morning and in the evening. Hardening-off should be done by gradually withholding water and shade from plants prior to field out-planting:
- Weeding and root pruning should be undertaken as necessary.
- Nursery and plant hygiene should be observed by undertaking appropriate preventive and curative practices. The factors that affect plants are non-biological and biological: non-biological include: low or high temperature, drought or water logging, chemical injury, physical damage and biological include diseases and pests: bacterial, viruses, viroids, phytoplasm, fungi, insects, mites, nematodes, weeds, birds, and palastic plants. Among the commonest diseases is damping-off caused by several species of fungi particularly *Pythium, Rhizoctonia,* and *Phytophthora*. To prevent damping of avoid high plant density, over watering and heavy shade.
- To overcome pests and diseases, integrated pest management should be adopted and these consist of physical, biological or chemical pest management. Usually chemical spray should be used only as a last resort when high percentage of stock is affected.
- Planting seedling sizes will vary but a plant of 20 cm long is good enough for planting.
- Grafting of plants, particularly fruit and flower plants will be done at the nursery and nursery workers will be trained on grafting techniques.

0. Nursery calendar.

For synchronised tree seedlings production, the nursery stock should be ready at the onset of rain in fields. To do that, various production activities must be planned backwards to allow for the time needed for essential growing tasks to come out with seed sowing date in the nursery.

Table B-13: Nursery calendar to determine sowing time for tree species

Activity	Days needed	Species
1	Days needed from pricking out to field out-planting	120
2	Days needed from germination to pricking out (2	15
3	Days needed from sowing to germination	8
4	Allowance for poor germination	20
5	Days needed to plan procurement	5
	Total days needed	168

As a general rule, activities 1 to 5 require the following days: 1 takes 120 days, 2 about 15 days, 3 about 8 days, 4 about 20 days and 5 about 5 days. Total time required then is 168 days or approximately 6 months to produce right size planting

stock. In Swaziland, planting is in November and nursery operations should therefore start in May for most plants.

Table B-14: Schedule of monthly nursery activities to synchronize field planting

Activity	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
1						
2						
3						
4						
5						

p. Sustainable Organization and Management Systems

All the six tree nurseries in the country belong to the Government and are run by forestry employees. The proposed integrated tree nursery will be different in the sense that it will belong to the community and be run by the community. To make its operations sustainable, effective management modalities have been discussed with the community and below are salient features on agreement in a workshop, which was attended by about 72 households.

- The community will own the tree nursery. As such, it will determine what to do with the seedlings produced in the nursery.
- Members of the community will contribute labour for various occasional and regular nursery activities.
- The community will also be involved in initial development of the nursery by providing labour e.g. fencing.
- The Department of Forestry will initially provide one skilful employee to train the community on various activities of tree nursery at least for the first year. Subsequently, the Department will build capacity by way of occasional training and study tours of key committee members as a part of its routine forestry extension.
- Community will employ necessary maintenance people and pay for such staff from income obtained from sale of tree and fruit seedlings or from any other source depending on community suggestion.
- Community will develop its own rules and regulations on procedure of running nursery, election of office bearer and financial accounting.
- Initial development material such as water and infrastructure will be the main assistance the community will get.
- Duty allocation on who does what will be one of the tasks as spelt it in the constitution of the nursery committee.
- Despite its location in Zikhoteni Chiefdom, the nursery will serve the whole Inkhundla.

- The nursery committee will elect its own office bearers- mainly Chairman, secretary, and Treasurer.
- The committee will open a bank account with money from their initial contribution.

On day- to-day operations, the like-minded farmers should be allocated specific seedbeds for management and sale of the seedlings output. A method of repayment or refund by such farmers for the communal benefits such as water and general protection should be worked out.

B.6 Afforestation Guidelines

B.6.1 Background

The main objective of this pilot project is to establish community woodlots whose products can be used for communal purposes. Currently, the community is spending disproportionably high income on purchase of firewood, which come from private farms. It is hoped that demonstration of effective afforestation techniques through the pilot project will stimulate wide-scale afforestation on appropriate sites. Afforestation programme will also produce poles for communal use and in addition, appropriate rehabilitation tree species will be planted on degraded sites to address that specific problem.

B.6.2 Technical Aspects

Afforestation will be undertaken in three sites. In total, 9 ha will be planted and fenced off to protect the young seedlings from livestock browsing. The initial tree species to plant and their role is indicated in Table 1.

Table B-15: Tree species for the initial afforestation programme

Species	Purpose	Quantity of seedlings
Eucalyptus saligna	Poles and fuel wood	22,500
Khaya anthotheka	Rehabilitation	2,500
Lonchocarpus capassa	Rehabilitation	2,500
Total		27,500

The sites where tree species will be planted are degraded and in other cases carrying coarse grass. Establishment of trees will be what is referred to as grassland planting, where spot hoeing will be made with a radius of 0.5 metres around the planted tree. Spacing of trees will be 2mx2m and the trees will be harvested at a rotation of 8 years. Subsequently, for eucalyptus, coppicing method of management will be adopted while for rehabilitation trees, extremely light selection for felling method will be adopted as a standard management technique.

B.6.3 Ownership and Management

The forests thus created will truly be communal and members of community will have to consult each other on their use. The few existing community forests are indeed sustainable, particularly in case of eucalyptus plantations. The only major

issue is that user rights of these forests are not well defined and most farmers do not have clear mind how these forests can be used. Some think that authority to cut them or sell wood will have to come from the Government.

With the assistance of forestry extension, proactive management plans will be made for each site and the plan will detail management, harvesting and sharing of benefits accruing from the sale of forest products to households in the vicinity and to the outsiders. To make the project sustainable, as a part of cost sharing, the local community has agreed to provide labour for establishment and subsequent activities, a process, which will create a sense of ownership and sustainability.

B.6.4 Detailed Planning

a. Purpose

The purpose of the afforestation project is to assist in provision of wood for communal purposes such as poles and fuel wood. Already Target Area 2 is in acute shortage of fuel wood and households are spending disproportionably high percentage of their limited income on buying fuel wood (typically each household paying E1225 per year). In addition, the afforestation project will also contribute to rehabilitation of degraded areas by way of checking soil erosion, improvement of soil structure via addition of organic matter and enhancement of water infiltration which would otherwise cause considerable soil erosion via run off.

b. Site:

The Pilot Project Afforestation will be undertaken in three sites. Site 1 and 2 are at Galile in Zikhoteni. Site 3 is at Zikhoteni. GPS coordinates of the three sites and the proposed dimensions are indicated in Figure 1

c. Area:

A total of 9 ha will initially be planted in the three sites. Each site will have three ha of afforestation.

d. Fence:

To avoid browsing of the planted trees, fencing of the identified areas will be undertaken. The fence will be made of metal posts for durability purposes. In case of unserviceable fences, fencing will involve repair of the existing fences. It was found that to keep off both small and large stock, each distance of 12 metres needs 2 droppers and 1 standard. Also each site requires a new gate.

e. Afforestation practices:

Species selection: For posts and fuel wood, the preferred species by the community is several varieties of eucalyptus. They grow fast although they are not very effective for rehabilitation purposes. Other varieties of tree species have not been tried, but this project will try other indigenous trees species whose growth rates compares favourably with eucalyptus.

Demarcation: Demarcation of three ha to be planted in each area will be made by the staff of Department of Forestry and the community. Depending on each site, the area will be square or rectangular and layout will be done at the time of demarcation. Demarcation will include putting pegs at the four corners of area to be afforested.

During demarcation, quick investigation of sites, which might require some patching up or soil trapping for tree growth will be made.

Land preparation: The three sites carry low poor grass and hence there will be no need for major clearing of obstacles. Grass planting will be adopted as a method of afforestation. There are however some exposed parts of ground which may need soil filling up or re-arrangement of some stones to trap soil for afforestation as observed under demarcation exercise.

Staking: Pegs will be made on demarcated area at a spacing of 2 metres x 2 metres. On sloppy grounds, rows of trees shall be made parallel to the contour lines to minimize soil erosion due to terrace effect.

Spot hoeing: Rather than clearing all the vegetation for planting, a practice, which is adopted for rapid growth, only a spot of 0.5 metres radius will be hoed around the staking pegs. After spot hoeing, pitting holes of 30cm deep and 30cm wide will be made to break hard soil.

Planting: Planting will be made at the onset of rain in November after the necessary soil moisture builds up. Planting is an emergency operation and must be completed within a few days for trees to take full advantage of rains. Fertiliser will be applied to each planted seedling at the time of planting and mixed well with soil.

Weeding: After planting, some weeds will grow around planted trees including grass encroachment on trees. About two weeding are planned depending on the field observation.

Beating up: If plant survival falls below 80 per cent, there will be a need for replanting the spots where trees died, a practice which is referred to as beating up.

Maintenance: Maintenance activities will include fence repair, culling off fallen trees and general protection against browsing.

Harvesting: Harvesting age and tree size (diameter and height will depend to what purpose the product will be put to. In most cases, the community will decide the time of harvesting in each case tentatively estimated at 8 years. Ideally, the buyer will fell the required trees under the supervision of afforestation committee. The committee will also decide modalities of utilization of some trees for use by farmers or the communal purpose such as school or dip.

Labour requirements: Afforestation is a very labour intensive project and apart from tree seedlings and fencing material, the rest of the inputs will consist of labour. After the initial establishment, labour requirements will be low as coppice method of management will be applied to pole and fuel wood tree species. For rehabilitation species, only light selection felling will be undertaken. For guidance, the man-days required for various operations are as indicated in Table below. The community has agreed to provide labour for the pilot project.

Table B-16: Labour requirements for various afforestation activities

Activity	Man days per ha	Total man-days required.
Demarcation	2	18

Land preparation	4	36
Staking	15	135
Spot hoeing	24	216
Planting	116	944
Weeding	4	36
Beating up	5	45
Maintenance	4	36
Harvesting	2	18
Total man days		1484

Table below indicates schedule of activities. If planting is done in November, several land preparation activities need to be done long before the inset of rain. In particular planting holes must be ready**.**

Table B-17: Schedule of afforestation activities

Activities	Months											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Demarcation												
Land Prepare												
Staking												
Spot hoeing												
Planting (November)												
Weeding												
Maintenance												

f. Afforestation Committee

Already there is a development committee for all the project activities. In addition, the community is in the process of constituting a fairly representative committee specifically for the tree nursery. It was agreed that the same committee should handle the issue of afforestation. It was felt that once trees are planted, follow-up activities are not as demanding as those of tree nursery. Already community forests exist and this is not a new idea.

g. Sustainable Organization and Management System:

The few existing community forests are indeed sustainable, particularly in case of eucalyptus plantations. The only major issue is that user rights of these forests are not well defined and most farmers do not have clear mind how these forests can be used. Some think that authority to cut them or sell wood will have to come from the Government.

These guidelines will form basis of management plan for each specific plantation. With the assistance of forestry extension, proactive management plans will be made for each site and the plan will detail management, harvesting and sharing of benefits accruing from the sale of forest products to households in the vicinity and to the outsiders.

B.7 Improved Fallow Guidelines

B.7.1 Background

The main objective of this technology is to increase soil fertility and by implication, higher crop yields, which have been on serious decline due to persist cropping without adequate fertilizer input. With higher crop harvests, food security is ensured and poverty is also addressed at the household level. This will indirectly address the issue of land degradation, which is partly aggravated by poverty. Survey of fields particularly in TA2 indicates that several terraces in fields have been abandoned on account of infertility. In other cases, maize is completely stagnated and matures at a height of 0.5 metres and carrying very small cobs. Obviously, yields are too low to even compensate for cultivation labour. The soil is generally sandy and totally lacks organic matter. Similarly in other study areas, in TA1 and TA2, there are portions of terraces which have been abandoned on account of soil infertility.

Improved fallow will generate copious organic matter for enhancement of soil fertility through improvement of soil structure and plant nutrient budget in the soil. Where the practice has been tried in Zambia, the maize yields at on-farm trial have been improved from 1.28 tonnes/ha to 4.42 tonnes/ha, an improvement of 245% over the commonly practised continuous cropping without fertiliser. Whereas economic response of maize is in the range of 100-200Nkg/ha, improved fallow of *Sesbania sesban* nitrogen fixation rates of up to 350Nkg/ha per year have been recorded and has long residual effect running to 7 years. Litter and fresh leaves of *sesbania* contain 2% and 4% nitrogen respectively. Additionally improved fallow can yield about 27 tonnes/ha of fuel wood in a three year fallow, a very important contribution to households who otherwise spend many hours and income fetching and purchasing fuel wood.

Many other tree species can also be used for improved fallow. The tree species which have been experimented in improved fallow are: *Gliricidium sepium, Leucaena leucocephala, Calliandra calothyrsus, Flemingia macrophylla, Senna siamea, Tephrosia vogelii, Sebania sesban* was the most suitable candidate because of many attributes: rapid and vigorous growth, high biomass production, high quality litter, ease of propagation from seed , ease of removal by clear felling to harvest wood - it does not leave unmanageable stumps, and it is native to the region.

B.7.2 Technical Aspects

The project will be implemented among 60 farmers in Zikhoteni Chiefdom. Already, 31 of these farmers have been visited and sensitised on the merits of the technology. They in turn have recruited another 29 farmers who are willing try the technology. TA1 (Kukhanyeni) and TA3 (Ngwempisi) will each have 20 farmers, making the whole number of farmers trying improved fallow as 100. Each farmer is expected to initially plant a plot of 400 square metres and hence total area intensively under the technology will be 4 ha even though some farmers expressed desire to do more than 400 m^2 in view of large unfertile areas in their fields.

The improved fallow will initially be maize inter-cropped with *Sesbania sesban*. Hence the first year, maize will be planted in rows as usual and after germination, rows of sesbania seedlings will be planted parallel to the rows of maize at a spacing

of 1 metre by one metre. In the second year, tree shrubs will be left to grow alone for in any case they would shade maize. In third year the trees will be harvested- leaves and small twigs incorporated into the soil while bigger branches will be used for firewood. It is the leaves thus incorporated into the soil, the litter that has fallen in due course and nitrogen fixation by the species modulating roots that greatly improve the soil productivity. Some farmer may wish to plant Sesbania alone as an experiment to see if higher soil fertility can be achieved.

B.7.3 Ownership and Management

Unlike the tree nursery and afforestation programme, this technology is at farmers' level and will privately be owned. Management of technology is simple as farmers will plant the tree shrubs just like other crops and in view of its benefits- environmental and economics in form of firewood, the technology will be sustainable without external cash input except occasional monitoring by the Government extension officers and other development NGOs.

B.7.4 Detailed Planning

a. Purpose

The technology aims at rejuvenating soils, which have been made infertile through continuous cropping. In the past, farmers used to leave their fields fallow for over ten years but with shortage of land, the long duration fallow period is no longer tenable and at the same time farmers cannot afford chemical fertilizers which are very expensive. Currently, soil fertility has been impoverished as is evidenced by extremely low maize yields in the order of 1600 kg/ha in most of Swazi National Land. Where fertilization is applied, like in most Title Deed Land, higher maize yields in the order of 2300kg/ha have been obtained. Research in Zambia indicates that improved fallow system can double or treble maize yield because of their ability to fix nitrogen and copious generation of organic matter which greatly improves soil structure besides injection of the necessary plant nutrients.

b. Site

The technologies will be established among the 86 farmers who have expressed willingness to adopt the technology as per the table below: It is estimated that other many farmers will adopt the technology after observing productivity effect in plots under the improved fallow. Each farmer will have a plot of 400 $m^{2.}$

c. Fence

Planting of the shrubs will be in areas normally protected against browsing and in any case the species proposed are not very palatable. Even though the shrub of the *Sesbania sesban* is not very palatable, farmers should be willing to fence off the small plots to avoid unusual browsing of the shrubs in winter.

d. Improved fallow practices

Land preparation: Initially, the plots will be cultivated as usual. No other land preparation is required. Inter-cropping with maize will be made in the first year and weeding done as usual. In second year only the Sesbania shrubs will be left to grow separately as their shading will not anyway allow maize growth.

Species: The species to be used will primarily those that fix nitrogen and produce copious amount of organic matter. Tentatively the species which have been used elsewhere are: *Sesbania sesban*, *Calliandra calothyrsus*, and *Tephrosia vogelii*.. Initially only *Sesbania sesban* will be used. *Sesbania sesban* is described as a magic bush in soil enrichment and will grow to a height of about two metres.

Spacing: Tree spacing will be 1m x 1m squares, equivalent to 10,000 plants per hectare of land. On the other hand, a plot of 20 m x 20 m will require 400 plants each.

Establishment: Trees will be planted from tree seedlings. Direct sowing can also be applied but take a longer period before maturity. Plant maize crop and when maize is about 30 cm tall, plant *Sesbania sesban* seedlings. Rows of maize will be alternated with rows of *Sesbania sesban* as per Figure 1.

Management: RDA staff will be trained on concept and implementation of technology by the project and they in turn will train farmers. Demonstration plot at the nursery will be used for training. Already farmers in the chiefdom have been sensitised on benefits of the technology.

Activities: These include Inter-cropping trees with crop during first year. After harvesting maize crop, Sesbania is left growing. During second year, trees should be allowed to grow a lone as shading is anyway too heavy. Trees are clear-felled at the beginning of third year and application of leaves and small twigs to the soil is subsequently undertaken. Stems can be used for firewood. Hygienic practices will be adopted to avoid pests and diseases particularly leaf defoliating beetles.

Inter-planting pattern: During the first year, Sesbania sesban will be planted at a spacing of one meter along the rows. Distances between the rows will also be one meter. In the same first year, rows of maize will be planted as usual alternately between the rows of tree shrubs.

e. Management committee

The tree nursery committees will oversee development of improved fallow in the fields. In the sense that this technology will be tried among the willing farmers, there is no need to formulate a specific committee. The first farmers to practice the technology will be contact farmer and some of them have already been sensitized on the benefits of the technology.

f. Cost and work sharing agreement

Initial trial farmers will be provided with seedlings free of charge. They will be responsible for collection, planting, land preparation, management of the tree shrubs and their incorporation into the soil. The RDA people will undertake the usual extension services.

B.8 Benefit of Improved Fallow and Establishment Procedure

B.8.1 Background of the technology

Improved fallow has been proposed as one of the key technologies within Agroforestry and Community Forestry component of the overall " Study on improvement of rural environment in degraded land in Kingdom of Swaziland". In brief, the main objective of this technology is to increase soil fertility and by implication, higher crop yields, which have been on serious decline primarily because of persistent cropping without adequate fertilizer input. With higher crop harvests, food security will be ensured and poverty will also be addressed at the household level. This strategy will indirectly address the issue of land degradation, which is partly aggravated by poverty.

Survey of fields in the all the Target Areas indicates that several terraces have been abandoned on account of infertility. Farmers have also confirmed the problem of low crop yields. Improved fallow will rapidly generate copious organic matter, which will enhance soil fertility through improvement of soil structure and plant nutrient budget in the soil. Where the practice has been tried in Zambia, the maize yields at on-farm trial improved from 1.28 tonnes/ha to 4.42 tonnes/ha, an improvement of 245% over the commonly practiced continuous cropping without fertilizer. Whereas economic response of maize is in the range of 100-200Nkg/ha, improved fallow of *Sesbania sesban* nitrogen fixation rates have been found to be even higher - up to 350Nkg/ha per year and residual effect is pleasantly long, spanning over a period of 7 years. Litter and fresh leaves of *sesbania* contain 2% and 4% nitrogen respectively. Additionally, improved fallow can yield substantial amount of fuel wood in a three year fallow, a very important contribution to households who otherwise spend many hours fetching and at times purchasing fuel wood with scarce income.

The most recent investigation in Zambia indicates that high demographic pressure on available cultivable land has meant that the traditional strategies to restore soil fertility based on long fallow periods are no longer possible. Fallow periods have declined from 20 years to less than 5 years. One technology which appears to have considerable potential is improved fallow using carefully selected multipurpose tree species, preferably those that fix nitrogen, with the obvious advantage that they make their contribution to soil fertility more quickly than natural regeneration. In addition, the competition between trees and crops, a common problem in most of agroforestry practices, is eliminated and valuable byproducts such as poles, fuelwood or fodder can simultaneously be produced on-farm, depending on species, length of fallow and management.

B.8.2 On-farm results

In Zambia results from 6 seasons consistently showed that *S. sesban* fallow of 1-3 years significantly increased maize grain yields with or without application of inorganic fertilizers in addition to the production of between 10-35 tonnes per ha per year fuelwood. Under on-farm conditions on severely depleted soils, maize yields increased from 0.15 to 4.0 tonnes per ha per year after only 2 years of *Sesbania* fallow. Further, results have shown that soil physical and chemical conditions are significantly improved in addition to substantial root organic matter input in the

ranges of 1.2 and 1.7 tonnes/ha/yr after 1 and 2 years fallow respectively. Also a cost/benefit analysis of the data has shown that *Sesbania* fallow are profitable.

In Kenya under the advice of International Centre for Research in Agroforestry (ICRAF), a case study of some farmer in western parts of the country indicated that small-scale resource poor farmers have experienced something of a miracle on crop yield improvement after adopting the technology. Typically, farmers with a two-acre plot (0.8 ha) for the first time, can harvest between 30 and 35 bags of maize without using fertilizers and herbicides on land they had come to expect no more than 6 bags a year. Not only that. The improved fallow technology also helped in eradicating notorious weeds especially the striga, which further compounded the farmers' problems, choking the crops in the battle for scarce soil nutrients.

Initially, many farmers were understandably skeptical about testing improved fallow technology. They feared that planting the improved fallow on their small farms would seriously compromise crop yield on account of limited farm area, which were not even enough for their subsistence crops. One farmer (George Ochindo) confirmed that in the past, he was harvesting **4** bags of maize on his 1.25 acres (0.5 ha) plot and with adoption of improved technology he now gets **15** bags from the same area of land. In his own words, "the outcome is fantastic".

The interesting thing with these trees, "he added, was that you do not spend money to improve one's soil. He was also making some cash income of about KSh 4,000 (equivalent to 400E) from selling seedlings of the trees to the other farmers. In fact so popular is technology that farmers in the area have decided to form cooperative society that would oversee the storage and marketing of their harvest. The introduction of the new technology has helped many farmers, particularly women, to realize that the improved fallow techniques do not only guarantee food security, but also a steady supply of firewood. The improved fallow technique is thus offering women economic empowerment.

B.8.3 Summary benefits of Improved fallow:

1) The technology leads to dramatic increase of maize yields from ordinary 0.15 tonnes/ha/year to 4.0 tonnes/ha/year when technology is adopted, an increase of 26 folds after only 2 years.
2) There is also additional on-farm fuelwood production, in the order of 10-35 tonnes/ha/year.
3) Soil physical and chemical conditions are significantly improved in addition to substantial root organic matter input of 1.2 and 1.7 tones/ha/year after 1 and 2 years of fallow respectively.
4) Unlike inorganic fertilizer, which can tire soil and with short residue effect, effects of improved fallow can last for 7 years.
5) Competition between trees and crops, a major problem in agroforestry, is eliminated.
6) Valuable by-products such as poles and fodder become available in addition to fuelwood.
7) It is an indigenous fast growing and nitrogen-fixing tree easily propagated by seeds and technology can easily be grasped with minimum training.
8) Adoption of the technology can help eliminate notorious weeds such as striga.

9) Technology is also economically feasible with cost/benefit analysis of data indicating that Sesbania fallow is indeed profitable.
10) The technology can be a source of extra cash income via sale excess fuelwood, seeds, and seedlings to the neighboring farmers.

B.8.4 Other species for improved fallow

Besides use of Sesbania which is indigenous and quite profitable, other tree species can also be used for improved fallow. The tree species, which have been experimented in improved fallow are: *Gliricidium sepium, Leucaena leucocephala, Calliandra calothyrsus, Flemingia macrophylla, Senna siamea, Tephrosia vogelii*. Among all these tree species, *Sebania sesban* was the most suitable candidate because of its many attributes: rapid and vigorous growth, high biomass production, high quality litter, ease of propagation from seed, ease of removal by clear felling to harvest wood - it does not leave unmanageable stumps, and it is native to the region.

B.8.5 Establishment procedure

Plough land for crop planting as usual. In rain, season during first year, select a small plot of about 400 square metres or less. Plant maize normally in rows. Between the maize rows, plant Sesbania seedlings at approximately one metre by one metre spacing. After harvesting maize during first year, leave Sesbania to grow on that plot for a year. During third year harvest wood, leaving litter and leaves in the field. Plough the land, removing small stumps and incorporating litter and leaves in soil as organic matter. Plant maize and the soil are already fertile for higher yields. Initially Sesbania seedlings available from Malkerns and Ludzeludze tree nurseries.

B.9 Tree species diversity in the Target Areas

The indigenous vegetation of Swaziland is quite rich in tree diversity. A transect survey was made in representative remnant vegetation types in each target area. With assistance of local people versed with names of different trees, a frequency of tree species was carried out in each Target Area. The vegetation is quite degraded, but the names suggest a country previously with a large variety of trees. From the survey, it would seem the area with more species diversity is TA 3 with about 83 observed different tree species. TA1 comes second with 77 species and TA 2 had less diversity at 61. There could have been error on naming the same tree species with more than one name, but on the whole the survey presents a fair picture of tree species diversity.

Table B-18: Frequency of tree species in the three Target areas.

Target Area 1				Target Area 2:				Target Area 3			
	Local Name	No	% Freq		Local name	No	% Freq		Local name	No	% Freq
1	Emagwava	1	0.5	1	Emagwava lamhlophe	6	2.5	1	Ematfundvuluka	7	0.9
2	Emehlo akati	1	0.5	2	imbondo lemhlophe	9	3.7	2	Imbondvo	13	1.6
3	Gwava	3	1.5	3	indendende	5	2.1	3	Imbondvo lemhlophe	9	1.1
4	Imbondo Lemnyama	9	4.6	4	indlulamitsi	2	0.8	4	Imbondvo lemnyama	8	1.0
5	Imbondvo lemnyama	1	0.5	5	inhlangashiyane	5	2.1	5	Imfuce	11	1.3
6	Imfuce	4	2.1	6	inhliziyo nkulu	1	0.4	6	Inhlaba	6	0.7
7	Indodebovu	2	1.0	7	inkhokhokho	3	1.2	7	Inhlangishiyane	15	1.8
8	Inhlaba Lenkulu	2	1.0	8	inkunzi	1	0.4	8	Inhlangushane	2	0.2
9	Inhlaba Lenkulu	1	0.5	9	inkunzi	1	0.4	9	Inhliziyo	8	1.0
10	Inhlangushane	7	3.6	10	intonje	1	0.4	10	Inhliziyo (Umhuwane)	3	0.4
11	Inkunzi	1	0.5	11	Jacaranda	9	3.7	11	Inkhokhokho	9	1.1
12	Intfombi	2	1.0	12	ligwaba lelibovu	6	2.5	12	Intfocwane	16	2.0
13	Intfombi	1	0.5	13	lihlala	1	0.4	13	Intfokolovu	8	1.0
14	Licobhe	1	0.5	14	lingoza	2	0.8	14	Intfombe	7	0.9
15	Lihlolo	3	1.5	15	linyela	3	1.2	15	Intfonja	4	0.5
16	Linyatselo	1	0.5	16	lipentjisi	5	2.1	16	Intfuma	7	0.9
17	Litsambo Lenja	7	3.6	17	liputjutju	5	2.1	17	Intokolovu	2	0.2
18	Lugagane	8	4.1	18	liqobhe	7	2.9	18	Izandzu	1	0.1
19	Lusekwane	3	1.5	19	liqume	1	0.4	19	Libota	7	0.9
20	Lusololo	6	3.1	20	litfundvuluka	1	0.4	20	Liboyi	3	0.4
21	Lusundvu	2	1.0	21	lithongane	4	1.7	21	Ligungumence	5	0.6
22	Mahubhula	1	0.5	22	litjalo	1	0.4	22	Lihlolo	2	0.2
23	Mangololo	1	0.5	23	lusekwane	4	1.7	23	Liletsa	28	3.4
24	Masweti	3	1.5	24	lusekwane	11	4.5	24	Litinyolemamba	9	1.1
25	Nyamane	1	0.5	25	lusololo	2	0.8	25	Litsambolenja	15	1.8
26	Nyamatane	2	1.0	26	maguqu	3	1.2	26	Lugagane	29	3.5
27	Schotia tsachipelala	1	0.5	27	Mhuluka	1	0.4	27	Lunyenye	25	3.0
28	Senungu	1	0.5	28	ncithamuzi	1	0.4	28	Lusasasa	4	0.5
29	Siganganyane	4	2.1	29	ngotho	1	0.4	29	Lusololo	3	0.4
30	Siganyane	3	1.5	30	siganganyane	7	2.9	30	Madlozini	1	0.1
31	Sihlanga	5	2.6	31	sihlangu	4	1.7	31	Magucu		0.0
32	Singa	4	2.1	32	sipheshula	5	2.1	32	Maphipha	6	0.7
33	Sinkonze	1	0.5	33	sitfwetfwe	3	1.2	33	Santinya	2	0.2

34	Sinywati	1	0.5	34	sitfwetfwe	7	2.9	34	Santinyana	29	3.5
35	Sitfwetfwe	2	1.0	35	umcafutane	3	1.2	35	Sicalaba	10	1.2
36	Sizaza	1	0.5	36	umdlelanyamatane	3	1.2	36	Sidolofiya	1	0.1
37	Thunzinkulu	2	1.0	37	umdomi wesilungu	1	0.4	37	Sihlangu	9	1.1
38	Tincozi	1	0.5	38	umgamba	3	1.2	38	Silliloko	15	1.8
39	Tintokolovu	1	0.5	39	umganu	11	4.5	39	Silver wattle	3	0.4
40	Umbatancephe	1	0.5	40	umgumba	3	1.2	40	Singa	23	2.8
41	Umcozi	3	1.5	41	umgwabagwaba	2	0.8	41	Siphama	5	0.6
42	Umgamba	8	4.1	42	umhlabelo	1	0.4	42	Sitfwetfwe	25	3.0
43	Umganu	4	2.1	43	umhlampunzi	5	2.1	43	Tincozi	10	1.2
44	Umgwava	1	0.5	44	umhlangamlambo	1	0.4	44	Tintfuma	6	0.7
45	Umhlala	2	1.0	45	umhlonhlo	2	0.8	45	Uhlahlabhetfu	11	1.3
46	Umhlala	1	0.5	46	umkhiwane	4	1.7	46	Ulozililo	5	0.6
47	Umhlamatsetse	1	0.5	47	umkhuhlu	5	2.1	47	Umbatancwephe	5	0.6
48	Umhlonhlo lomnyama	3	1.5	48	umkhwakhwa	1	0.4	48	Umbhongozi (Maguqu)	3	0.4
49	Umhlume	1	0.5	49	umlahlabantfu	2	0.8	49	Umbindzangulube	5	0.6
50	Umhubhulu	2	1.0	50	umndoni	2	0.8	50	Umbinta	16	2.0
51	Umkhaya	1	0.5	51	umndubu	2	0.8	51	Umchafutane	22	2.7
52	Umkhiwa	9	4.6	52	umnsinsi	15	6.2	52	Umcobhe	13	1.6
53	Umkhokha	1	0.5	53	umnyamatsi	4	1.7	53	Umcozi	2	0.2
54	Umlahlabanftu	6	3.1	54	umsane	6	2.5	54	Umdlelanyamatane	25	3.0
55	Umndlalanyamatane	3	1.5	55	umsehla	2	0.8	55	Umdvubu	28	3.4
56	Umndlela	1	0.5	56	umsenge	1	0.4	56	Umfomfo	6	0.7
57	Umneyi	3	1.5	57	umtfolo wesintfu	9	3.7	57	Umfusamvu	7	0.9
58	Umntulwa	2	1.0	58	umtholo wesilungu	1	0.4	58	Umgamba	8	1.0
59	Umntulwa	1	0.5	59	Umtulwa	22	9.1	59	Umgamba	21	2.6
60	Umnumbela	3	1.5	60	umvangati	2	0.8	60	Umganu	2	0.2
61	Umnungwana	2	1.0	61	umvongotsi	1	0.4	61	Umgwava	13	1.6
62	Umnunu	3	1.5					62	Umhlabanyoni	8	1.0
63	Umphafa	2	1.0					63	Umhlele	12	1.5
64	Umphehlacwatsi	4	2.1					64	Umhlonhlo	3	0.4
65	Umsenge	3	1.5					65	Umkhabamkhombe	22	2.7
66	Umsilinga	4	2.1					66	Umkhiwa	15	1.8
67	Umsinsi	4	2.1					67	Umkhiwane	12	1.5
68	Umsutane	1	0.5					68	Umlahlabantfu	18	2.2
69	Umtelemba	2	1.0					69	Ummukelambiba	8	1.0
70	Umtfolo wesiganga	1	0.5					70	Umnchozi	15	1.8
71	Umtfundvuluka	2	1.0					71	Umntulwa	16	2.0
72	Umtsetane	3	1.5					72	Umnumbela	8	1.0
73	Umvangati	1	0.5					73	Umnyetane	9	1.1
74	Umvongotsi	3	1.5					74	Umphahla	13	1.6
75	Umvutwamini	2	1.0					75	Umphehla cwatsi	10	1.2
76	Umzilazembe	2	1.0					76	Umsenge	10	1.2
77	Vovovo	1	0.5					77	Umsilinga	5	0.6
								78	Umtelemba	7	0.9
								79	Umtfolowesintfu	7	0.9
								80	Umtfoloyesiganga	2	0.2
								81	Umumbi	10	1.2
								82	Umvutfwamini	2	0.2
								83	Umzilazembe	5	0.6
		194	100			242	100			820	100

B.10 Nursery Training Programme

Practical Training of TA2 Nursery Committee Members: -Malkerns Research Station June 16-19, 2003

Training notes:

- The training is a part of capacity building on TA2 communities on management of tree nursery and subsequent afforestation and agroforestry development in their respective areas.
- Only practical aspect should be dealt with in the course of training and reliance will be made on nursery management guidelines prepared by JICA team and any other relevant source of information.
- Training will be guided and undertaken by staff from forestry division and agriculture. Forest Division will identify the specific staff to undertake the training, sharing the topics presented by this training manual. Preferably, two instructors will be deployed.
- The TA2 nursery committee members will be resident in Malkerns Research Station during the training period where they will be fed and accommodated.
- With the training obtained from Malkerns, the committee members will be expected to start, manage and maintain the tree nursery, which is under construction in TA2 with minimum assistance from the Forestry Division.

PART1: TECHNICAL ASPECTS ON MANAGEMENT AND MAINTENANCE

To make nursery operation sustainable, it is necessary to undertake capacity building of the initial nursery committee members through training by the Division of Forestry on site and on the job as soon as the nursery is completed. However to give the committee members a practical and useful exposure, it is suggested that they be taken for three days training on nursery operation at Malkerns Research Station. The staff and nursery specialist at Malkerns could undertake this training. Opportunity should also be taken of the existing agricultural facilities to expose the nursery committee members on methods of fruit tree propagation and grafting possibly from the existing agricultural research staff at Malkerns. The suggested time is 17, 18 and 19 June 2003. Committee members to reach Malkerns Research Station on the evening of 16 June 2003 and leave after lunch on 19 June 2003.

The training should be undertaking on the following key topics on nursery management:

1. Seedbed preparation and maintenance:

Orientation of seedbeds and maintenance; Drainage and cleanliness; Protection of seedbeds from animals and diseases

2. Tree species selection:

Criteria of tree species selection: rehabilitation, woodlot for poles and fuel wood, agroforestry, live fence etc.; Useful tree species for Swaziland- sample of tree

possible tree species to be grown. Special treatments for various tree species seeds and tree seedlings; Planning of annual seeds requirements.

Rehabilitation	**Woodlot**	**Agroforestry**	**Live fence**
Acacia xanthophlloea	*Acacia mearnsii (wattle)*	*Calliandra calothyrsus*	*Dovyalis caffra*
Albizia falcata	*E. grandis*	*Parinari curatellifolia*	*Bauhinia rufescens*
Faidherbia albida	*Eucalyptus saligna*	*Sclerocarya birrea*	*Hakea saligna*
Podocarpus falcatus	*E. camadulensis*	*Gliricidium spium*	*Ziziphus mauritania*
Syzygium cordata	*Cassuarina equisetifolia*	*Leucaena leucocephala*	
Khaya anthotheca		*Sesbania sesban*	
Lonchocarpus capassa		*Cajanus calliandra*	

3. Seeds procurement:
Various sources of tree seeds in the country; Collection methods from farms, plantation, and indigenous vegetation; Major types of seeds; Processing and pre-treatment of various types of seeds; Seed storage and viability

4. Germination of seeds
Testing procedures for viability; sowing density to avoid diseases

Fertilization and shading requirements and reasons. Transplanting; Optimum size of transplants; Handling methods to avoid root and stem damage; Transportation and storage of transplants.

5. Containers to be use:
Size of pots to be used (litres); Root trainers and possible use in nurseries; Arrangement in the nursery beds; Air pruning

6. Soil to be used
Desirable type of soil- physical and chemical properties; Soil mixture ratio for optimum growth; Pot filing and soil curing - pots filled per person per day.

7. Fertilizers and manure
Type of fertilizers for plants; Application of fertilizer; Dosage for tree seedlings

8. Watering regime
Timing of watering –twice a day; Hardening of seedlings for better survival in the field.

9. Weeding and general maintenance
Damping off avoidance - high plant density, over-watering and heavy shade; Weeding and root pruning should be undertaken as necessary; Integrated pest management; Grafting of tree and fruit seedlings

10. Size of field planting stock
Size for agroforestry planting; Grassland planting stock; Optimum size of seedlings for field planting

11. Nursery calendar
Determination of days required to have optimum planting material; Preparation of nursery monthly schedule of activities; Keeping of nursery records: species, date of sowing, germination dates etc

Example of nursery calendar to determine sowing time for various tree species.

Activity	Days needed	Species 1	Species 2	Species 3	Species 4
1	Days needed from pricking out to field out-planting	120	X1 (2)	X1 (3)	X1 (4)
2	Days needed from germination to pricking out (2	15	X2 (2)	X2 (3)	X2 (4)
3	Days needed from sowing to germination	8	X3 (2)	X3 (3)	X3 (4)
4	Allowance for poor germination	20	X4 (2)	X4 (3)	X4 (4)
5	Days needed to plan procurement	5	X5 (2)	X5 (3)	X5 (4)
	Total days needed	168	∑Sps2	∑Sps3	∑Sps4

PART 11: ORGANIZATION AND MANAGEMENT SYSTEMS

1. Allocation of duties and rights to community members
2. Optimum size of seedlings per individual family
3. Marketing of seedlings and optimization of income
4. Sharing of costs for overall nursery maintenance.
5. Development of rules and procedures in management of tree nursery

Day	8:00-9:00	9:00-10:00		10:15-11:00	11:00-12:00	12:00-1:00		2:00-3:00	3:00-4:00
Monday								Arrival	Registration
Tuesday	Seedbed preparation & nursery Hygiene Mkhatshwa	Species selection and collection Magagula		Seed collection, processing and storage Magagula	Seed germination, pre-treatments Magagula	Transplanting soil mixture, fertilization Mkhatshwa		Practical Mkhatshwa Magagula	Practical Mkhatshwa Magagula
Wednesday	Irrigation Hardening off Mkhatshwa	Weeding and general maintenance Mkhatshwa		Grafting and budding Horticulture	Bee-keeping Lomakhaya	Planting stock size nursery calendar Mkhatshwa		Practical Mkhatshwa Magagula Horticulture	Practical Mkhatshwa Magagula
Thursday	Duties and rights to members Mkhatshwa	Number of seedlings per family Mkhatshwa		Marketing and optimization of income Mkhatshwa	Cost sharing for nursery maintenance Mkhatshwa	Rules and procedures on management of tree nursery Mkhatshwa		FAREWELL	FAREWELL

B.11 Capacity building for Master Plan and support component

Capacity building is essential for sustainability of the forestry projects undertaken under Master Plan. Essentially the most important component will be equipping the relevant stakeholders by way of training and education that will enable them perform various tasks. It is not possible to train all the farmers. Hence the training should be targeted to key members who in turn will train others**.** In other words training of trainers**.** Farmers learn best from what they are told by their colleagues or see what their colleagues are doing. Discussions with farmers indicate that while interested in a number of forestry intervention, their knowledge and skills are naturally quite limited. The training needed is onsite workshops, residential training outside their area of operation and international training outside the country.

As farmers will always rely on Forestry Section, it is also necessary to train the Forest officers. Indeed the success and sustainability of most of the proposed agroforestry and community forestry activities will greatly depend on the staff of the Forestry Section. They are the people who will be the contact Government persons providing necessary extension and the required back up in various implementation activities both, privately or communally initiated. Firstly it is important to train those officers who will be in charge of the areas covered by the project and then others who provide the necessary backup. The capacity envisaged here are short courses in other countries, diploma training and also training to degree level.

Swaziland does not yet have forestry at diploma and degree level. All the current professional staff has been trained abroad. Currently, several African countries have forestry training at diploma and degree levels and could provide training until the country has its own training facilities and programme. The countries, which could offer such training are: South Africa, Tanzania, Kenya, Uganda, Nigeria among others.

The following training schedule is proposed.

Capacity building of community and Forestry section for Master Plan

Training category	2004-2009	2010-2015	2016-2020	Total 17yr
1. Nursery management				
Committee Members:				
On site training	45	45		90
Residential training	60		60	120
International workshops	6		6	12
On site tree and fruit grafting	6	9	12	27
Inter-location tours	30	60		90
2. Afforestation				
Committee Members:				
On site training	30			30
Residential training		30	30	60
Forester				
International management on plantation	3	3		6

3. Wattle development				
Forestry Extension officer				
International wattle management course	3	3		6
Diploma in wattle management		2		2
4. Agroforestry:				
Key farmers:				
On site course	60	60	60	180
Residential training	30		30	60
Forestry Extension officer:				
International workshops		3	3	6
5. Backup services				
RDA Forest Officers:				
Short international courses	6		6	12
BSc Training	1	2		3
Chiefdoms extension officers				
Diploma	6	6	6	18
Total trained people	286	223	213	722

Residential training of the community members will be done at Malkerns Research Station. The courses will each take 10 days and will be attended by 10 committee members from each Target area. International workshop will take 4 weeks in any of the recommended countries in Africa where the committee members can be properly exposed. There will be a need for short courses for foresters on afforestation and also the wattle management outside the country.

The officers in charge of extension in various Chiefdoms should be trained to Diploma level for maximum impact. The RDA Forestry officers could be better motivated by training them by short courses and also helping them acquire Degree in Forestry.

Required Capacity Building for Forestry Section as a Whole.

It is the Forestry Unit, which will also implement Forestry Policy and the necessary Legislation for cost effective development of forest resources in Swaziland. Compared to the giant role forests play in Swazi culture and tradition (economic, social, and environmental) the Forestry Section is indeed very understaffed as has been noted by the recently completed Forestry Policy. Examination of the existing staff also indicates that there is an urgent need for further training, to equip the staff with skills and knowledge necessary for modern days challenging forestry management. Recommendation on staffing requirements as well as training is made after a brief analysis of the current staff position

Examination of the existing Forestry Section staff indicates some shortages and inadequate training. There are total 20 professional and sub-professional staff in the

whole country. Only 5 of them have degrees and the rest of 15 have diplomas and certificates as indicated in the Table below.

Current staff position and qualification for the Forestry section

Position	Number of Staff and grades	Qualification	Comments
Head Forestry Section	1 (Grade 14)	MSc Forestry BSc Agriculture DIP Forestry DIP Agriculture	Appropriate qualification
National Herbarium Curator	1 (Grade 12)	MSc taxonomy Bsc Plant Science DIP S oil	Appropriate qualification
Assistant National Herbarium Curator)	1 (Grade 11)	MSc (Taxonomy) BSc (chemi & Bio	Appropriate qualification
Assistant Forestry Officer	1(Grade 9)	MSc in tree breeding BSc (Chemi & Bio)	Appropriate qualification
Senior Forester	1 (Grade 9)	Diploma (Forestry) Certificate (Forestry)	Needs higher qualification
Senior Forester (Wattle)	1 (Grade 9)	Diploma (Forestry) Certificate (Forestry)	Needs higher qualification
National Seed Centre	1 (Grade 8)	BSc forestry DIP Forestry	Needs higher qualification for the forestry research
Forestry Mensuration	1 (Grade 8)	DIP Forestry	Needs higher Grade in mensuration
RDA Forestry Extension	9 (grade 8)	DIP Forestry	Needs higher qualification for leadership and extension guidance
Nursery management	1 (Grade 5)	Certificate in forestry	Adequate for nursery work
Vocational Employees	2 (Grade 1)	DIP Forestry	Not employed due to lack posts
Secretarial Services	1 (Secretary/Typist Grade 5)	Certificate typing	Needs higher qualification in secretarial line
Subordinate staff	45 Grade 4/5 vocational)	No formal training	This includes a few drivers.
Total professional and sub-professional staff as June 2003			19
Drivers and subordinate staff			45

To man the various important sections, as identified by the Forestry Policy and also the JICA study Team undertaking this Master Plan, there will be a need for more qualified staff as indicated in the next Table. Essentially, the areas which should be manned by professional staff are mainly at higher grades of administration and the very technical services. In particular, there is a need for two deputies, one dealing with technical matters while the other one will deal with administrative matter paying special attention to staff motivation, identification and recognition of exemplary performance and corresponding rewards. Each of the four regional areas needs to be

headed by professional. Forestry research at a minimum will require 7 professional (2 in herbarium, 1 in seed section, 1 for silviculture, 1 for industry, 1 for non-wood forest product promotion, 1 Tree breeding. Other sections, which will require a professional each, are policy and national planning. The following table indicates the proposed positions within the Forestry Sector.

Proposed staff capacity for the Forestry Section for the country:

Position	Proposed staff	Qualification	Current staffing June 2003	Shortfall
Head Forestry Section	1	BSc and above	1	0
Deputy Head	2	BSc and above	0	2
Regional Heads	4	BSc Forestry	0	4
RDA Heads	17	BSc Forestry	0	17
Forestry Research	4	BSc Forestry	4	0
	3	PhD Forestry	0	3
National Policy	1		0	1
Planning and development	1		0	1
Subtotal Professional	32		5	28
Chiefdom Extension staff	150	Diploma and Certificates	12	138
Support staff	20	Diploma and Certificates	3	13
Total posts to be filled				179

Staff development during the Master Plan

Level of qualification	2004-2009	2010-2015	2016-2020	Total 17 years
Diploma	54	54	43	151
Bachelor of Science	12	12	1	25
Doctor of Philosophy	2	1		3
Total				179

B.12 Supporting Required

Lastly, supporting required for common input supply to three TAs is summarized here.
As to seed orchards establishment, for sustainable afforestation programme, there is a need to establish reliable seed supply. This will be achieved by establishing seed orchards in the major ecological zones including three TAs. The initial areas which should get support are: Malkerns; Magoga Fattening Ranch; Manyonyaneni Breeding station; Kubuta Sisa Ranch; Highveld Ranch; Mkhulamini Fattening Ranch. In each place, enough land of 20 ha is available for establishment of seed orchards for both exotic and indigenous trees. This will eliminate a need to import more seeds for various afforestation needs in the country. Afforestation activities will follow standard procedure which includes proper land preparation and protection.

As for necessary support to Malkerns Forestry Research Station, the Forestry Seed Research Station is technically the research unit of Forestry Section but remains understaffed and under funded. Yet for the envisaged research and production of seeds for the country's use and

possible export, the unit is not well prepared. It needs support in terms of staff, and the necessary infrastructure to be able to provide necessary technical services to the Master Plan and forestry as a whole in the country. As concern needed facilities, there is a need to establish a green house next to the tree nursery. The green house will facilitate research in germination of varieties of tree species and will be handy especially in winter. The house could also be used for growing of planting stock for other parts of the country during winter especially for recalcitrant seeds. An area of 180 m^2 would be adequate.

As to another requirement for seed storage cold room, a cold room will be used for seed storage for improvement of seed viability. It is expected that large quantity of seeds to be collected and processed will correspondingly require space for storage. As a matter of professional standards, most seeds need to be stored under controllable cool temperature. This is the facility being requested. An area of 40m^2 would be required. Further, a seed laboratory is needed. This is the place where seed technicians will be undertaking laboratory tests. It is also the area, which will serve as dispatching point for seeds to planting programmes and sale. The relevant forest officers and indeed the community can be trained on various key aspects of seed germination and treatment in this kind of facility. A space of 160m^2 would be adequate.

Concerning nursery tools for an envisaged enlarged tree nursery, the centre will need tools to perform specialized activities including grafting of various plants. For Seed collection and extraction facilities, the equipment will assist centre in field seed collection and also facilities for extraction and winnowing at the center. The main equipment, which will be included are various tree climbing gadgets, collection facilities, chains, knives, hooks to severe seeds and fruits. At the Seed Centre seed thrashers and winnows etc will be needed.

Annex C

C Grazing and Range Management

C.1 Cattle Herd Distribution and Livestock Holding Patterns in Different Zones

Table C-1: Proportion of the national herd in different zones (FAO, 1994a)

Zone	Range of holdings (%) between years	Mean distribution (%)
Highveld	20.0 to 24.4	22
Middleveld	31.3 to 37.5	35
Lowveld	34.1 to 43.1	37
Lubombo	4.5 to 6.4	6

Table C-2: Relative holdings of cattle and other stock in each zone

(Government of Swaziland, 1998)

Zone	Range of holdings in rich group	Range of holdings in mode group	Range of holdings in poor group
Highveld	10 to 20 % of farmers in group	35 to 50 % of farmers in group	30 to 45 % of farmers in group
	20 to 25 cattle (some have many more) very prestige conscious, less commercially oriented, sales lower goats relatively abundant	5 to 10 cattle goats relatively abundant	0 to 2 cattle chickens important
	15 to 25 % of income 15 to 25 % of food consumption	5 to 15 % of income 15 to 25 % of food consumption	0 to 15 % of income 0 to 5 % of food consumption
Middleveld	15 to 25 % of farmers in group	40 to 55 % of farmers in group	35 to 30 % of farmers in group
	15 to 30 cattle (even >100) more commercially oriented, sales common	5 to 15 cattle 0 to 1 cattle	typically often only have chickens
	20 to 25 % of income 20 to 30 % of food consumption	10 to 15 % of income 15 to 25 % of food consumption	0 to 2 % of income 0 to 2 % of food consumption

C.2 Problems With Respect to Grazing/Range Management in Swaziland

C.2.1 Range Management Problems

The problems with respect to grazing and range management in Swaziland have been summarised in Table C-3. In summary, rangeland deterioration and degradation occur either due to over stocking or to grazing mismanagement. There are a number of exacerbating factors associated with these, but the most problematic is the customary practice of keeping large numbers of livestock at little cost which acts as a severe disincentive to controlling stock numbers to the carrying capacity of the land – unfortunately, this is a problem beyond correction by merely improving grazing management and government has yet to take a firm stance to resolve this issue despite a number of studies have been carried out to look at solving this particular issue.

Table C-3: Rangeland management problems in Swaziland

PROBLEM TYPE	PROBLEM
Technical	Overstocking Overgrazing Lack of rest Indiscriminate burning Lack of grazing management practices
Ecological	Soils prone to erosion Grazing on steep slopes Grazing on land inappropriate for grazing Inappropriate land use practices Lack of protected access to water and stream banks and sponges and springs Lack of rangeland improvements Lack of range and soil rehabilitation practices
Economic	Low input livestock systems yield higher marginal returns than more intensive systems Lack of funds for inputs Market prices Lack of charges for livestock services Free riding on communal natural resources Economic incentives favour keeping of livestock above carrying capacity of the land Lack of development of suitably economically attractive and useful alternatives for the main uses of keeping livestock (draught, manure, investment, etc)
Social	Cultural proclivity to keeping cattle Simultaneous overstocking and yet being short of livestock to satisfy needs Lack of responsibility to rangeland resource Boundaries disputed and/or ill-defined High human population levels
Institutional	Lack of extension Lack of resources for research on range management, fodder production and soil conservation Lack of regulations to control stocking rates Lack of development of packages for intensification of livestock production for each of the agro-ecological zones

In order to achieve rangelands in sustainable and productive condition, attention must be paid to control of stock numbers (stocking rate) and access to the grazing (intensity of use during a grazing period and amount of rest afforded to the grazing during rest periods). In Swaziland, due to overgrazing, the rangelands are in a deteriorated condition and this is a problem as it leads to land degradation in the form of reduced plant biodiversity (species composition adversely affected), reduced litter cover (reduced protection afforded to the soil surface and lack of organic matter being recycled), reduced basal cover (reduced protection afforded to prevent surface run-off and soil erosion), increased soil erosion and compaction, reduced plant vigour (resulting in reduced productivity and hence reduced grazing and carrying capacities). This overgrazing is due to simultaneously overstocking, over utilisation and lack of rest.

Problems related to grazing and range management in Swaziland are intimately linked to the keeping of livestock, and in particular cattle. Culturally in Swaziland, livestock are a symbol of a man's worth within his society. This poses problems as the farmers on Swazi National Land (SNL) are disinclined to reduce the numbers of their livestock, in particular cattle, in fact they are inclined to accumulate cattle, and their objectives are to maximise productivity per unit area rather than per animal which is the objective on Title Deed Land (TDL). Confounding this is the high human population of Swaziland. All this is then complicated by the fact that economically, at least in the short term, it is not possible to match the returns obtained from having high stocking rates with low inputs aimed at maximising production per unit area when compared to more intensive systems with higher inputs and lower stocking rates aimed at maximising production per animal.

Where overstocking is the cause of land degradation it is important that solutions to the overstocking be sought and found – no other interventions will succeed. An attempt has been made to evaluate remedies to the overstocking problem, and it seems only those remedies that makes livestock holders pay i.e. bear the full cost for access to grazing areas (currently free) or to the keeping of livestock (currently subsidised) will be successful. What these have included with their expected medium and long-term effects on stocking rates in SNL is shown in Table C-4 (Brokken, 1993).

Table C-4: Some proposed destocking remedies and their possible medium and long term effects on stocking rates (Brokken, 1993)

Proposed remedy	**Expected effect on stocking rate**
Sisa or fattening ranch	Nil to exacerbating the situation
Feedlotting	Nil to exacerbating the situation
Improved marketing	Exacerbating problem
Marketing of animals at younger age	Nil to exacerbating the situation
Provision of subsidized dipping and other services	Exacerbating the problem
Reduced subsidies on dipping and other services	Reduces the problem
Grazing management demonstration areas	Nil
Range improvement to increase range and animal productivity	Exacerbating the problem
Education programmes appealing to sense of responsibility	Nil - not related to economic incentives
Educational programmes dealing with technical range and animal management problems	Nil – not related to economic incentives

It must be stressed that although high stocking rates are one of the major factors leading to overgrazing and eventually to soil erosion, there are few intentions by farmers to drastically reduce stocking rates. The situation is that of farmers wanting and even needing more livestock for draught, manure, milk and prestige whilst there are too many for the carrying capacity of the rangelands. At best, grazing schemes etc only help to treat the symptoms as a result of overgrazing; they will not mitigate the effects of overgrazing due to overstocking – only destocking can do this and there are no statutes on the law books for such eventualities despite repeated calls for such. Ultimately, only action by government will change this situation, and this seems very unlikely to occur at present.

Brokken (1993) went on to analyse the factors tending to increased or decreased stocking rates as shown in Table C-5. In Swaziland, the situation is more on the left of the table than on the right, and that there are more factors tending to an increase in stocking rates than to decreasing them.

Table C-5: Factors leading to stocking rate changes (Brokken, 1993)

Factors tending to lead to increase in stocking rates	**Factors tending to lead to decrease in stocking rates**
Increased net prices	Decreased net prices
Decreased input costs	Increased input costs
Increased productivity	Decreased productivity
Decreased opportunity cost of capital	Increased opportunity cost of capital

Sweet and Khumalo (1994) have also looked at the issue of controlling stocking rate and concluded that improved range management practices cannot be viewed as alternatives to stock control, and furthermore may be pointless if the causal factors of degradation remain in place.

Land tenure also complicates the issue as there is an uneven availability of grazing areas between different communities, there is often grazing shared between more than one community, community boundaries are often disputed and, upon decree, are sometimes changed adding to the confusion. Further, there is no direct responsibility for managing rangelands by individuals within a community, not even by the umsumpi who is basically an advisor to the Chief.

In terms of land use, topographically, the rangelands in the high and middleveld of Swaziland are found especially on the steeper parts of the landscape with cropping on the less steep areas. These areas are very sensitive to overgrazing and therefore erosion starts when the plant cover (litter and basal) is broken. This is particularly true of the study's target areas. In places there appears to be inappropriate land use with grazing being allowed to occur on land which is patently degraded and should be destocked – this results from a lack of application of land use planning principles.

Access to water for livestock can also cause problems especially where animals are walked to and from points at which water is available. Sometimes the animals have to get water from stream lines and in the process of entering the stream line erode the stream banks which can lead to the start of gullies from these places. Similarly, sponges are often puddle and become useless as they are not protected from trampling by livestock.

The "tradition" of indiscriminate burning the rangelands not only reduces the amount of forage available for livestock to feed on during the dry season, but also volatilises nutrients

and reduces organic matter (carbon and nitrogen) which are essential for the health of the rangelands and rangeland soils.

Physical services provided by government include dips and market places. Choice of siting of dips is done as much by considerations to the need by the Department of Veterinary and Livestock Services to service the dip as to servicing the needs of the farmers. Thus, there is often significant cattle tracking to and from dip sites as the animals are fairly large in number that use the dips and may be from a large area. Whilst markets have been set up to try to facilitate the offtake of animals, often these are old animals and/or of poor quality which only attract low prices, and this further discourages offtake.

Other services include provision of extension and conduct of research. Although there is some advice given on animal health and production, there is limited extension on range management. This is also true of extension on development and production of fodder crops. Research on range management in Swaziland and in production of fodder crops has been very limited. As a result, it has not been possible to determine the most appropriate times at which different parts of the landscape should be used in order to avoid rangeland degradation, nor to determine the most appropriate stocking rates to use.

C.2.2 The Stocking Rate Dilemma

It has been said "In communal grazing areas there are simultaneously too few and too many animals being carried".

This idiosyncrasy occurs because if we look at the average sized holding of livestock, in this case cattle, we find that:

- per household as many as 50% may not have any cattle at all and most that do have in fact only have less than ten head which is not a sustainable herd size and would require animals to be regularly bought in if the herd is to be sustained. Therefore, most farmers do not have adequate non-terminal product access to draught power for ploughing and transport, manure for fertilising, milk for consumption, etc, and do not have adequate terminal product access to meat and bones for consumption as a source of protein, hides for making into various products (ropes, shoes, etc), bones for fertiliser, sales to raise cash, and
- the often found high number of livestock are leading to overgrazing and, thus, too many animals are being held.

A farmer will generally not voluntarily destock when he does not have a large enough herd for its own sustainability, as it is not in his immediate interests to do so. Indeed in the sense of "the tragedy of the commons", he will never destock unless all his neighbours does and if he is the only one who does not destock he will get greater benefit from the use of the resource which encourages him to retain rather than dispose of his stock.

Another question that has been asked is "Does the farmer want to keep higher numbers of stock and earn some money whilst the farm is slightly degraded now, or does he want to farm with few livestock now to give the rangelands a chance to recover so that he can earn good money on rangelands that are in good condition in 10 years time?" If there is any uncertainty, he will tend to go for the first option where he will knowingly get some return even if not the maximum.

Culturally in many parts of Africa a person's stature in public is measured by the demonstration of his wealth as shown by the numbers of livestock that he has. Few farmers are willing to reduce their status by having fewer cattle.

From this short discussion, it is apparent that there are economic and social factors that have to be considered and not just ecological ones. In addition, the temporal setting also needs to be considered. When discussing stocking rates with farmers it is important to keep all these factors in mind when developing interventions.

C.3 Livestock Numbers in The Target Area Chiefdoms

Table C-6: Adjusted livestock numbers in each chiefdom area in TA1

Chiefdom	Cattle	Goats	Sheep	Horse	Donkey
Eni	350	225	0	1	46
Mdayane	596	593	0	0	0
Butfongweni	84	101	0	0	31
Maliyaduma	419	1013	30	0	9
Ngwazini	699	1351	0	0	0
Mbeka	294	191	0	0	18
Swaceni	91	68	0	0	0
Mkhulamini	105	43	8	3	18
Sankolweni	378	146	0	0	0
Ngcayini	1049	225	13	0	0
Ntunja	776	450	0	0	18
Nkiliji	1748	945	0	0	0
Nyakeni	7760	2251	495	6	46
Bhekinkoshi	489	563	50	0	15
Nsenga	870	113	10	0	15
Total TA1	15707	8278	605	10	217
Mean per chiefdom	1047	552	40	1	14
Range per chiefdom	84 to 7760	43 to 2251	0 to 495	0 to 6	0 to 46

Table C-7: Adjusted livestock numbers in each chiefdom area of TA2

Chiefdom	Cattle	Goats	Sheep	Horse	Donkey
Manyadzeni	87	98	10	3	6
Mchinsweni	760	3056	612	0	8
Mabona	1216	978	47	0	32
Dumenkhungwini	342	183	41	0	42
Zikhoteni	9497	917	102	0	106
Total TA2	11902	5232	811	3	195
Mean per chiefdom	2380	1046	162	1	39
Range per chiefdom	87 to 9497	98 to 3056	10 to 612	0 to 3	6 to 106

Table C-8: Adjusted livestock numbers at each chiefdom area in TA3

Chiefdom	Cattle	Goats	Sheep	Horse	Donkey
Bhadzeni II	1306	374	72	27	35
Dlandleni	78	829	14	0	3
Lishikisini	2395	935	98	0	12
Macudvulwini	* 1305	62	33	0	7
Mahhashini	122	106	6	0	7
Bhadzeni I	* 1044	249	65	4	9
Mgazini	* 1100	170	0	16	12
Khabonina	133	374	65	6	11
Ngcoseni	5721	939	405	0	50
Velezizweni	7837	8411	0	11	124
Total TA3	21040	12448	758	64	273
Mean per chiefdom	2104	1245	76	6	27
Range per chiefdom	78 to 7837	62 to 8411	0 to 405	0 to 27	3 to 124

* Data adjusted to allow for census data (Macdvulwini), field observations (Bhadzeni I) and royal cattle (Mgazini)

C.4 Stocking Rates in Target Areas

Table C-9: Adjusted stocking rate in each chiefdom area in TA1

	Adjusted Total LSUs	Adjusted total area (ha)	SR LSU/ha total area	SR ha/LSU total area	SR LSU/ha range area
Eni	271	341	0.80	1.26	1.43
Mdayane	446	507	0.88	1.14	1.47
Butfongweni	81	714	0.11	8.80	0.20
Maliyaduma	397	1032	0.38	2.60	0.62
Ngwazini	606	774	0.78	1.28	1.21
Mbeka	217	764	0.28	3.52	0.39
Swaceni	65	308	0.21	4.72	0.54
Mkhulamini	83	2033	0.04	24.47	0.07
Sankolweni	254	652	0.39	2.56	0.54
Ngcayini	685	894	0.77	1.30	1.12
Ntunja	551	835	0.66	1.52	0.81
Nkiliji	1211	1734	0.70	1.43	1.29
Nyakeni	5221	4110	1.27	0.79	1.84
Bhekinkoshi	390	1671	0.23	4.28	0.40
Nsenga	567	1011	0.56	1.78	0.85
Total for TA1	11047	17380	0.64	1.57	0.99
Mean per chiefdom	737	1159	0.64	1.57	0.99

Table C-10: Adjusted stocking rate in each chiefdom area in TA2

	Adjusted total LSUs	Adjusted total area (ha)	SR LSU/ha total area	SR ha/LSU total area	SR LSU/ha range area
Manyadzeni	73	1951	0.04	26.61	0.06
Mchinsweni	938	4065	0.23	4.33	0.65
Mabona	905	5682	0.16	6.28	0.23
Dumenkhungwini	264	4435	0.06	16.80	0.08
Zikhoteni	6119	6776	0.90	1.11	1.63
Total for TA2	8299	22909	0.36	2.76	0.56
Mean per chiefdom	1660	4582	0.36	2.76	0.56

Table C-11: Adjusted stocking rate in each chiefdom area TA3

	Adjusted total LSUs	Adjusted total area (ha)	SR LSU/ha total area	SR ha/LSU total area	SR LSU/ha range area
Bhadzeni II	907	2700	0.34	2.98	0.66
Dlandleni	156	826	0.19	5.30	0.26
Lishikisini	1632	4972	0.33	3.05	0.51
Macudvulwini	* 831	5488	0.15	6.60	0.21
Mahhashini	94	844	0.11	8.97	0.18
Bhadzeni I	* 700	2839	0.25	4.06	0.51
Mgazini	* 725	3642	0.25	4.06	0.51
Khabonina	148	921	0.16	6.23	0.23
Ngcoseni	3770	1999	1.89	0.53	3.24
Velezizweni	6021	6353	0.95	1.06	1.38
Total for TA3	14984	30584	0.49	2.04	0.78
Mean per chiefdom	1498	3058	0.49	2.04	0.78

C.5 Mean Livestock Holdings per Household

Table C-12: Mean household livestock holdings in each chiefdom in TA1

Chiefdom	Cattle	Goats	Sheep	Equines
Eni	2.5	1.0	0.0	0.2
Mdayane	3.5	2.2	0.0	0.0
Butfongweni	1.0	0.7	0.0	0.2
Maliyaduma	1.3	1.9	0.1	0.0
Ngwazini	0.7	0.9	0.0	0.0
Mbeka	3.2	1.3	0.0	0.1
Swaceni	2.5	1.2	0.0	0.0
Mkhulamini	0.2	0.0	0.0	0.0
Sankolweni	5.7	1.4	0.0	0.0
Ngcayini	7.4	1.0	0.1	0.0
Ntunja	9.6	3.4	0.0	0.1

Nkiliji	3.0	1.0	0.0	0.0
Nyakeni	15.0	2.7	0.7	0.1
Bhekinkoshi	1.3	0.9	0.1	0.0
Nsenga	5.0	0.4	0.0	0.0
Mean	3.5	1.2	0.1	0.0
Range	0.2 to 15.0	0 to 3.4	0 to 0.7	0 to 0.2

Table C-13: Mean household livestock holdings in each chiefdom in TA2

Chiefdom	Cattle	Goats	Sheep	Equines
Manyadzeni	0.2	0.1	0.0	0.0
Mchinsweni	3.3	8.3	5.0	0.0
Mabona	0.7	0.3	0.0	0.0
Dumenkhungwini	2.4	0.8	0.5	0.1
Zikhoteni	2.8	0.2	0.1	0.0
Mean	1.9	0.5	0.2	0.0
Range	0.2 to 3.3	0.1 to 8.3	0 to 5.0	0 to 0.1

Table C-14: Mean household livestock holdings in each chiefdom in TA3

Chiefdom	Cattle	Goats	Sheep	Equines
Bhadzeni II	4.3	1.7	0.2	0.1
Dlandleni	1.3	19.6	0.2	0.0
Lishikisini	1.5	0.8	0.0	0.0
Macudvulwini	0.5	0.1	0.0	0.0
Mahhashini	3.2	3.9	0.1	0.1
Bhadzeni I	2.5	1.6	0.2	0.0
Mgazini	0.2	0.4	0.0	0.0
Khabonina	0.4	1.5	0.1	0.0
Ngcoseni	10.0	2.3	0.5	0.1
Velezizweni	6.7	10.0	0.0	0.1
Mean	3.3	3.1	0.1	0.0
Range	0.2 to 10.0	0.4 to 19.6	0 to 0.5	0 to 0.1

C.6 Land Use in Each Chiefdom

Table C-15: Areas of land use in each chiefdom (ha) within TA1

Chiefdom	Livestock and grazing	%	Cropping	Forestry	Amenities	Total area
Eni	165	55	125	7	0	297.3
Mdayane	300	60	180	20	0	498.5
Butfongweni	410	58	280	25	0	712.8
Maliyaduma	635	62	370	20	0	1023.8

Ngwazini	500	65	275	0	3.8	775.0
Mbeka	550	73	205	0	0	753.5
Swaceni	120	39	160	12	13.3	307.5
Mkhulamini	640	57	370	100	6.8	1116.5
Sankolweni	475	73	155	20	0	652.3
Ngcayini	545	68	255	0	0	799.0
Ntunja	685	82	125	25	0	837.3
Nkiliji	935	54	770	25	0	1731.8
Nyakeni	2820	69	1255	15	4.0	4094.3
Bhekinkoshi	980	59	675	3	4.3	1661.8
Nsenga	670	66	330	6	8.8	1010.8
Total area TA1	10430		5530	280	40.9	16272.2
Areas (%)	64		34	2	0.2	
Mean per chiefdom	695		369	19	2.7	1085
Range % areas	39 to 82		15 to 52	0 to 9		

Table C-16: Areas of land use in each chiefdom (ha) within TA2

Chiefdom	Livestock and grazing	%	Cropping	Forestry	Amenities	Total area
Manyadzeni	615	65	330	1	3.8	952.0
Mchinsweni	70	35	125	0	0	198.5
Mabona	3165	68	1400	110	1	4674.3
Dumenkhungwini	775	80	190	2	2.8	970.5
Zikhoteni	1600	55	1280	6	0	2887.8
Total area TA2	6225		3325	120	7.6	9683.1
Area (%)	64		34	1	0.1	
Mean per chiefdom	1245		665	24	1.5	1937
Range % areas	35 to 80		20 to 63	0 to 2		

Table C-17: Areas of land use (ha) in each chiefdom within TA3

Chiefdom	Livestock and grazing	%	Cropping	Forestry	Amenities	Total area
Bhadzeni II	1350	51	665	625	20	2638.0
Dlandleni	600	73	225	0	0	826.8
Lishikisini	3160	64	1650	75	25.3	4910.0
Macudvulwini	3230	72	670	555	4	4458.5
Mahhashini	520	63	300	2	0	825.3
Bhadzeni I	1380	49	700	755	1	2837.5
Mgazini	1985	55	1510	85	8.8	3583.5
Khabonina	645	70	255	20	0	919.0
Ngcoseni	1155	58	795	8	21.5	1980.5
Velezizweni	4300	69	1730	235	15.3	6276.3
Total area TA3	18325		8500	2360	95.9	29255.4
Areas (%)	63		29	8	0.3	
Mean	1833		850	236	9.6	2926
Range % areas	49 to 73		15 to 42	0 to 27	0 to 25	

C.7 Carrying Capacity

Table C-18: Carrying capacity of erosion/degradation units in TA1

Unit	Location	Total area (ha)	% grazing	Range condition	Grazing area (ha)	Range type *	Grazing capacity ha/LSU	Carrying capacity (LSU)
1	Lububu Hill	350.0	75	Fair	262.5	UM3	3.3	80
2	Mbekelweni	576.3	65	Poor	374.6	UM3	4.3	87
3	Mtilane/Sigombeni	506.3	70	Poor	354.4	UM3	4.3	82
4	Mbuluzane	1333.8	85	Poor	1133.7	UM3	4.3	264
5	Mbuluzane	1101.3	75	Fair	826.0	UM3	3.3	250
6	Ntunja	251.3	80	Poor	201.0	UM3	4.3	47
7	Sigombeni	890.0	45	Poor	400.5	UM3	4.3	93
8	Sigombeni-Sankolweni	975.0	90	Poor	877.5	UM3	4.3	204
9	Ndlembeni/Nsenga	615.0	55	Fair	338.3	UM3	3.3	103
10	Nsenga Hill	187.5	95	Poor	178.1	UM3	4.3	41
11	Nsenga/Eni	852.5	55	Poor	468.9	UM3	4.3	109
12	Eni	137.5	80	Poor	110.0	UM3	4.3	26
13	Nsenga/Ngcayini	322.5	25	Poor	80.6	UM3	4.3	19
14	Ngcayini	275.0	65	Fair	178.8	UM3	3.3	54
15	Mhlambanyoni Valley	411.3	80	Poor	329.0	UM3	4.3	77
16	Nkiliji	152.5	15	Poor	22.9	UM3	4.3	5
17	Ntunja-Sankolweni	756.3	55	Poor	416.0	UM3	4.3	97
18	Mangcineni Plain	272.5	99	Poor	269.8	UM3	4.3	63
19	Kukhanyeni-Bufongweni	627.5	35	Fair	219.6	UM3	3.3	67
20	Nkiliji/Malete Valley	447.5	70	Poor	313.3	UM3	4.3	73
21	Nkiliji	412.5	58	Fair/Good	239.3	UM3	3.0	80
22	Mdayane	701.3	19	Poor/fair	133.2	UM3	4.0	33
23	Lutfotja Hill	406.3	85	Fair/poor	345.4	UM3	3.6	96
24	Lutfotja Hill	186.3	65	Good	121.1	UM3	2.8	43
25	Bhekinkosi/Mapopoma	831.3	50	Fair	415.7	UM3	3.3	126
26	Ngwazini/Bhekinkosi	475.0	65	Poor	308.8	UM3	4.3	72
27	Ngwazini	251.3	19	Poor	47.7	UM3	4.3	11
28	Swageni	487.5	55	Poor	268.1	UM3	4.3	62
29	Nyakeni	1166.3	45	Poor	524.8	UM3	4.3	122
30	Maliyaduma	1106.3	45	Fair	497.8	UM3	3.3	151
31	Mkhulamini	927.5	45	Poor	417.4	UM3	4.3	97
32	Maliyaduma	701.3	65	Very poor	455.8	UM3	5.3	86
33	Mbeka	655.0	70	Very poor	458.5	UM3	5.3	87
34	Mbuluzane	1462.5	60	Good	877.5	UM3	2.8	313
	Total/Mean for TA1	20812.0	60		12466.5		3.9	3219
	Range for chiefdoms	138-1463	15 to 99	Very poor: 2 Poor: 21 Fair: 9 Good: 2	23 - 1133	UM3: 34	2.8 to 5.3	5 to 313

Range type *: UM3 Upper middleveld hill grassland

Table C-19: Carrying capacity of erosion/degradation units in TA2

Unit	Location	Total area (ha)	% grazing	Range condition	Grazing area (ha)	Range type	Grazing capacity (ha/LSU)	Carrying capacity (LSU)
1	Sivule/Manyadzeni	1561.3	60	Fair/good	936.8	UM3	3.3	284
2	Sivule/Manyadzeni	560.0	85	Poor	476.0	UM3	4.8	99
3	Sivule/Manyadzeni	251.3	80	Poor	201.0	UM3	4.8	42
4	Southern watershed	300.0	85	Very poor	255.0	UM3	5.8	44
5	Sivule basin	188.8	20	Poor/fair	37.8	UM3	4.3	9
6	Sivule basin	50.0	100	Very poor	50.0	UM3	5.8	9
7	Sivule basin	75.0	100	Fair	75.0	UM3	3.8	20
8	Sivule basin	62.5	70	Very poor	43.8	UM3	5.8	8
9	Sivule basin	161.3	24	Poor	38.7	UM3	4.8	8
10	Mantambe	102.5	0	-	0.0	UM3	-	-
11	Lower Mantambe	198.8	85	Poor	169.0	UM3	4.8	35
12	Sivule basin	515.0	60	Poor	309.0	UM3	4.8	64
13	Matsiphula	300.0	20	Fair	60.0	UM3	3.8	16
14	Matsiphula	258.8	70	Very poor	181.2	UM3	5.8	31
15	Ncotshane Valley	336.3	80	Very poor	269.0	UM3	5.8	46
16	Ncotshane Valley	325.0	80	Very poor	260.0	LM3	5.2	50
17	Emzipha	127.5	0	-	0.0	LM3	-	-
18	Emzipha	87.5	9	Fair	7.9	LM3	3.2	2
19	Ncotshane Valley	315.0	55	Poor/fair	173.3	LM3	3.7	47
20	Ncotshane/Mboloba	422.5	80	Poor	338.0	LM3	4.2	80
21	Ncotshane Valley	481.3	60	Poor	288.8	LM3	4.2	69
22	Makhosini	186.3	80	Poor	149.0	UM3	4.8	31
23	Mlokotwa	25.0	20	-	5.0	UM3	-	-
24	Galile	726.3	45	Very poor	326.8	UM3	5.8	56
25	Hlobane	225.0	30	Very poor	67.5	UM3	5.8	12
26	Hlobane	225.0	95	Very poor	213.8	UM3	5.8	37
27	Hlobane/Mahanga	816.3	30	Very poor	244.9	UM3	5.8	42
28	Mahanga	101.3	95	Poor	96.2	UM3	4.8	20
29	Mahanga	275.0	38	Good	104.5	UM3	2.8	37
30	Mahanga	227.5	60	Fair	136.5	UM3	3.8	36
31	Hosea	323.8	45	Poor	145.7	UM2	4.4	33
32	Msila	1265.0	40	Fair/good	506.0	UM2	2.9	174
33	Mantambe	1127.5	40	Fair/good	451.0	UM2	2.9	156
34	Hluti Hills	543.8	60	Poor	326.3	UM2	4.4	74
	Total/Mean for TA2	12748.2	54	Poor	6943.4		4.2	1672
	Range per chiefdom	50 to 1561	0 to 100	Very poor: 10 Poor:13 Fair:7 Good:1	5 to 937	UM2: 4 UM3:24 LM3: 6	2.8 to 5.8	2 to 284

Range type *: UM2 Upper middleveld plateau wooded grassland
UM3 Upper middleveld hill grassland
LM3 Lower middleveld hilly broadleaf savanna

Table C-20: Carrying capacity of erosion/degradation units in TA3

Unit	Location	Total area (ha)	% grazing	Range condition	Grazing area (ha)	Range type	Grazing capacity (ha/LSU)	Carrying capacity (LSU)
1	Mbulungeni Hills	1251.3	55	Poor	688.2	H3	3.6	191
2	Mbulungeni	2120.0	45	Very poor	954.0	H3	4.6	207
3	Ngwempisana	1235.0	70	Very poor	864.5	H3	4.6	188
4	Macudvulwini	530.0	85	Poor	450.5	H3	3.6	125
5	Macudvulwini	197.5	10	Very poor	19.8	H3	4.6	4
6	Plateau	186.3	95	Fair	177.0	H3	2.6	68
7	Macudvulwini	787.5	70	Poor	551.3	H3	3.6	153
8	Plateau	656.3	10	Poor	65.6	H3	3.6	18
9	Plateau	145.0	90	Fair	130.5	H3	2.6	50
10	Velezizweni	808.8	80	Poor	647.0	H3	3.6	180
11	Hill slopes	306.3	50	Poor	153.2	H4	3.6	43
12	Velezizweni	1353.8	60	Poor	812.3	H4	3.6	226
13	Ngwempisi	656.3	60	Poor	393.8	H4	3.6	109
14	Ngwempisi	801.3	60	Poor	480.8	H4	3.6	134
15	Ngwempisi	752.5	20	Very poor	150.5	H4	4.6	33
16	Ngwempisi	866.3	35	Poor	303.2	H4	4.6	66
17	Ngwempisi	792.5	39	Fair/good	309.1	H4	2.3	134
18	Ngwempisi	408.8	48	Fair	196.2	H4	2.6	75
19	Ebhadzeni	455.0	80	Poor	364.0	H4	3.6	101
20	Ebhadzeni	797.5	30	Poor	239.3	H4	3.6	66
21	Tsawela	980.0	23	Poor	225.4	H5	3.0	75
22	Tsawela	451.3	95	Fair	428.7	H5	2.0	214
23	Mhlatane	1275.0	35	Fair	446.3	H4	2.6	172
24	Mhlatane	822.5	70	Poor	575.8	H4	3.6	160
25	Ngwempisana	872.5	35	Very poor	305.4	H4	4.6	66
26	Mbulungeni	736.3	45	Very poor	331.3	H4	4.6	72
27	Footslopes	310.0	25	Poor	77.5	H4	3.6	22
28	Mponono	1043.8	15	Poor	156.6	H3	2.6	60
29	Mponono/Buzemi	627.5	60	Poor	376.5	H3	3.6	105
30	Nkhanyezini	2150.0	60	Fair to poor	1290.0	H4	3.1	416
31	Ngwempisi	1377.5	65	Poor	895.4	H4	3.6	249
32	Escarpment	515.0	85	Poor/fair	437.8	H5	2.7	162
33	Escarpment	945.0	80	Poor/fair	756.0	H5	2.7	280
34	Escarpment	450.0	65	Poor/fair	292.5	H5	2.7	108
35	Nkhanyezini/Musi	506.3	75	Very poor	379.7	H4	4.6	83
36	Kuboni	300.0	95	Very poor	285.0	H4	4.6	62
37	Tsawela	1475.0	70	Very poor	1032.5	H5	4.0	258
38	Nokuthula	1110.0	20	Poor	222.0	H5	3.2	69
39	Mathlangatja Hills	326.3	80	Poor/very poor	261.0	H4	4.4	59
	TOTAL/MEAN	31382.0	53	Poor	16725.9	H4/H3	3.4	4865
	Range	186 to 2150	10 to 95	Very poor: 9 Poor: 23 Fair: 6	65 to 1290	H3:12 H4:20 H5:7	2.0 to 4.6	4 to 416

				Good: 0				

Range type: H3 Highveld steep hill grassland
H4 Highveld valley grassland
H5 Highveld plateau grassland

C.8 Project Design Matrix

Table C-21: Controlled Management Of Rangelands Using Fenced Rotation Schemes In TA1

Project: Study Of Improvement Of Rural Environments On Degraded Land In Swaziland
Target Group: Rural Communities in Kukhanyeni Target Area (TA1) Duration: 2001-2003
Target Location: Eni/Ngcayini Pilot Area Preparation Date: June 2003

NARRATIVE SUMMARY	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
OVERALL GOAL Soil erosion is reduced and land condition returns to normal.	Within five years: 1.1 Ground cover increased by 100 % (i.e. current cover doubled) 1.2 Range condition all increased to fair or good condition 1.3 Water available in rangelands	Range condition assessments	o No adverse socio-political, economic and financial and environmental conditions, neither during nor after implementation
PURPOSE To have rangelands under controlled management and livestock sold in good condition	For each of the two nominated pilot area range management schemes: 1.1 Range management activities implemented by February 2003 1.2 Fodder produced and used for livestock fattening by March 2003 1.3 Livestock sold well fleshed for high prices by September 2003 1.4 Fully functioning management and control by September 2003	For each of the two nominated pilot area range management schemes: 1.1 Range management records 1.2 Feedlot records 1.3 Livestock condition assessments and sale prices 1.4 Records of management committee	o The seasons following implementation not adverse in any way
OUTPUTS 1. Plans prepared for controlled management of rangelands 2. Fenced grazing scheme erected and under controlled grazing 2. Feedlots erected and cattle being fattened 3. Fodder plots established and productive 4. Monitoring procedures developed for implementation	**For each of the two nominated pilot area range management schemes:** 1.1 Plans developed by March 2002 and finalised by September 2002 2.1 Fencing erected by September 2002 3.1 Feedlots erected by September 2002 4.1 Fodder plots planted by January 2003 5.1 Range condition assessment plans developed by March 2003	**For each of the two nominated pilot area range management schemes:** 1.1 Range management plans 2.1 Fence inspection 3.1 Feedlot inspection 4.1 Fodder plot inspection 5.1Monitoring guidelines	o Community training sessions well attended o Lessons learnt in training effectively implemented

ACTIVITIES	**INPUTS**		
1.1 Community agreed on need for controlled management of rangelands and interventions 1.2 Community agreed on action to be taken and grazing rules and by-laws 1.3 Grazing sub-committee appointed and activated 2.1 Sites selected for range management activities endorsed by elders 2.2 Grazing areas inspected and surveyed; plans for controlled management made and endorsed by community and elders 2.3 Training needs and schedules determined, and training materials developed 2.4 Cost and work sharing agreed and all plans and agreements signed by stakeholders at a signing ceremony 2.5 NGO help obtained for fence construction, materials procurement and work group organisation, and fencing erected 2.6 Grazing procedures explained, so villagers can implement them 3.1 Sites surveyed for feedlots and final siting determined 3.2 NGO help obtained, materials procured and work groups organised and feed pens erected 3.3 Fattening procedures explained so villagers can start fattening stock 4.1 Sites surveyed for fodder plots and final siting of fodder plots determined 4.2 Help from NGO obtained for establishment of fodder plots, obtaining fencing materials, etc, and planting of fodders, and fodders planted 4.3 Inspection for when fodder ready for harvest, cut-and-carry procedures commenced and feeding to fat stock started 5.1 Activities, expected outputs and purpose of interventions reviewed, items to monitor selected and methodology described 5.2 Monitoring procedures and protocols designed and developed 5.3 Baseline survey designed, organised and conducted to initiate monitoring procedures	**Japanese Government** 1. Manpower: Range management expert Supervisory assistance for implementation 2. Materials: Fencing wire and posts Treated poles Gates Cement and stone chips Piping and plumbing Brick shed with door Fertiliser Fodder planting material 3. Machinery & Tools: Fencing tools Building tools Transport for staff and materials Maps and air photos **COSTS**	**Swaziland** 1. Government: Coordination On-going extension Transport for inter-site tours 2. Community: Labour Locally gathered rock and sand Meeting place Cash savings for maintenance	o Sites selected for specific interventions endorsed by community and elders o Sufficient funds and materials available o Communities abide by agreement for cost and work sharing o Government support provided, especially for provision of adequate staffing to undertake training in leadership, range and grazing management, fodder production, animal nutrition and feeding --- ***PRE-CONDITIONS*** o Communities and their leaders interested in participating o Government committed to active support of activities

Table C-22: Controlled Management of Rangelands Using Fenced Rotation Schemes In TA3

Project: Study of Improvement of Rural Environment in Degraded Land in Swaziland
Target Group: Rural Communities in Ngwempisi Target Area (TA3) Duration: 2001-2003
Target Location: Macudvulwini Pilot Area Preparation Date: June 2003

NARRATIVE SUMMARY	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
OVERALL GOAL Soil erosion is reduced and land condition returns to normal.	Within five years: 1.1 Ground cover increased by 100 % (i.e. current cover doubled) 1.2 Range condition all increased to fair or good condition 1.3 Water available in rangelands	Range condition assessments	o No adverse socio-political, economic and financial and environmental conditions, neither during and nor after implementation
PURPOSE To have rangelands under controlled management and livestock sold in good condition	For the nominated pilot area range management scheme: 1.1 Range management activities implemented by February 2003 1.2 Fodder produced and used for livestock fattening by April 2003 1.3 Livestock sold well fleshed for high prices by September 2003 1.4 Functioning management and control by September 2003	For the nominated pilot area range management scheme: 1.1 Range management records 1.2 Feedlot records 1.3 Livestock condition assessments and sale prices 1.4 Records of management committee	o Seasons following implementation not adverse in any way
OUTPUTS 1. Plans for controlled management of rangelands prepared 2. Fenced grazing scheme erected and under controlled grazing 3. Feedlots erected and cattle being fattened 4. Fodder plots established and productive 5. Monitoring procedures developed for implementation	For the nominated pilot area range management scheme: 1.1 Plans developed by March 2002 and finalised by September 2002 2.1 Fencing erected by January 2003 3.1 Feedlot erected by February 2003 4.1 Fodder plots planted by January 2003 5.1 Range condition assessment plans developed by March 2003	For the nominated pilot area range management scheme: 1.1 Range management plans 2.1 Fence inspection 3.1 Feedlot inspection 4.1 Fodder plot inspection 5.1 Monitoring guidelines	o Community training sessions well attended o Lessons learnt in training effectively implemented

ACTIVITIES	INPUTS		
1.1 Community agreed on need for controlled management of rangelands and interventions 1.2 Community agreed on action to be taken and grazing rules and by-laws 1.3 Grazing sub-committee appointed and activated 2.1 Sites selected for range management activities endorsed by elders 2.2 Grazing areas inspected and surveyed; plans for controlled management made and endorsed by community and elders 2.3 Training needs and schedules determined, and training materials developed 2.4 Cost and work sharing agreed and all plans and agreements signed by stakeholders at a signing ceremony 2.5 NGO help obtained for fence construction, materials procurement and work group organisation, and fencing erected 2.6 Grazing procedures explained, so villagers can implement them 3.1 Sites surveyed for feedlots and final siting determined 3.2 NGO help obtained, materials procured and work groups organised and feed pens erected 3.3 Fattening procedures explained so villagers can start fattening stock 4.1 Sites surveyed for fodder plots and final siting of fodder plots determined 4.2 Help from NGO obtained for establishment of fodder plots, obtaining fencing materials, etc, and planting of fodders, and fodders planted 4.3 Inspection for when fodder ready for harvest, cut-and-carry procedures commenced and feeding to fat stock started 5.1 Activities, expected outputs and purpose of interventions reviewed, items to monitor selected and methodology described 5.2 Monitoring procedures and protocols designed and developed 5.3 Baseline survey designed, organised and conducted to initiate monitoring procedures	**Japanese Government** 1. Manpower: Range management expert Supervisory assistance 2. Materials: Fencing wire and posts Treated poles Gates Cement and stone chips Piping and plumbing Brick store shed with lockable door Fertiliser Fodder planting material 3. Machinery & Tools: Fencing tools Building tools Transport for staff and materials Maps and air photos **COSTS**	**Swaziland** 1. Government Coordination On-going extension Transport for tours 2. Community: Labour Locally gathered rock and sand Meeting place Cash savings for maintenance	o Sites selected for specific interventions endorsed by community and elders o Sufficient funds and materials available o Communities abide by agreement for cost and work sharing o Government support provided, especially for provision of adequate staffing to undertake training in leadership, range and grazing management, fodder production, animal nutrition and feeding --- ***PRE-CONDITIONS*** o Communities and their leaders interested in participating o Government committed to active support of activities

C.9 SUMMARY ACCOMPLISHMENT GRID OF GRAZING SCHEME, FODDER PLOT AND FEEDLOT IMPLEMENTATION ACTIVITIES

*Accomplishment Grades: A = successful, no modification needed, B = workable, needs review, C = partly workable, needs revision, D = unworkable, needs redesign/completion

Category Indicators	Source Of Information	Evaluation Method	Evaluation	Grade*
Inputs: • Technical assistance • Materials • Tools • Coordination • Extension and training • Community participation	Logframe matrix	Comparison of anticipated need with actual use, especially with respect to design and use	Being a pilot project the basic minimum of inputs required to allow operational success to be achieved were used. Under full-scale operation greater inputs may be required. For example: ▪ Handling facilities are needed close to, if not actually inside, grazing schemes; a small storeroom (such as at feedlots) should be built beside these handling facilities ▪ Kits for basic animal husbandry needs should be available as there can be no reliance on timely visits of government animal production extension staff ▪ Fodder needs to be planted well in advance of feedlot erection; the full 4 ha should be planted at same time ▪ Fodder plots need goat-proof fencing rather than just cow-proof fencing ▪ Protection from cold winds and the sun should be considered especially at feedlots – use and planting of suitable tree species, appropriately placed and spaced, should be considered ▪ Attention urgently needs to be paid to setting up a sustainable form of extension and training – *ad hoc* visits will not lead to long term sustainability	B C C B B C

Activities: ▪ Community participation in activities ▪ Community, committees and elders develop grazing scheme ▪ Community, committees and elders develop fodder plot and feedlot ▪ Monitoring protocols developed	• Plan of operation • Logframe matrix • NGO records • Committee records	Monitoring of activities and checking records of activities carried out	Activities primarily those involving the major beneficiaries of the pilot projects: ▪ Community participation in discussion and work contribution has been more active by some members than others but there was enough overall to achieve the anticipated outputs ▪ Site selection and endorsement for grazing scheme was done by elders, fencing to a high standard done by household members, committees supervised a pool of workers drawn from members households, supervision given by experienced NGO staff ▪ Site selection and endorsement for feedlot and fodder plot was done by elders, feedlot fencing and construction to a high standard done by homestead members and local builder, fodder plot planting interfered with crop husbandry and was not done as well as possible but this not helped by early closing poor rains during the growing season, supervision given by experienced NGO staff ▪ Monitoring protocols not developed by committees through lack of training and experience	B A B D
Outputs: ▪ Plan preparation ▪ Grazing fence erection ▪ Feedlot construction ▪ Fodder planting ▪ Monitoring conducted	• Documentation prepared • Facilities on ground	Inspection and ground truthing of actual outputs achieved	Major outputs are considered as being the infrastructure developments: ▪ Plans of operation developed for each pilot project facility; these need review and translating into Seswati ▪ Grazing schemes fenced well; straining posts used at weak places as needed; separation of wires appropriate; braces used to strengthen fence ▪ Feedlots robustly constructed; construction of concrete; feeding and watering places included ▪ Fodder planting started late and not finished due to poor rains • Due to lack of experience, management committees have still to develop monitoring protocols such as range condition assessment etc.	B A A C D

C.10 SUMMARY EVALUATION OF GRAZING SCHEME, FODDER PLOT AND FEEDLOT IMPLEMENTATION ACTIVITIES

Narrative Summary	**Efficiency**		
	Inquiry result	**Assessment**	**Significance**
Goal	X	X	X
Purpose/Objectives	X	X	X
Outputs/Results	Using materials donated by donor and other resources from government, NGO assistance and community participation:		
Inputs	• 2 sets of plans of operation produced	++	High
	• Management sub-committees in place for each unit	++	High
	• 3 fenced rotation grazing schemes erected	++	High
	• 3 constitutions/by-laws produced for fenced grazing	+	High
	• 1 of 2 fodder plots established	+/--	High
	• 2 fattening pens constructed	++	High
	• No constitutions/by-laws produced for feedlots	--	High
	• Whilst committees have had training, there has been limited training of farmers	-	High

Narrative Summary	**Effectiveness**		
	Inquiry result	**Assessment**	**Significance**
Goal	X	X	X
Purpose/Objectives	Whilst various facility and management structures are in place, not all are fully operational and aiming at overall achievement of controlled grazing management and sale of livestock in good condition:		
	• plans of operation need translation and review	+	Medium
		+	High

Outputs/Results	• grazing schemes not fully operating a grazing rotation • there is a tendency to increase rather than restrict stock numbers • grazing scheme constitutions need review • fodder plot needs planting (other needs expansion) • 1 or 2 fattening units in operation • written by-laws for operation of feedlots needed • more on-going and continuing training needed	- + -- +/- -- -	High Medium High Low Medium High
Inputs	X	X	X

Narrative Summary	**Impact**		
	Inquiry result	**Assessment**	**Significance**
Goal **Purpose/Objectives**	It is anticipated that once fully operational and farmers become committed to a business approach to livestock keeping that soil erosion, at least on grazing areas, will be significantly reduced, but as at present the projects have not been operating for long enough there is no discernable impact, neither positive nor negative, on achievement of the projects' goals and purposes.	+/-	Low
Outputs/Results	X	X	X
Inputs	X	X	X

Narrative Summary	Relevance		
	Inquiry result	**Assessment**	**Significance**
Goal	• The government's policy is to halt and reverse soil degradation in the country, and its policy's and commitment remain unchanged, although not all these policies have been formally promulgated. • The initial strong resolve of farmers to participate in conservation remains firm. • The initial inclination of farmers to control stock numbers in controlled grazing areas and to fatten stock for sale would seem to have been tempered with ideas as to the alternate uses of the facilities for other purposes, for example fenced grazing as daytime holding camps and fattening units for conditioning cattle.	+ ++ -	Medium High High
Purpose/Objectives			
Outputs/Results	X	X	X
Inputs	X	X	X

Narrative Summary	Sustainability		
	Inquiry result	**Assessment**	**Significance**
Goal	• Government's lack of formalised policies for conservation work leaves a feeling of insecurity with respect to future policy, development and funding • Government has not committed itself fully with staff to support conservation initiatives, and in particular development of long term "in-field" hands-on extension and training programmes in support of the grazing, fodder plot and fattening units	- --	Medium High
Purpose/Objectives			
Outputs/Results			

Inputs	• Experience of participation and use of a systematic approach to planning and development has been beneficial and could contribute to sustainability as it has shown farmers that they are capable of doing things using their own resources of initiative.	++	High
	• Community management sub-committees in place (some more dynamic than others) which will promote sustainability of the purpose so long as they remain dynamic and committed to the management of the units	++/-	High
	• Community committees subject to change which can be disruptive especially if the main training effort has been directed at the committee rather than the community members and if there is no substantial sustained extension programme in place	-	High

C.11 PROJECT CYCLE MANAGEMENT MATRIX FOR SPRING WATER SOURCE PROTECTION

Table C-23: Spring Water Source Protection Matrix For TA1, TA2 And TA3

Project: Study of Improvement of Rural Environment in Degraded Land in Swaziland
Target Group: Rural Communities in TA1, TA2 & TA3 Duration: 2001-2003
Target Locations: Eni/Ngcayini, Zikhoteni & Macudvulwini Pilot Areas Preparation Date: June 2003

NARRATIVE SUMMARY	VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
OVERALL GOAL Soil erosion is reduced and land condition returns to normal.	Within five years: 1.1 Ground cover increased by 100 % 1.2 Range condition all increased to fair or good condition 1.2 Water available in rangelands	Permanent secure protected clean water sources	o No adverse socio-political, economic and financial and environmental conditions, neither during nor after implementation
PURPOSE Secure protected clean water sources established in rangelands near homesteads	For each of the 3 nominated pilot project areas: 1.1 Functioning management and control of protected water sources by September 2003	For each of the 3 nominated pilot project areas: 1.1 Records of management committee 1.2 Use of water sources	o Seasons following implementation not adverse in any way
OUTPUTS 1. Selected watering points and sources protected 2. Monitoring procedures developed for implementation	For each of the 3 nominated pilot project areas: 1.1 Selected watering points protected by March 2003 2.1 Water quality assessment plans developed by July 2003	For each of the 3 nominated pilot project areas: 1.1 Water sources inspected 2.1 Monitoring guidelines	o Community training sessions well attended o Lessons learnt in training effectively implemented

ACTIVITIES	**INPUTS**		
1.1 Community agrees on need for water protection and management in rangelands 1.2 Community agrees on action to be taken and rules and by-laws and water management sub-committee appointed and activated 1.3 Sites for water protection inspected, selected and surveyed and endorsed by elders 1.4 Cost and work sharing agreements made and all plans signed by stakeholders at a signing ceremony 1.5 NGO help obtained for water source protection, materials procured, work groups organised and work started 1.6 Water source protection and management procedures explained, so villagers can implement them 2.1 Design and development of monitoring procedures and protocols 2.2 Baseline survey conducted to initiate monitoring procedures	**Japanese Government** 1. Manpower: Rangeland resource expert Supervisory assistance 2. Materials: Fencing Cement and stone chips Piping and plumbing Washing tables Wash rooms 3. Machinery & Tools: Building and plumbing tools Maps and air photos **COSTS**	**Swaziland** 1. Government: Coordination On-going extension 2. Community: Locally collected sand and stone Labour Cash savings for maintenance fund Meeting place	o Sites selected for specific interventions endorsed by community and elders o Sufficient funds and materials available o Communities abide by agreement for cost and work sharing o Government support provided, especially for provision of adequate staffing to undertake training in leadership, range and grazing management, fodder production, animal nutrition and feeding ***PRE-CONDITIONS*** o Communities and their leaders interested in participating o Government committed to active support of activities

C.12 SUMMARY ACCOMPLISHMENT GRID OF SPRING WATER SOURCE PROTECTION IMPLEMENTATION ACTIVITIES

*Accomplishment Grades: A = successful, no modification needed, B = workable, needs review, C = partly workable, needs revision, D = unworkable, needs redesign/completion

Category Indicators	Source Of Information	Evaluation Method	Evaluation	Grade*
Inputs: • Technical assistance • Materials • Tools • Coordination • Training • Community participation	Logframe matrix	Comparison of anticipated need with actual use, especially with respect to design and use	Being a pilot project the basic minimum of inputs required to allow operational success to be achieved were used. Under full-scale operation greater inputs may be required. For example: • Where there are eroded areas and especially sponges, these need to be fully fenced and protected from grazing animals • Where there are more than 15 families the number of wash tubs and washrooms should be increased • Toilets need to be included at the sites for health reasons • Greater training on maintenance is needed (washer changes etc)	 C A D C
Activities: • Community, with Elders, participate in decision to protect water sources • Community participates in water source protection • Monitoring protocol developed	• Plan of operation • Logframe matrix • NGO records • Committee records	Monitoring of activities and checking records of activities carried out	Activities primarily those involving the immediate beneficiaries of the pilot project (i.e. those families living close by): • Community participation has been particularly good by those few families benefiting • Site selection and groups to benefit endorsed by Elders • Monitoring protocols for water quality not worked out for community; although they are aware that water quality is much cleaner and tastes better, no objective tests developed	 A A C
Outputs: • Protected water sources used by communities • Water quality monitoring	• NGO reports • Facilities on the ground	Ground inspection of actual facilities and checking of water quality for taste, turbidity and clarity	Major outputs are considered as being the infrastructure developments and start of use of facilities: • Building works done to high and durable standard • Fencing protecting water source done to high standard • Water quality improved	 A A A

C.13 SUMMARY EVALUATION OF SPRING WATER SOURCE PROTECTION IMPLEMENTATION ACTIVITIES

Narrative Summary	**Efficiency**		
	Inquiry result	**Assessment**	**Significance**
Goal	X	X	X
Purpose/Objectives	X	X	X
Outputs/Results	Using materials donated by donor and other resources from the community, NGO assistance and community participation in planning, development and construction:		
Inputs	• Management structures in place • 6 water source protection sites developed and protected (five springs and one pump) • 6 washing facilities erected (one per site) • No formal by-laws written, although understandings made • Only hands-on training provided	++ ++ ++ +/- -	High High High Medium Low

Narrative Summary	**Effectiveness**		
	Inquiry result	**Assessment**	**Significance**
Goal	X	X	X
Purpose/Objectives	Following the construction of the units: • There is enthusiastic and appreciative use of the facilities as they ease the burden of carrying water to the homesteads to undertake washing and bathing • Water quality as it is protected from contamination right from its source, is pure, sweet	++ ++	High High

Outputs/Results	tasting, crystal clean and clean • Due to the construction around the water sources and the fences in the surrounding areas, there is prevention of puddling and little likelihood of erosion developing from these sites	++	High
Inputs	X	X	X

Narrative Summary	**Impact**		
	Inquiry result	**Assessment**	**Significance**
Goal	The impact of the development of the facilities has all been positive and water sources have come under protection. Communities are already fully using the facilities and sharing them with neighbours.	++	High
Purpose/Objectives			
Outputs/Results	X	X	X
Inputs	X	X	X

Narrative Summary	**Relevance**		
	Inquiry result	**Assessment**	**Significance**
Goal	• The commitment to start conservation of all the resources in the rangeland areas is met. • The need to provide tangible benefits to communities is met • The level of satisfaction with the facilities has been summed up by one beneficiary "I never knew what it was like to live in town before, with running water"!	++ ++ ++	High High High
Purpose/Objectives			
Outputs/Results	X	X	X
Inputs	X	X	X

Narrative Summary	Sustainability		
	Inquiry result	**Assessment**	**Significance**
Goal	• Having an active management structure in place should ensure that the facilities continue to provide benefits over the long-term	++	High
Purpose/Objectives	• The sturdy construction using quality materials and skilled labour (a builder) in the construction of the facilities will ensure the structures will remain long standing	++	High
Outputs/Results	• The start to the collection of an annual subscription to be used for maintenance works should ensure long-term sustainable use of the facilities	++	High
Inputs	• The need for maintenance especially of the surrounding fences needs to be reinforced periodically with extension training on maintenance to protect sponges and spring, but there is little facility for this type of extension within Ministry programmes at present	-	Low

C.14 TRAINING NEEDS

C.14.1 Leadership Training

To be effective, committee members should be given leadership training. This training should be of a more general nature to allow them to carry out their duties as leaders in an efficient manner as well as of a more specific nature to allow them to manage the specific projects in which they are providing leadership.

Topics to be covered on leadership training courses would cover, for example:

- duties of officers
- establishing accountability of leaders
- holding meetings
- community mobilisation and organisation
- planning and development of master plans
- development of plans of operation
- planning activities
- project management and monitoring
- motivating and working with communities
- motivating and working with elders
- find help
- making constitutions
- consultation techniques
- managing confrontation
- establishing community discipline
- organising and conducting training
- keeping records and activity monitoring
- development of business plans

In consultation, there should be development of the final content of such courses, production of a "training manual/notes" in Seswati, production of training aids, delivery of the training, performance measurement as follow-up on training for evaluation purposes.

Expectation of time involved would be 2 days for delivery plus 2 additional days set aside for refresher training of leaders and follow-up by trainers at intervals of one month thereafter.

Note that these training courses are meant to complement, not replace, normal extension activities.

C.14.2 Range Management Training

To be effective range managers, grazing management committees and farmers need training in range management of a general nature whereby they learn about some "theory" and concepts of range and grazing management, and of a specific nature where they learn exactly how to apply their plans of operation.

Topics to be covered on grazing and range management courses would cover, for example:

- components of rangelands (air, soil, water, animals, people)
- natural resources and the need for their conservation (renewable and non-renewable resources)
- basic ecology
- causes of soil erosion
- requirements for plant growth

- meeting needs of keeping animals on the land
- meeting people's needs from farms
- setting long term goals and medium term objectives
- planning land use and allocating land for grazing
- dividing range areas for use as grazing camps (paddocking and considerations of water, range type, slope, aspect)
- fencing (erection and maintenance)
- grazing procedures (continuous, rotational resting and deferred, rotational grazing, rotational resting and grazing, zero grazing)
- grazing principles (stocking rates, period of use, period of rest, top hamper control)
- grazing management records
- planning paddock use, rotations and rest
- range/veld condition assessments and monitoring
- range reinforcement
- range rehabilitation
- integrating crops and livestock on the farm
- opportunities and constraints for commercialising ruminant production from rangelands

In consultation, there should be development of the final content of such courses, production of a "training manual/notes" in Seswati, production of training aids, delivery of the training, performance measurement as follow-up on training for evaluation purposes.

Expectation of time involved would be 2 days for delivery plus 2 additional days set aside for refresher training of committee members and farmers attending and follow-up by trainers at intervals of one month thereafter.

Note that these training courses are meant to complement, not replace, normal extension activities.

C.14.3 Animal Feeding, Fattening And Feedlot Management Training

To be effective feedlot managers, feedlot management committees and farmers need training in feeding and fattening of livestock and management of feedlot units of a general nature whereby they learn about some "theory" and concepts of these, and of a specific nature whereby they learn exactly how to apply these principles to their plans of operation.

Topics to be covered on feedlot management and livestock fattening courses would cover, for example:

- types of feed (bulk, supplement, concentrate, fresh, conserved)
- feed resources
- feed composition and quality
- animal feed and nutrient needs (maintenance, growth, production)
- planning feed flows
- planning fattening of livestock
- budgeting and calculating gross margins and profitability
- record keeping and activity monitoring
- obtaining feeds
- mixing different feedstuffs and concentrates
- precautions in handling and feeding feedstuffs
- provision of water
- animal waste disposal
- finding markets for fattened stock

In consultation, there should be development of the final content of such courses, production of a "training manual/notes" in Seswati, production of training aids, delivery of the training, performance measurement as follow-up on training for evaluation purposes.

Expectation of time involved would be 2 days for delivery plus 2 additional days set aside for refresher training of leaders and follow-up by trainers at intervals of one month thereafter.

Note that these training courses are meant to complement, not replace, normal extension activities.

C.14.4 Fodder Production, Management And Feeding

To be effective fodder production managers, fodder plot management committees and farmers need training in fodder plot management and fodder production of a general nature whereby they learn about some "theory" and concepts of fodder production, and of a specific nature whereby they learn exactly how to apply these principles to their plans of operation and specific units.

Topics to be covered on fodder plot management and fodder production courses would cover, for example:

- types and suitability of different fodders
- planning fodder needs
- land preparation
- planting and growing of fodder crops
- fertilising fodders
- harvesting fodders
- feeding of fodders
- weed control
- pest control
- use of manure
- planning and conserving excess fodder growth
- monitoring fodder production, management and use and record keeping.

In consultation, there should be development of the final content of such courses, production of a "training manual/notes" in Seswati, production of training aids, delivery of the training, performance measurement as follow-up on training for evaluation purposes.

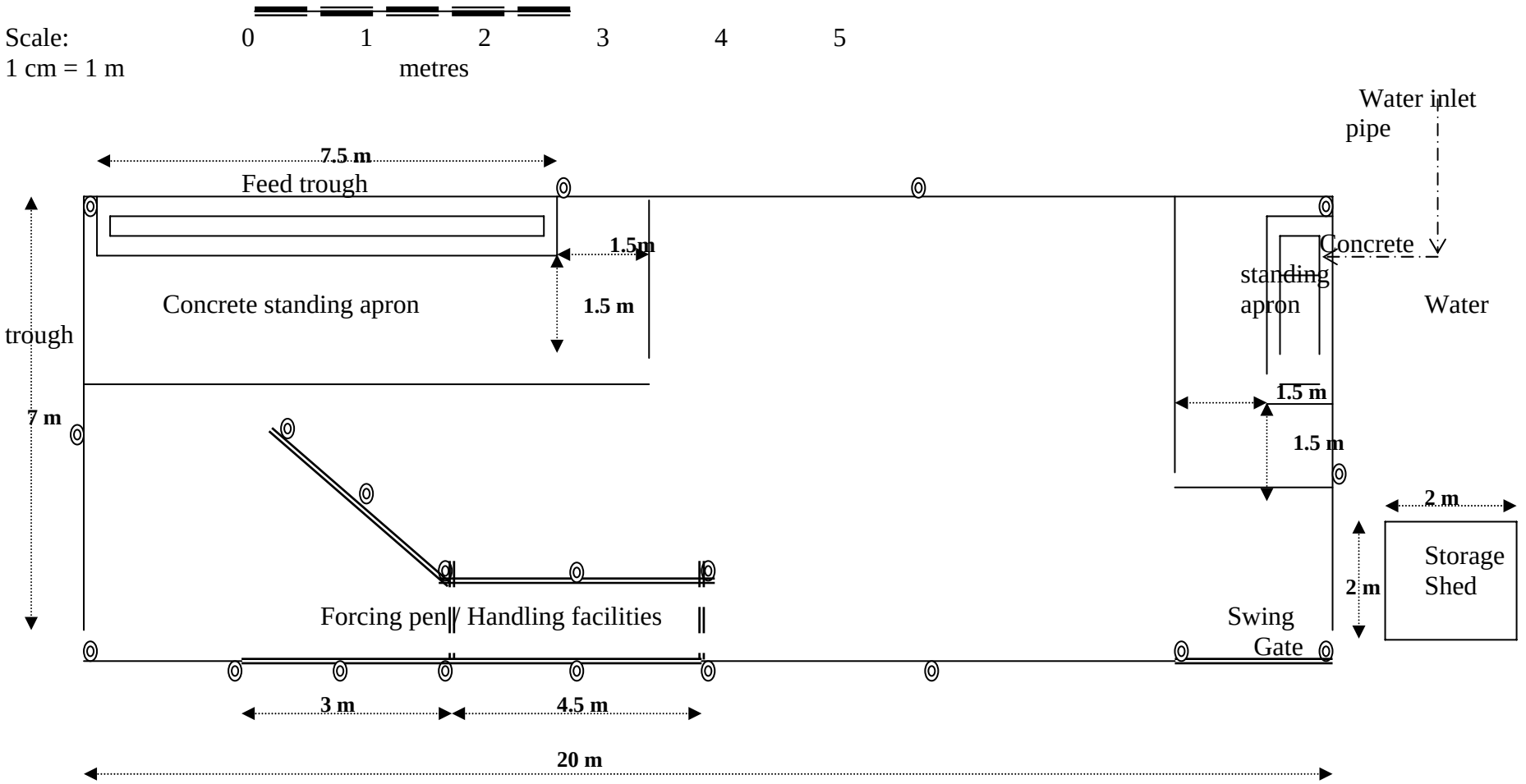
Expectation of time involved would be 1 day for delivery plus 2 additional days set aside for refresher training of leaders and follow-up by trainers at intervals of one month thereafter.

Note that these training courses are meant to complement, not replace, normal extension activities.

C.14.5 Other Training Courses

Other courses will need to be developed, for example, milk production and dairy cow management, management of small dairy units, general management of range animals (cattle, goats, sheep). As with the other courses described here, these courses are designed to complement, not replace a good well-designed extension programme.

C.15 Schematic Diagram of A Typical Fattening Unit Construction



C.16 Grazing In Erosion Units

Table C-24: Units and areas where fenced rotation grazing management treatment

is needed in moderately and severely eroded areas of TA1

Soil erosion unit & condition	Range area in erosion unit (ha)	Chiefdoms affected	Area (ha)	Comments concerning implementation
1 Serious	300	Mkhulamini Nyakeni	178 122	Potential but only with joint co-operation, include also northern part of unit 31
2 Serious	200	Outside target area	200	Has potential
7 Moderate	130	Outside target area	130	Relatively fragmented river lines
9 Moderate	340	Outside target area	340	Very fragmented along river lines and slope bases
11 Serious	300	Ngcayini Eni Nsenga Outside target area	142 69 70 19	Bit fragmented but some potential in north west corner, dip area and facing slope Included in pilot phase Potential only if added to unit 10 to get big enough area Ignore
13 Moderate	80	Ngcayini Nsenga	27 53	Too fragmented and small Too fragmented and small
14 Serious	80	Ngcayini Nkiliji	76 4	Partly included in pilot scheme, add additional area to pilot scheme Ignore
16 Moderate	50	Nkiliji	50	Too small and fragmented along river lines
19 Moderate	130	Nkiliji Butfongweni Ngwazini Swaceni	38 77 1 14	Small and isolated at southern end Very fragmented along river lines Ignore Ignore
20 Serious	130	Nkiliji Butfongweni	118 12	Small area but with limited potential in southern end of unit Ignore
21 Moderate	410	Nkiliji	410	Potential in west and, if added to remnant of unit 23, in east
23 Serious	300	Nkiliji Mdayane Outside target area	35 233 32	Potential use only if included with part of unit 21 Has potential Ignore
26 Moderate	170	Bhekinkoshi Ngwazini	67 103	Potential with joint co-operation
28 Serious	220	Ngwazini Swaceni Nyakeni	101 72 47	Some potential especially if linked with unit 26 Requires co-operation with Ngwazini Small, ignore
29 Moderate	410	Nyakeni	410	Some potential in eastern side, rest somewhat fragmented
31 Serious	280	Nyakeni Mkhulamini Maliyaduma	2 254 24	Ignore Fragmented but with some potential in central area, northern area should be joined with unit 1 Ignore
32 Moderate	390	Maliyaduma	390	Has potential

Table C-25: Units and areas where fenced rotation grazing management treatments needed in moderately and severely eroded areas of TA2

Soil erosion unit & condition	Range area in erosion unit (ha)	Chiefdoms affected	Area (ha)	Comments concerning implementation
2 Moderate	450	Mchinsweni	20	Limited potential only if added in as part of unit 1 in west – requires co-operation
		Mabona	378	Limited potential only if added to unit 1
		Manyandzeni	52	Potential in central area only if added to unit 1 plus unit 12 – requires co-operation
3 Moderate	210	Mabona	210	Potential only if added to unit 4
4 Serious	230	Mabona	230	Has potential for two to three schemes if linked to unit 3
5 Serious	70	Mabona	70	Fragmented and with only limited potential and only if added to unit 2 and unit 1 in west
7 Moderate	60	Mchinsweni Manyandzeni Mabona	13 29 18	Fragmented and with only limited potential and only if added to unit 6 and unit 8 – requires co-operation
9 Serious	50	Manyandzeni	50	Too small and fragmented
13 Moderate	80	Mabona	80	Too fragmented
20 Moderate	230	Dumenkhungwini	161	Has potential especially if unit 20 linked to unit 21
		Mabona	69	Some very limited potential if linked to unit 16
21 Moderate	310	Dumenkhungwini	310	Has potential
22 Serious	140	Zikhoteni	140	Small but has potential especially if linked with rest of hill to east in Paradise
25 Moderate	70	Zikhoteni	70	Some potential only if added to northern part of unit 24 and with use of hills in west outside target area
27 Moderate	200	Zikhoteni	200	Fragmented along river lines only
30 Serious	180	Zikhoteni Outside target area	17 163	Small area Has potential especially if linked to unit 29
31 Moderate	80	Outside target area	80	Fragmented – might be added to unit 32
34 Moderate	520	Outside target area	520	Has potential possibly as two schemes

Table C-26: Units and areas where fenced rotation grazing management treatment is needed in moderately and severely eroded areas of TA3

Soil erosion unit	Range area (ha) in erosion unit	Chiefdoms affected	Area (ha)	Comments concerning implementation
2 Moderate	950	Macudvulwini Bhadzeni I Bhadzeni II	363 312 275	Has potential Has some potential if joined with area in unit 1 Has potential
3 Moderate	1050	Macudvulwini Bhadzeni I	989 61	Has potential as two to three separate schemes Has potential only if joined with areas in units 7 and 24
4 Moderate	440	Macudvulwini	440	Has potential – includes part of pilot area scheme
7 Moderate /Serious	590	Macudvulwini Velezizweni	486 104	Has potential and possibility of two schemes if linked with unit 6 Has potential only if amalgamated with unit 24
9 Moderate	110	Velezizweni	110	Has potential only if amalgamated with unit 10
10 Moderate	650	Velezizweni	650	Has potential with two to three schemes with unit 9
12 Moderate	270	Velezizweni	270	Fragmented between fields
13 Serious	620	Velezizweni	620	Has potential maybe as two schemes
18 Moderate	120	Ngcoseni Dlandleni	112 8	Small area, bit fragmented Ignore
20 Moderate	360	Bhadzeni I Khabonina Ngcoseni	249 87 24	Fragmented along river line Fragmented Ignore
22 Moderate	320	Ngcoseni Mgazini	285 35	Has potential Ignore
23 Moderate	450	Unknown Velezizweni Macudvulwini Dlandleni	137 247 59 7	Fragmented along river lines Fragmented along river lines Small area along river line Ignore
25 Moderate	390	Macudvulwini Bhadzeni I Velezizweni	180 168 42	Fragmented along river lines between fields Fragmented Small area, fragmented
27 Moderate	90	Khabonina Mgazini	37 53	Small area, fragmented along river line Small area, fragmented along river line
29 Moderate	410	Bhadzeni II	410	Has potential
31 Moderate / Serious	1030	Lishikisini Mahhashini Bhadzeni II	431 438 161	Has potential but a bit fragmented Has potential Small area – consider co-operation
32 Moderate	440	Lishikisini	440	Has potential for two (or more) schemes
33 Moderate	660	Lishikisini	660	Has potential for two to three schemes
34 Moderate	180	Lishikisini Mgazini	166 14	Fragmented Ignore
37 Moderate	590	Mgazini Khabonina	572 18	Has potential probably as two schemes Ignore
38 Moderate	170	Lishikisini	170	Fragmented

C.17 Overall Range Condition in Target Area Erosion Units

Table C-27: Range condition in TA1

Unit	Physiography/ Topography	Overall status of range condition
1	Lububu Hill	Fair cover, some sheet erosion Condition: Fair
2	Mbekelweni hill slopes	Steep-sided hills, open patches Condition: Poor
3	Mtilane/ Sigombeni	Overgrazing on valley hillsides Condition: Poor
4	Upper Mbuluzane watershed	Low cover, patchy, erosion evident Condition: Poor
5	Middle Mbuluzane watershed	Includes Nyakeni grazing scheme fair, litter low, improving Condition: Fair
6	Ntunja	Steep, overgrazed Condition: Poor
7	Sigombeni plateau	Grazing mainly on river lines, moderately overgrazed Condition: Poor
8	Sigombeni/ Sankolweni	Low vigour, overgrazing, open patches Condition: Poor
9	Ndlembeni/ Nsenga upland	Reasonable cover, local overgrazing Condition: Fair
10	Nsegna hills	Steep, overgrazed patchy cover Condition: Poor
11	Nsenga/ Eni lower hills	Patchy broken cover, heavily grazed Condition: Poor
12	Eni hill, upper slopes	Steep, patchy cover, eroded sides Condition: Poor, crest fair
13	Nsenga/ Ngcayini plain	Limited grazing, heavy grazing mainly along river lines Condition: Poor
14	Ngcayini plain	Open, moderate cover, some sheet erosion Condition: Fair
15	Lower Mhlambanyoni valley	Overgrazed slopes, wooded ravines Condition: Poor
16	Nkiliji western plain	Limited grazing except along stream lines, heavily used, eroded Condition: Poor
17	Ntunja- Sankolweni hills	Severe overgrazing, low basal cover, high erosion Condition: Poor
18	Mangcenini plain	Low basal cover, poor vigour Condition: Poor
19	Khukanyeni- Bufongweni plain	Limited grazing, mainly on lower slopes Condition: Fair
20	Nkiliji/ Malete Valley	Low basal cover, low litter, depleted vigour Condition: Poor
21	Nkiliji northern plain	Open, moderate cover Condition: Fair/good
22	Mdayane plain	Limited grazing, heavily used, encroached ravines Condition: Poor/fair

23	Lutfotja hills north	Ridge fair, severe guava, acacia, Mauritius thorn encroaching, cover fair Condition: Fair/poor
24	Lutfoja hills south	Good cover, fair vigour, reasonable use Condition: Good
25	Bhekinkosi/ Mapopoma plain	Some erosion, light grazing, relatively good cover Condition: Fair
26	Ngwazini/ Bhekinkosi valley slopes	Cover poor, relatively heavy grazing, eroded Condition: Poor
27	Ngwazini upland	Limited grazing, heavily used Condition: Poor
28	Swageni upland	Heavily used river lines, poor cover Condition: Poor
29	Nyakeni plain	Cover fair, heavy use, little vigour Condition: Poor
30	Maliyaduma northern hills	Cover relatively good, some erosion Condition: Fair
31	Mkhulamini plain	Eroded, heavily used, cover relatively poor Condition: Poor
32	Maliyaduma southern hills	Cover poor, eroded, steep Condition: Very poor
33	Mbeka hills and valleys	Eroded, cover low, steep, aloes on thin soil Condition: Very poor
34	Lower Mbuluzane	Good cover, fair vigour, little erosion Condition: Good

Table C-28: Range condition in TA2

Unit	**Physiography/ Topography**	**Overall status of range condition**
1	Sivule/ Manyadzeni plateau	Relatively flat, reasonable cover Condition: Fair/good
2	Sivule/ Manyadzeni northern slope	Low basal cover, rocky Condition: poor
3	Sivule/ Manyadzeni southern slope	Steep, eroded, heavily grazed, low cover Condition: Poor
4	Southern watershed	Steep eroded, low cover Condition: Very poor
5	Sivule basin south mid slope	Limited grazing between fields, sheet erosion Condition: Poor/fair
6	Sivule basin south lower slope	Little cover, eroded on slopes Condition: very poor
7	Sivule basin valley bottom	Heavily grazed, fair cover along stream Condition: fair
8	Sivule basin/ Mantambe lower slope	Little cover, eroded on slopes Condition: very poor
9	Sivule basin/ Mantambe upper slope	Overgrazed, eroded, some cover Condition: poor
10	Mantambe upland	No grazing Condition: --
11	Lower Mantambe	Eroded, some cover, sensitive soil Condition: poor
12	Sivule basin eastern	Eroded, some cover, sensitive soil Condition: poor

13	Matsiphula north	Limited grazing, some erosion Condition: Fair
14	Matsiphula south	Poor erosion, little cover, low vigour, overgrazed Condition: Very poor
15	Upper Ncotshane west	Little cover, steep, eroded Condition: Very poor
16	Upper Ncotshane east	Low cover, eroded, gullied Condition: Very poor
17	Emzipha south	No grazing Condition: --
18	Emzipha east	Very limited grazing between fields Condition: Poor
19	Middle Ncotshane	Some sheet erosion, cover only fair Condition: Poor/fair
20	Lower Ncotshane west	Relatively steep, low cover, sheet erosion Condition: Poor
21	Lower Ncotshane east	Low cover, sheet erosion Condition: Poor
22	Makhosini Hills	Heavily grazed, reasonable cover, rocky Condition: poor
23	Mlokotwa Hill	No grazing permitted Condition: --
24	Galile	Little cover, eroded, tracking Condition: very poor
25	Hlobane west	Rocky, poor cover, bushy stream banks, shallow eroded soil Condition: very poor
26	Hlobane east	Little cover, eroded, tracking Condition: very poor
27	Hlobane/ Mahanga	Limited grazing mainly along eroded water courses Condition: very poor
28	Mahanga west	Sensitive soil, eroded, reasonable cover between Condition: poor
29	Mahanga plateau	Cover good, limited sheet erosion, light use Condition: Good
30	Mahanga east	Relatively steep, patchy, some erosion Condition: Fair
31	Hosea	Fair cover on flatter parts, rocky, tracking Condition: poor
32	Msila	Relatively well covered, limited erosion Condition: Fair/good
33	Mantambe River valley	Relatively well covered, limited erosion Condition: Fair/good
34	Hluti Hill	Cover relatively poor, relatively heavy use Condition: Poor

Table C-29: Range condition in TA3

Unit	Physiography/ Topography	Overall status of range condition
1	Mbulungeni Hill	High plantation cover, wattle encroached, open grassland, lowish basal cover, no litter Condition: poor
2	Mbulungeni escarpment	Limited grazing, wattle encroached, noticeable erosion Condition: very poor
3	Ngwempisana north	Heavy overgrazing, eroded, wattle encroached, Condition: very poor
4	Macudvulwini crest	Steepish, broken, wattle encroaching, cattle tracking Condition: poor
5	Macudvulwini crest	Limited grazing, heavy grazing of ravines, little cover Condition: very poor
6	Unnamed plateau	No litter, fair cover, heavily grazed Condition: fair
7	Macudvulwini east	Low basal cover, erosion evident, heavily grazed Condition: poor
8	Unnamed plateau	Limited grazing Condition: poor
9	Unnamed plateau	Reasonable cover, thin soil cover Condition: fair
10	Velizeweni upper	Steep, rocky, sheet eroded Condition: poor
11	Hill slopes	Steep, thin cover Condition: poor
12	Veleziweni lower	Patchy grazing, reasonable cover Condition: fair to poor
13	Ngwempisi lower north	Low cover, heavily grazed Condition: poor
14	Ngwempisi lower south	Low cover, heavily grazed Condition: poor
15	Ngwempisi lower north	Limited grazing, shallow soil, eroded Condition: very poor
16	Ngwempisi lower north	Heavily grazed, sheet erosion, gullied, low cover Condition: poor
17	Ngwempisi lower	Open, flat reasonable cover Condition: fair/good
18	Ngwempisi lower	Some sheet erosion, cover fair Condition: fair
19	Ebhadzeni grazing	*Diospiros* encroached, low cover, heavily grazed, gullied Condition: poor
20	Ebhadzeni arable	Heavily grazed, low cover, some sheet erosion Condition: poor
21	Tsawela lower	Limited grazing, heavily used valley slopes Condition: poor
22	Tsawela lower	Heavily grazed, reasonable cover Condition: fair
23	Mhlatane river	Reasonable cover but basal cover low Condition: fair

24	Mhlatane hills	Steep, eroded, low cover, heavy grazing Condition: poor
25	Ngwempisane	Fragmented grazing, patchy and low cover, gullied Condition: very poor
26	Mbulungeni	Fragmented grazing, patchy and low cover, gullied Condition: very poor
27	Footslopes	Fragmented between fields, sheet erosion Condition: poor
28	Mponono valley	Limited grazing between fields in river lines, fairly heavily grazed Condition: poor
29	Mponono/ Buzemi	Heavily grazed, steepish hills, broken cover Condition: poor
30	Nkhanyezini	Cover relatively good, poor local gully erosion Condition: fair/poor
31	Ngwempisi basin	Local gullying, cover fair, sheet erosion Condition: poor
32	Escarpment	Steep, sheet erosion, cover fair Condition: poor/fair
33	Escarpment	Steep, sheet erosion, cover fair, gullied (?) Condition: poor/fair
34	Escarpment	Well grazed, fair cover, sheet erosion, gullied (?) Condition: poor/fair
35	Nkhanyezini	Severe overgrazing, eroded, thin soil on slopes Condition: very poor
36	Kuboni	Low cover, erosion, steep, gullies, thin soil Condition: very poor
37	Tsawela	Very patchy, locally fair Condition: poor to very poor
38	Nokuthula	Limited grazing, heavily grazed along river lines Condition: poor
39	Steep slope	Stony, thin soil, steep, patchy, thorn encroachment Condition: poor/very poor

C.18 Areas Proposed For Treatment By Fenced Rotation Grazing Management

Table C-30: Areas proposed to be brought under fenced rotation grazing management in TA1, numbers of schemes and numbers of feedlots

Erosion unit & erosion condition	Chiefdom area	Grazing scheme size (ha) – approximate	Number of grazing units	Number of fattening pens & fodder plots
2004-2009				
11 – serious	Ngcayini	115	)	
14 – serious	Ngcayini	35	) 1	
20 – serious	Nkiliji	100	1	1
21 – moderate	Nkiliji	85	1	
Summary		**335**	**3**	**1**
2010-2015				
21/23 – serious	Nkiliji/Mdayane	100	1	
23 – serious	Mdayane	210	1	1
26 – moderate	Ngwazini	360	1	1
31 – serious	Mkhulamini	140	1	1
32 – moderate	Maliyaduma	315	1	1
Summary		**1125**	**5**	**4**
2016-2020				
1 – serious	Mkhulamini and Nyakeni	260	1	
28 – serious	Ngwazini and Swaceni	130	1	
29 – moderate	Nyakeni	110	1	1
Summary		**500**	**3**	**1**
TOTAL		**1960**	**12**	**6**

Table C-31: Areas proposed to be brought under fenced rotation grazing management in TA2, numbers of schemes and numbers of feedlots

Erosion unit & erosion condition	Chiefdom area	Grazing scheme size (ha) – approximately	Number of grazing units	Number of fattening pens & fodder plots
2004-2009				
22 – serious	Zikhoteni	120	1	1
25 – moderate	Zikhoteni	170	1	
Summary		**290**	**2**	**1**
2010-2015				
3 / 4 – moderate	Mabona	255	1	1
3 / 4 – moderate	Mabona	255	1	
Summary		**510**	**2**	**1**
2016-2020				
16/20 – serious	Dumenkhungwini	260	1	1

20/21 – moderate	Dumenkhungwini	190	1	
20/21 – moderate	Dumenkhungwini	200	1	
Summary		**650**	**3**	**1**
TOTAL		**1450**	**7**	**3**

Table C-32: Areas proposed to be brought under fenced rotation grazing management in TA3, numbers of schemes and numbers of feedlots

Erosion unit & erosion condition	**Chiefdom area**	**Grazing scheme size (ha) – approximately**	**Number of grazing units**	**Number of fattening pens & fodder plots**
2004-2009				
2 – moderate	Bhadzeni II	155	1	1
2 – moderate	Macudvulwini	280	1	1
3 – moderate	Macudvulwini	315	1	
Summary		**750**	**3**	**2**
2010-2015				
4 – moderate	Macudvulwini	310	1	
7 – moderate	Macudvulwini	190	1	
9/10 – moderate	Velezizweni	300	1	1
9/10 – moderate	Velezizweni	300	1	1
29 – moderate	Bhadzeni II	385	1	
Summary		**1985**	**5**	**1**
2016-2020				
22 – moderate	Ngcoseni	315	1	1
32 – moderate	Lishikisini	180	1	1
32 – moderate	Lishikisini	280	1	
33 – moderate	Lishikisini	260	1	
Summary		**1565**	**4**	**2**
TOTAL		**5225**	**18**	**5**

Annex D

D Soil Conservation

D.1 Description of Present Status of Soil Conservation at the Government Level

D.1.1 Brief review of overall recent policies and plans for soil conservation by GOS and foreign assistance

Policies for soil conservation have been written in the National Development Policy, especially in 4.3.9, (Curb and prevent the erosion of the soil.) concerned excerpt of which is attached in the Annex. In the article of Agriculture in the ”Kingdom of Swaziland National Development Strategy (NDS), A Twenty-Five Year Vision”, problems and possible measures on rangeland erosion are referred to (also attached in the Annex). However, these are written guidelines without any budgetary actions and no concrete steps to put into actual site-projects have ever been taken.

In the MOAC, an officer has been assigned to Land Use Division, who takes charge of the affairs on soil conservation. In the Ministry of Environment, no officer specialized in the soil conservation or assigned thereto has been appointed, because it is a coordinating agency and not a implementing one. “National tree planting program” has been promoted with the effort of Forestry section, MOAC, from early 1980s in five nurseries. Indirect contribution to soil conservation is expected from this program and also from COFOPRO that was initiated from 1993 to compensate for deforestation. GMDA initiated from late 1980s aims at control of grazing land though very few areas have been functioning. This can give positive effect on soil conservation if it is successfully implemented.

Gully training works have been implemented in the jurisdictional area under Hlatikuru ADC since 1998 (Ngololweni Chiefdom). Under this scheme, three gullies developed over the hill side along Halo and Mantube Rivers have so far been treated with vertical drops by means of gabion net cages worked inside the gullies. Also, fencing around them and parallel waterways for intercepting runoff has been constructed through participatory labor service organized by the inhabitants (details are summarized in the Appendix).

Description of cooperation by foreign donors with respect to soil conservation in Swaziland

It was taken up by the USAID in 1970s, but it was completed without any fruitful results because the proposed reduction of cattle herds held by farmers ended up in failure. Recently, foreign funds have been disbursed to environmental NGOs like Yongue Nawe indirectly for the purpose of check gully development, but so far as the Study Team has observed, it does not achieve what has been intended to. WFP funded Food for Work Programme that had been continuing during the period 1993~1998 to reclaim gullies by gabions grass transplanting and thorn shrub introduction to prohibit cattle invasion. This was implemented by such NGOs as SCF and SFDF, but the negative and positive results are mixed. In the Target Areas, a land reclamation project has been on-going since 1998 funded by CCD and implemented by MOAC, Yonge Nawe etc. for fencing off ravine gullies for stabilization by means of planting of vetiver grass and indigenous trees in and around the gullies.

D.2 Gullies

Gullies are called “Dvonga” in Swaziland, South Africa and Lesotho, meaning washed-out drain.

D.2.1 Causative Factor-Classification of Gullies, and Soils that can form them

There are two types of gullies in Swaziland, one is ravine type that is found in Highveld (800m ~ 1,400m) to Upper Middleveld (600m ~ 1,000m) where three of the Target Areas are located, and they develop on colluvial deposit. The other are alluvial (occurred in Pleistocene period) gullies that are distributed Lower Middle- and Low veld and so they are less observed in our target area except TA3 where hydromorphic sediment soils undergo gully formation.

Gullies almost always accompany with fairly wide bare patches ahead of their developing heads. Developing rills become gullies, but developed ones often lack surface water-flow that carries water into gullies. They take place not only at the streams but also starting at flat terrace and road-side drains, and end at flat field. Conditions of huge gully formation comprise: no solid rocks and boulders hinders its further entrenchment, soil layers contain much water-dissolving material like kaolinite or talc, such soft textured soil layers are thick enough to form deep gorges and an indispensable cause is enough annual rainfall with high intensities.

The starting points of gullies are very often located at barren ground surface where saprolite layers (soil scientists call it soils) are directly exposed. Groundwater incises and dissolves soluble minerals from decayed saprolite layers and deep rills appear. Then, they widen and deepen as weaker under ground layers are gradually attacked by ground water. Surface layers fall down as they lose support of layers underneath them. Thus, gullies proceed like a domino falling down, from down to top, not as ordinary rills and valleys that develop from top to down. Also, almost flat bottom of many gullies has a few step, because it is formed on less weathered or harder (often intruded) rocks, the base of which has step.

Sites where gullies develop are located in valleys, ridges of plateaus / hills and alluvial basins, implying that groundwater has bearing to their development although they start from runoff channels on ground surface. During the rainy season, more sub-surface water flows out of gully wall than surface runoff from ground surface, particularly in the case of ridge-gullies. Their outlets often open at hill-side (not by stream-side) where hard, intrusive rock forms their floor. Likewise, such hard rock appears at the bottom of gullies forming perpendicular frop, though most bottoms are rather flat or slightly inclined.

Active gullies developed along Mlanbanyoni River (TA-1) have been formed over colluvial deposits covering ancient (fossil) valleys, where past erosion surface can be seen as a stone line. Below it, thick B horizon (oxidized reddish layer) develops, underneath which top ceiling of saprolite appears with illuviated clay capping. It is this clay that exerts as temporary impermeable layer above which ground water flows out into gullies during and after rainfall. It means that B horizon acts as temporary aquifer. However, not only one aquifer carries ground water but some parts of saprolite also are saturated with water as aquifer where kaolinite, illite, hematite and other water dissolving compounds were carried away through fissure and cavity in the saprolite layers. Thus, saprolites still have rock skeleton but their specific weight is much lower than original less-weathered rocks as a result of loss of water-suspendable clays etc.

Gullies develop not only with surface runoff that scours top-soil but with shallow groundwater flow (30cm ~ 250cm below ground surface) that melts water-dissolving material contained in saprolite, resulting in the formation of hollow (This character has not been described even in recent references on soil erosion). Action of ground water on gully formation can typically be observed at the initial stage of ground cleavages which have

narrow split slits at less erodible surface (top) soils but broader cracks below them, often found in overgrazed shrub-steppe. It is also widely observed at the walls of road cutting where huge clods of kaolinite, illlite or talc have molten away by permeated groundwater seeping from temporary aquifers over relatively impermeable saprolite layers. They mostly develop on colluvial underground valleys (most probably formed during Pleistocene era) where groundwater flow concentrates into temporary aquifers horizontally sandwitched by relatively impermeable layers such as thinly illuviated clay deposits. The underground valleys formed vertically to the streams that have been developed along major tectonic faults and over other geo-structural formation. Such colluviated layers very often form vertical cracks to a few meter deep whereas basement saprolites have structures of inclined or vertical faults, fissures, slickensides or joints.

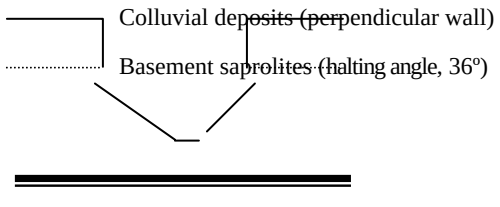
Ravine gullies generally develop on Oxisols (Ferralsols) derived from saprolites that are highly weathered debris of granitic, pegmatitic and granodioritic rocks accompanied with their metamorphosed types of gneiss or porphyry, or intruded by dolerite, but also can occur over Vertisols (in the center of TA-3) in alluvial fans (in the southern part of TA-2) or swampy basins and Ultisols (Acrisols) / Alfisols (Typic Hapludalfs) developed on alternate layers of sandstone / shale. As stated below, it mostly occurs over the severely sheet-eroded ground surface, starting from the ground surface of artificially degraded land where both A and B horizons have been washed away by torrential run off and upper saprolite layer exposes.

Causative factors of Gullies and other forms of erosion forms include:

- quantity and intensity of rainfall
- vegetative cover at the surface of soils and its artificial damage
- geology (thick saprolites covered with colluvial matrices as underground valley)
- soil erodibility and influencing factors to change extent of erodibility (cattle excretes)
- characters of animal husbandry (cattle density, movement or track, trampling)
- Man-made interventions (disturbing) over soil surface like construction works, tillage etc.

D.2.2 Morphological Classification of Gullies

Development of gullies shows sequential stages; namely, incipient stage (IS), developing stage (DS) and stabilizing stage (SS). Gullies at IS often appear in V shaped section or as deep cracks and single head. Those at DS have both V and U sections, often with plural heads or brachiated branches, usually deeper than those at IS. They sometimes accompany soil pillars or soil belts inside them. Then, gullies at SS often appear in U-shaped section, with trees, grasses and ferns growing at the bottom and wall side, so they shed out little sediments from their bottom. More precise observation tells us that walls of V-shaped gullies often have compound section as shown below.



Their shapes, with U and V / W section, with single head and plural heads, highly branched (brachiated) or parallel ditches (with thin and perpendicular soil walls separating each ditch), and their depths depend on the characters of surface soil / geology. Their bottom is almost flat as compared with natural slope gradient where they develop. The bottom has in some cases perennial water flow, but mostly seasonal flow. The material thereof consists of sand

bed but sometimes un-weathered or half-weathered huge stone / boulders. If soils or highly weathered saprolites are very thick without water-resistant rocks, and if they are distributed in wide tract, gullies develop as deeply insized and longer. If the soil layers or saprolites contain hard rocks or water resistant bed layers, then gullies begin to stabilize at these levels of rocks / layers, forming either flat or rocky bottom. Developing gullies often shed very acidic sediments at the bottoms that can prohibit growth of trees and other vegetation.

Their ages can be estimated from the age of trees grown inside or from an interview with old neighbors who remember state in his / her childhood. Large ravine type gullies at developing stage have age of 20 ~ 80 years identified by the interview with elder villagers.

Development of deeply incised, gorge type ones need action of groundwater rather than that of surface run off, because developing huge gullies often lack run off rills at their heads, but they always accompany with readily melting clay layers and water seepage at their perpendicular walls. Ground water is possibly supplied from the bare slope at the opposite side of the hill, if synclined structure of saprolite develops and governs the geological structure of the hill. This is the main reason why measures of cutting run off at the head of gully have ended up in failure in the past struggles with gully training. When we try to stabilize existing gullies, subsoil / geological nature should be fully taken into account.

From surface geology aspect, gullies are more readily formed along shallow underground valleys where a relatively impermeable base layer forms groundwater flow, and the flowing groundwater melts acidic clay minerals away from clay deposit geologically formed in saprolite layers and leaves hollows / cavities. Then, surface soil layers lose sustaining ground and slide or subside down to the hollow / cavity. This type of collapse can abundantly be observed at the brink of gully walls, road cut surfaces and borrow pits especially during rainy season. In other words, gullies can be deemed as a process from buried underground valleys to naked ground surface valleys with vegetation cover along them. Cattle paths can accelerate this process by stripping vegetation cover through trampling and urinating (cattle urine can convert soil aggregates into decomposed, single particles). Overgrazing can also do it by decreasing water retentive function over the surface and facilitates sheet erosion until gravel-accumulated ground surface and exposed B horizon percolate surface run off down to aquifers in saprolite layers.

Deeply incised ravine gullies are classified into two types, namely, dendritic (multi-heads) ones developing over valleys and single-head ones over the side slope of ridges (often convex). The former ones develop with collected subsurface flow in thick aquifers, while the latter ones are triggered by smaller sized fountains with groundwater channels through faults/joints.

D.2.3 Area Distribution of Existing Gullies and Risky Areas

Gullies can hardly develop on the mantles where un-weathered base rocks are widely exposed. Instead, they have been developing over horse-back shaped ridges of colluvial foothills with gentle topographic gradient and also over alluvial and colluvial fans with almost flat surface. This suggests us that past tectonic movement that had brought about great collapse or slide of old hill slopes accelerated weathering (by groundwater) of these disturbed ground matrices (saprolites are major components of these matrices), inducing clay formation and following clay dissolution into groundwater. Even most resistant quartz (against weathering) had become fine, round pebble / sand, and the stratified structure of gneiss (one of mother rocks from which saprolites are derived) has lost structure of massive and cohesive aggregation and has become subject to vertical incision / shearing. Geographic distribution of such matrices with higher risk of gully occurrence can be detected by means of geo-electric or seismographic methods.

From our observations we can say that the developing rate of gullies becomes retarded when they develop up to the flat tops of hills or plateaus, because of water depletion that had been

supplied for dissecting them. In so far as gullies are artificially accelerated form of natural phenomena dissecting valleys, and not only surface water but also groundwater has bearing to their formation, it is not easy to bring them into the stabilizing (or healing) stage, unless loss of earth from their mouth to outside them or to streams is blocked with artificial works inside them. Because old and stabilizing gullies have trees and other plants inside them, planting trees or sowing grass seed after the success of blocking earth flow from them. Development of a huge gully has also been retarded by a happening that a constructor wasted a huge rock boulder into a roadside gully, forming a dam inside it, thus sedimentation began in it and as a result mud flow out of it was completely blocked, the bottom submerged in ponding water (TA3, Tsawela). This implies that gullies can be trained artificially through relevant measures.

Also, developed gullies often have perennial water flow at their bottoms, meaning that they have already reached relatively impermeable layers or base rocks that also have higher resistance against weathering. Such types of gullies tend to have slower rate of development and often enter into stabilizing stage, though some exceptions can be observed. In a sense, they can be deemed as the superficial exposure of underground water valleys, approaching natural dissective stage of valley formation. Actually, many gullies have occurred at wetter portion of the ground rather than dry surface area, and so geo-electric detection can be applied to.

Areas with higher risk of gully formation are so far identified as:

Gleisols developed in fluvial basin overlain with rhodic / xanthic Ferralsols (red gullies), Regosols and Acrisols,
Fluvisols developed over low land capped with Regosols (dark colored gullies).
Vertisols / Gleisols developed over alluvial fans (grey-black colored gullies).

In 1) and 2), deep, ravine type and often dendritic gullies can develop over the gentle slope ground without hard or un-weathered rocks / boulders, with less outcrops. Ample supply of groundwater is another essential condition for gullies to develop. Therefore, huge gullies are always found at the center of invisible ground-valleys, to which groundwater is fed from woodlot / forest, grass striped arable tracts and other ground surface covered with readily permeable top-soils. As to 3) high water table is kept throughout the year because of low-lying basin.

Development process of ravine type gullies taking place at colluvial hill-foot is proposed as:

- Rill formation along cattle tracks, foot-paths and artificially disturbed ground surface.
- Deepening of rills taking place on highly erodible soil/ saprolite layer by surface run off.
- Scouring of sub-soil or weathered saprolite layers by groundwater underneath rills.
- Dissolution of clay minerals into groundwater and formation of hollows / cavities.
- Widening rills into gullies often accompanying with branching, also deepening.
- Domino-like chain reaction of falling surface pedons into gully bottom.
- Depletion of clay-contained layers or groundwater supply as they approach hill-top.
- Stabilizing with development of vegetation cover inside gullies.
- The following is a list of huge, active ones visited by the Study Team.

Table D.2-1: Location and character of gullies

No.		location							general character of gullie									estim.
TA-	stream	longitude			latitude			altitude	width	length	location	depth	soil class.	shape	end site	land-use	surface	age
I	Mhlambanyoni	26	18	420	31	23	196	800	25	480	hillside	18	Ferralsols	2HBU	stream	grass		75
I	Mhlambanyoni	26	21	180	31	22	865	659	5	120	river bank	3	Ferralsols	SHTV	stream	grass	slip er.	a few
I	Mhlambanyoni	26	21	971	31	22	739	713	35	180	hillside	8	Ferralsols	3HBU	stream	grass		-
I	Matete	26	19	40	31	24	903	847	65	300	hillside	12	Acrisols	MHBU	stream	woodlot		-
I	tr. Mbaluzane	26	23	824	31	25	848	653	38	300	hillside	11	Phaeozem	2HBV	stream	grass		40
I	Mhlambanyoni	26	22	457	31	22	121	713	19	645	hilltop	23	Ferralsols	MHBU	stream	grass		65
I	Mhlambanyoni	26	22	84	31	22	805	783	24	220	hillside	10	Ferralsols	3HBU	stream	grass		20
I	Mhlambanyoni	26	22	78	31	22	502	810	12	40	hillfoot	0.5	Ferralsols	Rectan.	hill slope	grass	track	3
I	Mhlambanyoni	26	18	536	31	22	649	770	93	340	hilltop	17.5	Ferralsols	MHBU	stream	grass		45
I	tr. Mbaluzane	26	23	844	31	25	859	713	49	288	hillside	9	Acrisols	2HSV	stream	grass		30
I	Mhlambanyoni	26	20	61	31	21	713	870	23	140	hilltop	11	Ferralsols	SHSU	stream	grass		-
I	Mhlambanyoni	26	20	709	31	23	105	732	60	280	hilltop	8.5	Ferralsols	MHBU	stream	grass		30
I	Mhlambanyoni	26	20	602	31	23	70	743	45	270	hilltop	10.5	Ferralsols	2HBU	stream	grass		30
I	tr. Mbaluzi	26	19	781	31	21	389	947	8	15	hillside	1	Ferralsols	oval	hill slope	grass		a few
I	Mgwanyane	26	25	777	31	24	462	720	15	110	hillfoot	9	Phaeozem	SHSV	stream	grass		10
III	Tsawela	26	45	560	30	59	624	1,067	7	157	roadside	4.5	Luvisols	SHSV	stream	arable		-
III	Tsawela	26	44	498	30	55	391	1,087	7	150	hillfoot	4	Ferralsols	2HSV	stream	grass		10
III	Ngwenpisi	26	44	183	31	0	39	1,050	27	330	hilltop	8	Ferralsols	4HSV	stream	grass		55
III	Ngwenpisi	26	44	110	31	0	32	1,040	7	75	hilltop	3.5	Ferralsols	2HSV	hill slope	grass		-
III	tr.Ngwenpisi	26	43	425	31	0	51	1,043	45	210	hillfoot	5	Ferralsols	3HSV	stream	grass		25
III	Tsawela	26	45	345	31	0	308	1,077	30	80	plain	25	Luvisols	2HSV	stream	flw.		10
III	tr. Tsawela	26	47	115	30	57	102	1,170	93	450	hillfoot	4	Ferralsols	MHBU	stream	grass		60
III	Ngwenpisi	26	44	410	30	53	527	1,072	16	80	swamp	4	Vertisols	2HSV	hill slope	grass		-
III	Ngwenpisi	26	44	901	30	54	281	1,070	28	125	hilltop	6	Vertisols	MHBU	stream	grass		15
III	Ngwenpisi	26	44	64	30	54	451	1,000	35	180	swamp	5.5	Vertisols	MHBV	stream	grass		20
III	Tsawela	26	45	352	30	57	205	1,173	9	80	hillside	4.5	Ferralsols	SHSV	stream	grass		a few
III	Ngwenpisi	26	44	590	30	57	172	1,080	12	323	hillfoot	3	Luvisols	2HSV	stream	grass		45
III	tr.Ngwenpisi	26	41	462	31	5	894	1,153	6	600	hillside	4.5	Ferralsols	3HBV	stream	grass		70
III	Mtagane	26	45	244	30	55	497	1,120	11	260	hillside	2.5	Luvisols	3HBU	stream	grass		30
III	Mhlatane	26	40	229	31	0	755	1,103	5	250	hilltop	2	Ferralsols	3HBU	stream	shrub		20
III	Ngwenpisi	26	44	77	30	59	932	1,050	22	150	hilltop	3.5	Luvisols	MHBV	stream	grass		10
III	Mhlatane	26	40	185	31	0	915	1,152	5	100	roadside	3	Luvisols	SHSU	stream	shrub		-
II	Ngwede	27	13	180	31	23	804	920	8	130	plain	3	Ferralsols	SHBV	stream	grass		15
II	Ngwede	27	13	54	31	23	797	870	12	70	hillside	5	Ferralsols	3HBV	hill slope	grass		-
II	Ngwede	27	12	863	31	23	890	923	15	240	hillfoot	6	Ferralsols	SHBV	stream	grass		20
II	Ngwede	27	12	753	31	24	127	880	64	140	hillside	5	Ferralsols	2HBU	stream	grass		-
II	Ngwede	27	12	381	31	25	223	937	20	200	hillside	2.5	Ferralsols	SHBV	stream	grass		25
II	Ngwede	27	12	947	32	25	170	987	15	350	hillside	5	Ferralsols	MHBV	stream	grass		45
II	tr.Ngwabuma	27	11	535	31	25	127	817	35	350	hillside	5	Ferralsols	SHVU	stream	grass		50
II	Ngochane	27	18	832	31	29	563	953	4	100	montside	2	Ferralsols	SHTV	stream	grass		-
II	Mantambe	27	16	532	31	25	607	850	6	110	hillfoot	4	Vertisols	SHBV	stream	grass		-
II	Mantambe	27	16	186	31	27	464	813	7	250	hillfoot	1	Vertisols	3HBV	stream	grass		35
II	Ngochane	27	18	174	31	29	917	747	6	120	hillside	2	Vertisols	SHBV	stream	grass		15
II	tr.Ngwede	27	10	946	31	26	879	880	12	60	hillside	4	Ferralsols	MHBV	hill slope	grass		-
II	Ngwede	27	9	404	31	26	974	717	15	25	hillfoot	4	Ferralsols	RBFC	hill slope	shrub		-
II	Ngwede	27	10	546	31	26	423	793	6	80	hillfoot	4	Ferralsols	SHBU	hill slope	grass		-
II	Ngwede	26	12	348	31	25	241	850	8	280	hillfoot	5	Luvisols	MHBV	stream	grass		30
II		27	11	468	31	24	695	699	2	150		1.5	rhodic F.	V	large gly	no	barren	
II		27	12	827	31	23	994	833										
II		27	12	554	31	24	491	818			roadside		rhodic F.	V	gr.surface			
II		27	12	412	31	24	312	796					rhodic F.	V				
II		27	16	302	31	27	68	778	8	200	fountain	3	blackglei	V	stream	grass		
II		27	16	285	31	29	711	760	4	250		1	blac-yel	V	gr.surface	fallow	degded	few y
II		27	11	813	31	25	114	740	L.gully here									
II		27	12	545	31	24	277	775	L.gully here									
II		27	10	314	31	24	772	667	30	400	roads	10		U	stream	grass	degded	-

Continued to the following page

No.		location							general character of gullie									estim.
TA-	stream	longitude			latitude			altitude	width	length	location	depth	soil class.	shape	end site	land-use	surface	age
III		26	45	160	30	55	763	1,027										
III		26	45	176	30	55	870	1,184	15	270	roadside	6	blac-yel	U	stream	grass		
III		26	44	814	30	57	237	-	7	50		5		V	stream	grass	sheet	
III		26	43	23	30	58	345	997	40	200		8	rhodic F.	U	stream	grass	burnt	30
III		26	34	376	30	56	783	1,202	5	260	roads	3	rhodic F.	U	stream	grass	burnt	25
III		26	40	6	31	1	107	1,082	10	300	roads	5	grey	U	stream	grass	degded	20
III		26	41	222	31	5	54	1,109	15	250		7	rhodic F.	U	stream	woodlot	degded	-
III		26	43	726	31	8	152	925	5	50		3						
III		26	39	376	30	56	788	1,202	15	330	roads	7	blac-yel	U	stream	grass	degded	20
III		26	39	976	30	55	870	1,184	12	400	roads	7.5	xanthicF	U	stream	grass	degded	20
III		26	44	624	30	57	846	999	12	200	track	5	rhodic F.	U	stream	grass	degded	-
III		26	45	167	30	55	799	1,162	20	250		3		broad				
III		26	41	495	31	10	322	-	L.gully here									
III		26	41	434	31	0	320	1,167	15	150	terrac	3	regosols	broad	stream	grass	degded	-
III		26	43	720	31	6	152	985	10	80		7	vertisols	V	stream	grass	degded	-
III		26	40	220	31	0	532	1,000	12	380	roads	6	xanthicF	U	stream	grass	degded	20
III		26	39	376	30	56	788	1,202	8	70	roads	7	regosols	V	stream	grass	degded	15
III		26	43	365	31	4	964	843										
III		26	43	670	30	55	885	1,015										
III		26	44	727	30	54	301	990					vertisols					
III		26	45	165	30	55	828	1,000					vertisols					
III		26	40	568	30	57	694	1,006	5	150	roads	3	xanthicF	U	roads	grass	degded	new
III		26	43	750	30	54	455	953	7	100	strm	4	rhodic F.	V	stream	grass	degded	17
III	waterponded	26	47	16	30	57	122	654	20	450	strm	9	fluvisols	U	stream	grass	degded	25
III		26	45	652	30	55	177	1,161	5	200	strm	5	xanthicF	U	stream	grass	degded	20
III		26	46	252	30	54	720	1,006	85	950	stream	8.5	rhodic F.	U	stream	grass	degded	51
III		26	46	299	30	54	424	1,157	22	250	track	3	xanthicF	V	stream	grass	degded	20
III		26	47	1	30	52	381	1,391	22	120	track	6	xanthicF	U	stream	grass	degded	20
III																		
I		26	18	172	31	23	180	644	65	300	roads	25	rhodic F.	W	stream	grass	degded	75
I		26	22	56	31	22	428	644	40	735		15	rhodic F.	W	stream	grass	degded	50
I		26	23	222	31	22	298	771	35	250	roads	12	rhodic F.	W	stream	grass	degded	35
I		26	20	697	31	23	57	655	49	280		13	blac-yel	W	stream	grass	degded	45
I		26	26	418	31	21	548	728	25	130	roads	6	rhodic F.	U	stream	grass	degded	-
I		26	21	928	31	20	384	955	5	100		2	rhodic F.	plate	hill slope	grass	degded	100
I		26	20	386	31	23	214	990	60	230		18	blac-yel	W	stream	grass	degded	-
I		26	18	377	31	23	679	880	8	200		10	white	U	stream	grass	degded	-
I		26	19	415	31	24	713	656	7	150	roads	6	rhodic F.	U	stream	grass	degded	50
I		26	20	45	31	21	21	-										
I		26	18	89	31	21	101	1,146			roadside							
I		26	28	124	31	22	538	648			roads		rhodic F.					
I		26	22	745	31	22	48	819	S1km	L.gully		SW1.5	L.gully	directed north				
I		26	22	207	31	22	454	747	25	735		8	rhodic F.	U	stream	grass	degded	60
I		26	17	853	31	25	73	747	E1km	white gully								
I		26	22	628	31	25	642	646	15	200	roads	6	blac-yel	U	stream	grass	degded	30
I		26	24	173	31	22	937	797	E0.5k	red gully		SWslope						
I		26	21	192	31	24	733	623			roads			U	stream	grass	stabild	60
I		26	20	615	31	23	305	668	10	200	track	8	rhodic F.	U	stream	grass	stabing	45
I		26	20	251	31	23	445	666	Mansinyeni NE				rhodic F.		proceeding gully			
I		26	17	807	31	21	325	831	SE.5k	slip gullly								
I		26	18	192	31	23	180	674	8	150	roads	15	rhodic F.	U	range	grass	stabing	70
I		26	20	697	31	23	53	-	60	380	track	9	gleysols	U	stream	grass	degded	60
I		26	19	415	31	24	715	656					gleysols	broad	stream	grass	degded	15
I		26	18	588	31	25	84	659	18	180	roads	6	rhodic F.	U	stream	grass	degded	-
I		26	18	677	31	23	679	640	L gully near perennial stream									
I		26	19	167	31	27	208	655	20	300	roads	7	acrisols	U	stream	grass	degded	-
I		26	18	166	31	21	213	899	8	250	track	1	rhodic.F.	broad	stream	grass	degded	5
I		26	19	566	31	23	151	644	11	350	track	5.5	leptosols	broad	stream	grass	deged	15
I		26	17	258	31	29	631	646	36	450	track	12.5	acrisols	W	stream	grass	reactiv	35
I		26	17	167	31	23	837	624	65	400	terrac	6.5	acrisols	W	stream	grass	reactiv	45
I		26	17	490	31	23	599	664	10	450	roads	6	acrisols	broad	roads	grass	deged	10

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T.A. No.	Map No.	Name of place	Coordinate							Character of Gullies					
			longitude			latitude			altitude	width	length	location	depth	soil class.	shape
3	1		26	41	687	31	7	154	1,045	2	150	track	3	mixed	V
3	2	Velezizweni	north hill top						1,130	10	230	stream	4	mixed	V
3	4	Velezizweni	26	41	222	31	5	482	1,090	7	180	stream	7	mixed	V
3	5	Ebazeni	26	45	212	30	58	402	1,012	10	150	stream	8	mixed	V
3	6	Kaboni	26	41	624	30	57	846	990	10	250	stream	7	mixed	U
3	7		26	45	167	30	55	799	1,150	3	170	track	7	mixed	V
3	8	Ruisikishini	26	45	382	30	55	815	1,040	10	300	stream	15	mixed	V
3	11		26	41	867	31	0	656	1,177	2	130	track	8	mixed	U
3	13		26	41	434	31	0	320	1,167	10	270	stream	20	mixed	V
3	14		26	40	252	31	1	98	1,080	4	160	stream	4	mixed	U
3	15		26	43	657	31	2	462	1,085	8	200	stream	7	mixed	V
3	18		26	44	645	31	0	570	892	5	150	stream	1	mixed	V
3	19		26	46	97	30	53	174	941	10	150	stream	7	mixed	U
3	20		26	46	530	30	57	933	940	10	200	stream	8	mixed	U
3	21		26	44	347	30	54	167	960	10	180	stream	7	mixed	U
3	22		26	45	583	30	53	105	960	10	220	stream	7	mixed	V
3	23		26	44	165	30	52	989	1,016	3	120	stream	8	mixed	V
2	101	Zikhotheni	27	12	545	31	24	277	775	10	200	stream	12	mixed	U
2	102	Galile East	TA2 western border							5	130	stream	8	mixed	U
2	103	Mhlobane	27	12	483	31	24	307	795	10	140	stream	15	mixed	U
2	104		27	11	813	31	25	114	740	10	230	stream	20	mixed	U
2	106		27	16	399	31	23	710	759	4	100	stream	4	mixed	U
2	107		27	17	706	31	31	28	700	7	140	stream	3	mixed	U
2	108		27	17	706	31	31	28	700	3	80	roadside	3	mixed	V
2	109	Buhle	27	17	137	31	25	895	764	8	170	stream	4	mixed	U
2	110	Buble	27	17	137	31	25	895	764	3	60	stream	4	mixed	U
2	111	Sivule	27	17	597	31	26	248	804	2	50	stream	8	mixed	V
2	112		27	18	617	31	32	740	562	4	100	stream	2	mixed	V
2	113		26	18	143	31	30	584	836	7	150	stream	7	mixed	U
2	115		26	18	428	31	32	740	544	2	70	stream	2	mixed	V
2	116		26	15	373	31	30	96	624	1	100	track	4	mixed	V
1	101		26	17	807	31	21	325	831	2	150	track	3	mixed	V
1	102		26	17	439	31	21	1	790	10	180	stream	7	mixed	U
1	103		26	17	517	31	23	732	644	4	120	track	3	mixed	U
1	104		26	17	517	31	23	732	644	2	100	roadside	4	mixed	V
1	105		26	18	183	31	23	162	640	10	230	stream	15	mixed	V
1	106		26	18	183	31	23	162	640	10	250	stream	20	mixed	U
1	107		26	22	150	31	24	596	635	3	160	track	7	mixed	U
1	209		26	22	745	31	22	48	819	4	120	stream	4	mixed	U
1	210		26	22	207	31	22	454	747	10	250	stream	15	mixed	U
1	211		26	17	853	31	25	73	747	10	200	stream	20	mixed	U
1	212		26	22	628	31	25	642	646	3	90	track	4	mixed	V
1	213		26	25	352	31	28	612	641	10	180	stream	20	mixed	U
1	215		26	27	698	31	24	716	730	4	150	stream	3	mixed	V
1	216		26	24	193	31	22	927	797	2	100	track	1	mixed	V
1	217		26	23	479	31	22	877	726	10	280	stream	15	mixed	U
1	218		26	21	331	31	24	733	664	8	150	stream	15	mixed	U
1	219		26	19	463	31	24	563	650	7	180	roadside	8	mixed	U
1	220		26	20	716	31	23	305	726	10	200	stream	20	mixed	U
1	221		26	20	251	31	23	445	666	10	240	stream	20	mixed	U
1	222		26	19	606	31	21	127	882	4	130	stream	7	mixed	U
1	223		26	26	125	31	21	78	802	2	80	track	4	mixed	U
1	224		26	39	976	30	55	870	1,184	7	160	stream	7	mixed	U

note: the third table gives the observation in AELDA evaluation in three TAs

Categorization of Existing Gullies.

Examples of factors for categorization of existing gullies are tabulated as follows:

Table D.2-2: Morphological categorization of gullies

Factor	I	II	III	IV
Soil Type (T)	Oxisols	Vertisols	Ultisols	Alfisols
Starting point (O)	Stream	Hillside	Road	Borrow-pit
Developing Stage (D)	Incipient	Young, Active	Developing*	Healing
Physiography (P)	Buried valley	Alluvial fan	Colluvial fan	Alluvial fan
Main Exerting Factor (M)	Run off	Groundwater	Stream	Artificial works
Shape (Form ; F)	Single-head	Few-heads	Dendritic	Parallel run
Site character	Ridge side	Plain surface	Buried valley	Foot plateau
Lateral Section (L)	V-shaped	U-shaped	W-shaped	Fan-shaped
Scale (Length ; S)	> 500 m	250 ~ 500 m	100 ~ 250 m	< 100 m
Scale (Depth ; S)	> 20 m	15 ~ 20 m	5 ~ 15 m	< 5 m
Scale (Width ; S)	> 100 m	50 ~ 100 m	20 ~ 50 m	< 20 m
Exigency (E, damage)	Road	Homestead	Crop field	Rangeland

Note: it includes reactivated ones.

D.2.4 Corresponding Measures to Stabilize Gullies and to Make Use thereof

Development rate of gullies becomes usually stagnated when they approach the summit of the hill / colline where they have started, because run off /groundwater supply dwindle. Hence, these are comparatively readily trained with bottom-up treatment to facilitate their stabilization.

For the gullies with incipient stage, to which concentrated surface run off exerts major function to dissect / incise them, cutting and diverting of run off likely are effective to stop escalation / development, though diverted and released water possibly induces another gully formation. For those developing through groundwater action, any treatment at the ground surface of gully heads (horizontal water channels to intercept run off, planting trees or sowing grass seed etc.) is useless to minimize their development rate. Such efforts to treat gullies have so far been made by NGOs even in our TAs, but no successful or effective case is yet reported from these trials.

Many of developing gullies can be trained by controlling loss of sediments flowing out by surface water from the gullies. Firstly, narrowed parts of the bottom where relatively water-resistant wall remains are chosen for creating barricades by piling wooden sticks and laying bundles of pruned twigs / branches on the bottom floor, so that sediments can be trapped and elevate the level of floor gradually. Another important treatment would be to rectify soil reaction or pH with lime until the vegetation can be established on the sediments heaped on the bottom. As far as topographic gradient of the gully bottom is concerned, it is almost flat in those without rock exposure in the bottom. If gullies have a lot of exposed rock or stone in the bottom, they can hardly develop deeper and they are not much different from ordinary valleys.

Deeply incised ones with much deposit of readily melting clay minerals in subsoil layers are the most difficult to deal with, because water flowing at their bottom contains colloidal clay that can hardly precipitate over their flowing beds. In TA3, a constructor wasted huge stone into such a gully, that happened to have created a water reservoir inside the gully where turbid water ponds. Further observation should be continued to see whether it gives any positive result to stabilize. Burying gullies by an explosion method with lateral boring of gully walls and dynamite insertion as applied to surface mining can be tried, but groundwater may dissolve clay from filled earth and sooner or later the same gully would appear at the same place.

Gullies occupy precious surface area of communal land at the sacrifice of otherwise grazable rangeland that is getting narrower as population swells. Currently, inhabitants can hardly use the bottom because plants cannot grow properly due to darkness, poor ventilation, acidic soils and perennial or seasonal surface water flow at the bottom that may wash the establishing vegetation away. Some useful device to make use of gullies should be exploited and tried along with gully training from land use point of view.

D.2.5 Sheet Erosion and Rill Erosion

a. Sheet erosion and types

Sheet erosion occurs virtually over all surfaces of the ground where rain wets topsoil. This is in a sense natural phenomenon, though man-made (artificial) action like pasturing, cultivation and construction works / practices can accelerate it. Severest sheet erosion may take place on bare land where no protective cover can intercept attack of raindrops or wind. Extent of erosion is difficult to measure, and there is only one contrast, forest soils that have undergone least erosion with thick vegetative cover and wind breaking action. It shows various appearances including teracette erosion, slip scar, stone pavement with accumulated, remaining gravel / boulder, as stated below.

Teracette erosion comprises a multiple series of parallel or rhombic steps on a slope where vertical face of each step has become barren without vegetation. It has been caused with minor slipping and livestock trampling. Landslips or Slumps are caused when masses of partly water-saturated soil moves down to the hill, usually in one single movement before settling on a place. Relatively little structural change would result in the soil matrix in spite of quite a large quantity of soil moved by slip. It often takes place after prolonged rainfall. Small crescent-shaped cleavages are formed where the faster sliding topsoil down to the slope tears away from the slower sliding pedon above the slope. Natural stone pavement occurs over the heavily eroded soil containing much gravel / boulder within layers, often found over colluvial sediments, but also on rocky hillsides.

b. Rill Erosion

Rill erosion is termed as remnant of water channels with the depth shallower than 30 cm where top soil has been removed away by collected run off. This waterway can readily be buried with cultivation practices if the farmers want to prevent water flow through rills. Many rills have meandering courses even they take place on straight hill-sides with nearly constant gradient. This is often observed over colluvial deposits with mosaic structure, where erodibility is not uniform over the surface but run off flow down in between hard and resistant soil clods.

Rills running over base saprolites exposed on the ground surface very often show straight and parallel lines. Also, those developed over fluvial terraces with uniform muddy material form similar straight lines. These rills tend to get deeper rather than develop wider, probably because ground surface is capped with materials resistant to crushing by raindrop, whereas sub-soil consists of soft and highly-erodible material.

Sheet as well as rill erosion by water and by wind are often observed also in arable land where crop cover is sparse due to poor plant nutrition or to wider spacing between planted hills. However, they are evenly tilled before planting and only clearly visible on fallow plots.

c. Methods of measurement to assess sheet erosion (AELDA)

Methods for measuring sheet erosion are more difficult than those for rills and gullies, because of the difficulty in finding baseline standard that gives least sheet erosion from pure natural condition free from artificial disturbance like grazing, tillage and construction of various facilities. Relative seriousness of sheet erosion can more or less be assessed through the lost thickness of ground surface that is guessed by pedestaling of perennial plants, rocks

or old termite mounds, or micro-sediments accumulated as soil-surface sealing. Soil surface that can be taken as a standard baseline is found in natural, undisturbed vegetation where no encroaching exotic plants thrive.

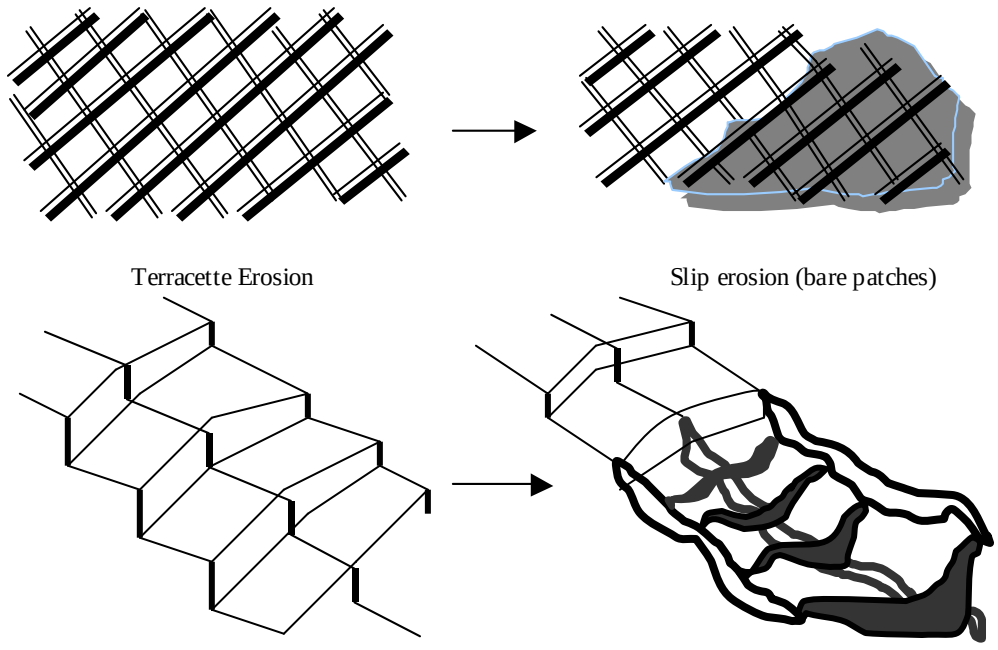
AELDA provides us with a fast and convenient method of assessment including all types of erosion, and it allows us to establish measures against further land degradation. Mapping unit is a core of argument to apply AELDA method to an area, but usually tracts of land under the same land use or with similar topographical or physiographical formation can be taken as units to which one sheet of description corresponds. If this assessment can be verified by field measurements of soil loss using movable lysimeters that can collect run off sediments during rainy season, the quantified soil loss are readily estimated.

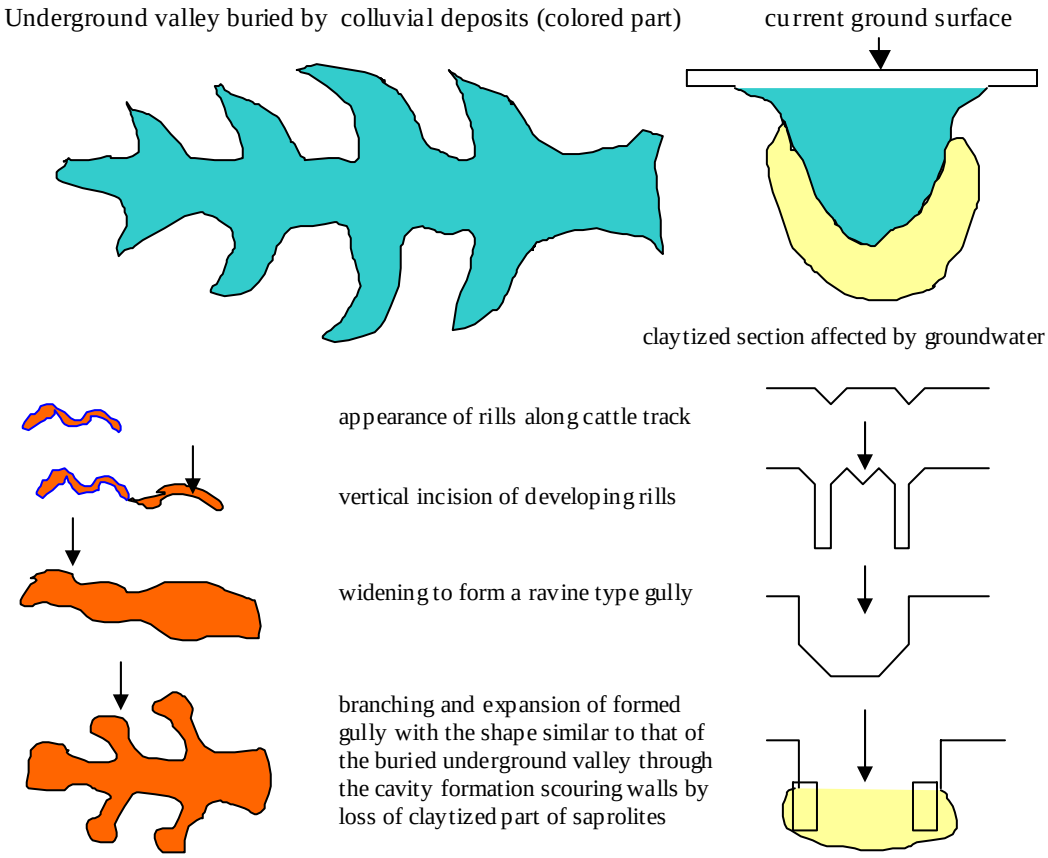
d. Relationship with other types of erosion

In Swaziland, there find some soils subject to sheet erosion where even B horizon of soil profile has completely been washed away, and C horizon is exposed over the surface. If this C horizon dose not contain much hard clods or materials resistant to scouring by run off, rills and gullies are sooner or later develop over the exposed C horizon. In this sense, areas widely affected with severest sheet erosion causing barren patches often accompany with occurrence of rills and gullies extending below the affected areas. Terracette erosion also fosters land slip causing bare patches over range.

In our target areas, even ditches constructed in parallel with trunk roads to intercept run off flowing down the slope located upward of road cutting are subject to deep scouring that can trigger development of new gullies. These ditches can be considered as man-made rills. In a few years after digging, depth of parts of these ditches reaches a few meters though the width keeps original size. This scouring implies that certain part of the bottom has dissolved into the flow in the ditches. This is equivalent to say that some parts of saprolites are highly soluble in water to form deep hollows or cavities. This may be closely related with fast development of ravine type gullies. The development process from terracette to slip erosion and from rills to ravine type gullies can be schematically illustrated below:

Schematic Concept of Erosion Development





Categorization of Existing (Sheet, Rill and Gully) Erosion

AELDA has proposed the following definitions to classify the extent of soil degradation:

Table D.2-3: Definitions of Degree on Erosion Assessment in AELDA

Item	Slight (S)	Moderate (M)	Severe (V)	Extreme (E)
Sheet erosion (WS)	Some damage but no direct visible evidence but removal part of surface horizon, in general < 10 cm removed	Clear evidence of loss of surface horizons in the form of pedestals, soil collars, root exposure etc. 10~30 cm	Clear evidence of removal of all surface horizons, exposing subsurface horizons, 30 cm or more removed	None
Rill erosion (WR)	Some evidence of loss to surface horizons, individual rills, removal of soil depth < 10 cm	Clear evidence of loss of surface horizons, rills confluent to form branches, depth ~30cm	None	None
Gully erosion (WG)	Cutting through surface horizons reaching subsurface ones, walls have gradient > 60° but depth < 2m reclaimable	Deeply into subsurface horizons & in most cases underlying sola, that is highly erodible > 2m not reclamable	None (Gullies with a wall gradient 45 ~ 60° with vegetation are deemed as in healing phases)	None
Teracette erosion	None	Series of parallel	Ditto, where	None

Item	Slight (S)	Moderate (M)	Severe (V)	Extreme (E)
		steps on hill side (> 15%), clearly separated by well-vegetated strips	vegetated strips are less clearly separating the steps & grass cover on strips→	has largely been lost.
Landslip / Slumps	None	Clear evidence of soil mass movement, sub- soil horizon exposed at limited depth	Clear evidence of soil mass movement, sub-soil horizon exposed at considerable depth	Extreme cases like land slides (or collapsed surface slip)
Topography	0 ~ 0,5% : F(lat) 0.5 ~ 2% : A(lmost F)	2~5% G(ently) U(ndul) 5~10% U(ndulating)	10 ~ 15% R(olling) 15 ~ 30% H(illy)	>30% M(ountainous) in case of E > 300m
Major landforms	MO : mountain	HI : hill	PL : plain PT : plateau	BA : basin VA : valley
Slope gradient	01 : flat 0 ~ 0.2% 02 : level 0.2 ~ 0.5% 03 : nearly level ~ 1%	04 : very gently sloping (1 ~ 2%) 05 : gentle slope 2~5%	06 : sloping (5 ~ 10%) 07 : strongly sloping (10 ~ 15%)	08 : modsteep 15~30% 09 : steep (30 ~ 60%) 10 : very steep > 60%
Slope description	S : Straight	C : Concave V : Convex	T : Terraced	X : Complex (irregular)
Vegetation code (human influence & soil conservation measures)	N: no influence NK: not known GS: grass strips BU: bunding TE: terracing	PL : ploughing CL: clearing BR: burning BP: borrow pit SC: surface compaction	VS: veg.slig, disturbed VM: veg.mod.disurbed VE: veg. str.disturbed WN: wire netting CD: check dam	WE: weir, DM: dam DS: drop structure GA: gavion AW: artificial waterway
Land use	A: crop agriculture	H : animal husbandry	F : forestry E : extraction / collection	P : nature protection
	AA : Annual cropping AP: Perennial cropping AA4: Rainfed arable AA6: Irrigated AP1(2) (non)irrigated	HE: extensive grazing HI: intensive grazing HE3(4): communal (ranch), HI1: meat pro. HI2: dairy production	FP : plantation forest	EV: exploitation of natural vegetation PN: natural / game pre. PN2 : parks PN3: wildlife mngmnt
Vegetation	N: no natural vegetation G: grassland (no tree)	FO: herbaceous forbs F : crowns overlapping	W: woodland, crowns not overlapping	S: shrub crowns touch SA: tree savanna
Grass cover	0 : no cover 1 : 0 ~ 15 %	2 : 15 ~ 40 %	3 : 40 ~ 80 %	4 : > 80 %
Outcrop exposure	N : none 0 % V : very few 0 ~ 2 % 1: interval > 50 m	F : few 2 ~ 5 % C: common 5 ~ 15 % 2: 20 ~ 50 m	M : many 15 ~ 40 % A : abundant 40 ~ 80% 3 : 5 ~ 20 m	D : dominant > 80 % 4 : 2 ~ 5 m 5. : <2 m
Surface coarse fragments	N : none 0 %	F : few 2 ~ 5 % M: medium gravel	M : many 15 ~ 40 %	D : dominant > 80 %

Item	Slight (S)	Moderate (M)	Severe (V)	Extreme (E)
	F: fine gravel 2~6 mm	6~20 mm C: coarse gravl. 2~6cm	S : stones 6 ~ 20 cm B: boulders 20 ~ 60cm	L :large boulders 60 ~ 200 cm
Surface sealing thickness, consistency	Thickness N: none Consist.S: slightly hard	F : thin (< 2 mm) H : hard	M : medium (2~5mm) V : very hard	C : thick (5~20mm) V : very thick(>20mm) E : extremely hard
Soil Depth	1: very shallow < 30cm 2: shallow30 ~ 50 cm	3: moderately deep 50 ~ 100 cm	4: deep 100 ~ 150 cm 5: very deep > 150 cm	
Erosion	N : no visible erosion S: sheet erosion R : rill erosion	W : water erosion G : gully erosion D: deposition by water	A : aeolian / deposition D : wind / deposition T : terracette erosion	M : mass movement L : land slip / slump S : landslide
Soil (mainly depth)	T : thin	M : medium	H : thick as described	as below column
Erosion reference area	Describe land use of	the area where observation was made		f.ex. past crop parcel
Area covered by erosion	1 : 0 ~ 5% , 2: 5~10%	3: 10~25% 4: 25~50%	5: 50~75% 6: >75%	but now grazing field
Degree of surface affected by erosion	S : slight Applicable to Sheet & rill only	M : moderate Applied to sheet, rill, terracette & landslip	V: severe Applied to gully, terra- cette & landslide	E : extreme Applied to gully and Land slide
Activity of man Made disturbance Distance intervals	A : active at present 1 : locally occurring	R : active in recent past (previous 50~100 years) 2 : clustered	N : period not known 3 : evenly distributed	X : accelerated and natural erosion not distinguishable
First two headline of erosion column	WS : sheet erosion WD: deposition by water	WR : rill erosion WA:water & wind erosion	WG : gully erosion AD:wind erosion+ deposit	MT: terracette erosion ML: landslide/slumps
Third compartment	Area as above classified	: 1, 2, 3, 4, 5, 6		
Fourth compartment	Degree as above-cited	: S, M, V, E		
Fifth compartment	Activity as above-cited	: A, N, R, X		
Sixth compartment	Distance as above	: 1, 2, 3		
Effective slope length	Fill the actual length in	meter	f.ex. 250, 080 etc.	
Gully assessment	Gully width 1: < 1m 2 : 1~ 2 m, 3 : 2~5m 4 : 5~10 m 5 : > 10m	Gully depth 1 : < 2m 2 : 2~5m, 3 : 5 ~ 10 m 4 : 10 ~20m, 5: > 20 m	Gully spacing 1 : > 50m 2 : 20~50 m 3 :5~20m 4 : 2 ~ 5 m, 5: < 2 m	Gully shape / system U : U-shaped section V : V-shaped section

Item	Slight (S)	Moderate (M)	Severe (V)	Extreme (E)
				I: single S: system
Rill assessment	Rill width 1: < 2cm 3 : 5 ~ 10cm 4 : 10 ~	2 : 2 ~ 5cm 20cm 5 : > 20 cm	Rill depth 1: < 2cm 3 : 5 ~ 15cm	2 : 2 ~ 5cm 4 : 15 ~ 30cm
Erosion expansion trend	1 : rate declined toward healing/stabilization	2 : rate not expected to change but to continue	3 : expansion 4 : wide-spread intensification	5: increase degradation
Causative factors of erosion	t: topography / slope g: geology / lithology	s: soil properties v: removal of veg..cover	c : cattle track l : livestock trampling	o : overstocking i :lack of infrastructure
Causative factors of erosion	t: topography / slope g: geology / lithology	s: soil properties v: removal of veg..cover	c : cattle track l : livestock trampling	o : overstocking i :lack of infrastructure
Soil profiles	O : oxisols	A : acrisols	H : histosols	V :vertisols
(thickness of soil layer)	T : thin (< 50 cm)	M : medium (50 ~ 100 cm)	H : thick (100 ~ 150 cm)	D : deeply thick (< 150 cm)
Remarks: Surface water at gully bottom	P : perennial S : seepage from walls	W : water-ponded	M : bottom moist	D : dried bottom
Remarks: Geology at gully bottom/wall Wall	G: saprolite derived from gneiss	D: saprolite from grano-diorite	P: saprolite from porphyrite	B: saprolites from alkaline rocks
Remarks: Clay deposits in the gully	1 : most part of gully wall contains	2 : fairly large deposits observed in the wall	3 : few clay deposit can be seen in gully	4 : almost no clay deposit found in it
Remarks(example) : Encroaching Plants	W: wattle	G: guava	C: Chromolaena odorata	L: lantana and other shrub species
Remarks: ditto, rate of invasion	1 : sparsely grown	2 : in the gullies or in valleys/stream-sides	3 : shrub covering part of rangeland	4 : shrubs at road-sides and fallow

This is very useful to make better understanding on the existing erosion, but too complicated to deal with. To consider concrete measures to mitigate sheet / rill erosion, the following summarized classification based on the detailed data by above listed criteria, and mapping by degree of erosion through the definitions shown in the table below should be made.

Table D.2-4: Classification of erosion

Erosion Degree	Very serious	Serious	Moderately Serious	Acceptable
Action Viewpoint	Immediate action	Immediate action	Conservation measures	Still under control
Land use changes	necessary	Not necessary	Not necessary	Not necessary
Sheet Erosion	>50% moderate	25~50% moderate SE	< 25% moderste SE or	<10% slight SE or
	SE, or	or	> 10% slight S.E. or	
Terracette erosion	>50% moderate	25 ~ 50% moderate TE	10~25% moderate TE	<10% moderate TE
	TE	A.		
Gully erosion	5~10% severe or	5~10% severe GE in	Or < 5 % severe GE	-

	<5% extreme in	combination with (A)		
	combination with (A)			
Combination with	25~50% mode-	10 ~ 25% moderate SE		
(A)	rate SE or TE	or 5 % severe SE		

In some African literature on soil erosion, 0.05 ~ 0.5 mm of surface soil is reported to have annually lost for the past half century. So it comes to 3 ~ 30 cm as a cumulative loss, implying that even B-horizon has been affected in shallow soils. As the unit of mapping, soil series distribution in the existing soil map can be used. In the above table, soil horizon is used as an indicator assuming that soil formation process has derived uniform and homogenous soil profiles in the soil series. Existence of patchy barren part also indicates that sheet erosion does not take place in a uniform manner, but extended barren part tells us more sheet erosion has taken place where some artificial effects has exerted over the soil surface. Topsoil texture reflects higher erodibility of topsoil. Finally, accumulated surface stone cover, often found directly covering saprolite layers, implies past (often natural) eroding activities, where even B-horizon was already lost for the most part. Most colluvial deposits have shallow stone lines that are probably buried ground surface at the depth of 20 ~ 30cm below current soil surface. This line can be used as a standard base to estimate sheet erosion, though the depth of stone line tends to be deeper in the past valley.

As far as the results of field observation in three TAs are concerned, it is awfully difficult to identify virgin soils that haven't undergone any action but natural erosion process, but a few cases can be observed in a way that loss of surface soil layer(s) has been estimated as thick as 30 cm for slope range surface as compared with virgin ones over flat and with shrub cover. So it can be defined that severely eroded condition in sheet erosion refers to complete loss of A horizon except gravel or stone once contained in it, and direct exposure of B horizon over ground surface.

D.2.6 Countermeasures to train rills and to minimize sheet erosion

a. General

There are two kinds of measures, one for minimizing currently occurring severe sheet / rill erosion and another for switching already eroded field into other, more suitable land use.

The former measures to be applied to sheet erosion depend on the stage of erosion:

For the sheet erosion of incipient stage (Grade 1) on rangeland, stocking rate of cattle should be adjusted, through effective fencing and other restrictive range management.

For the advanced stage (Grade 2), it is advised to rotate the land by switching into arable and fallow, and during fallow period livestock can be pastured on the fallow plots. Of course, grass strips and complete fencing around the plots should be provided.

If land use conversion is difficult due to such reason as total deficit of grazing surface, then partial terracing (for example, 1m terrace at the interval of 10m) on currently grazing space will give effect to check run off. Make flat strips along contour line by hoes or by angle blade of tractors in late rainy season, then, sow grass seed or plant rhizome and cover the stripped stripes with cut branches of thorny shrub trees (ex. *Caesalpinia mauritiaca*) encroached in the area, so that goats and cattle cannot trample into the created strips. This cover can be taken off for re-grazing when grass cover is well established over the stripped belts. Through this work encroaching detrimental shrubs can be cleared, while useful grass species can be introduced for rejuvenalizing devastated grazing field.

For the "very serious" stage, it is proposed that double fencing and browsing tree should be planted, because shrub trees can grow even on saprolite bed rocks, but grasses are hardly

grown except *Cynodon dactylon* without artificially treating the surface. Unless land use is radically changed, the severely eroded can never be effectively recovered with any measures. (*Vetiveria zizanoides* requires too much water to establish itself.)

For example, grazing land covered with pebbles and stones don't yield much grass, so feeding quantity for the community would not be affected much even though such land is converted into forest or woodlot. It will be far better to create canopy cover for firewood or browsing fodder production than keeping it in poorest grazing field.

Measures to be applied to rills depend on the ambient conditions surrounding them.

Rills are best treated with stone burying, or stone blockade / sand-bag filled with coarse sand / cement, coupled with stone lined (cordon-pièrre) grass channel vertically crossed to original rill to disperse run off once concentrated in it. Rills developed in parallel can be treated most readily by this method.

Those in more dissected stage mat need small culvert burying to evacuate run off to nearby stream. They should be buried on basal stone-piled bed, otherwise run off submerge under the buried culverts.

Measures to be applied to gullies depend either on the material in which they developed, or on the stage of their development. Because causative factors of gullies are more inclined to ground water rather than surface water, treatment of surface water with afforestation and diversion of rills at their heads are almost useless and ineffective for retarding their rate of development. Mechanical filling of gullies, such as bulldozing or dynamite explosion would last only a few years at best, after that buried soil will again be removed away from the gullies by ground water. Any gullies once occurred are only stabilized with treatment or training at their bottom. Air-exposed saprolite material possibly contains active alminium ion that makes soil acidic and causes toxicity to plants growing on the wall or over gully-bottom. Therefore, the following should be tried to facilitate their earlier stabilization:

(1) Lay heap of twigs/branches pinned up by piled sticks as barricade to intercept bottom water flow and foster sedimentation inside gullies, at a few narrow section therein. Twigs and branches of encroaching detrimental / useless shrub species like *Acacia mearnsii, Lantana camara* , *Psidium guayava* and *Caesalpinia decapetala*. If stone or boulder is available in or around the gully, a heap of fertilizer bags packed with stone pieces can be applied to as a trapping barrier of earth inside the gully.
(2) Neutralize the sedimented and heaped soil / decayed saprolite at the gully bottom with lime or calcium carbonate so that acidity of these materials can be neutralized from pH 4.5 to pH6.0 for more favorable growth condition to trees and grasses.
(3) When the inner space of the gully is enough filled with collapsed earth and condition of light and ventilation changes into more favorable to the growth of flora, planting of fodder tree seedlings like *Cajanus cajan, Sesbania sesban*, *Tephrosia vogelii* and *Gliricidia sepium* are tried to train the gully for earlier stabilization. During several years until the planted shrub trees grow taller than goats and cattle, the entrance of the gully should be barricaded with a gate to keep them off from the planted bottom.

In this connection, the Study Team estimates that it takes a long time until visible effects appear from these treatments, given that many decades have passed since most huge gullies have emerged. This implies that no significant result can be expected within the period of proposed Pilot Project, even though it can show the know-how to stakeholders.

Table D.2-5: Number of units and area under erosion class by AELDA

Target Area	Very serious	Serious	Moderately serious	Acceptable	Total
TA – 1	10	8	10	6	34
Area in ha	5,560	4,050	6,060	3,830	19,500
TA – 2	10	5	11	8	34
Area in ha	2,570	980	3,960	4,190	11,700
TA – 3	7	5	17	10	39
Area in ha	4,330	4,150	16,010	6,110	30,600
Total unit	27	18	38	24	107
Total area	12,460	9,180	26,030	14,130	61,800
composition	17.6%	20.8%	39.4%	22.2%	100%

In the above table, degree of erosion status is defined as the list tabulated below: Here, very severe sheet erosion accompanies with bare soil patches covering 10% or more of land surface and often with stony surface covered by gravel, pebble, stone and boulder. Such an extended bare soil surface almost always accompanies with gullies below it. The average area of bare soil patches developed above the gullies measures five times as much as the area occupied by the gullies, sometimes reaching a few hectares.

Table D.2-6: Definition of four erosion degrees

Erosion Degree	Very serious	Serious	Moderately Serious	Acceptable
Action Viewpoint	Immediate action	Immediate action	Conservation measures	Still under control
Land use changes	necessary	Not necessary	Not necessary	Not necessary
Sheet Erosion	>50% moderate SE	25~50% moderate SE	< 25% moderate SE or	<10% slight SE or
	or	or	> 10% slight S.E. or	
Terracette erosion	>50% moderate	25 ~ 50% moderate TE	10~25% moderate TE	<10% moderate TE
	TE	A.		
Gully erosion	5~10% severe or	5~10% severe GE in	Or < 5 % severe GE	-
	<5% extreme in	combination with (A)		
	combination with (A)			
Combination with	25~50% mode-	10 ~ 25% moderate SE		
(A)	Rate SE or TE	or 5 % severe SE		

b. Projection of With and Without Project

Since development of erosion rate has been accelerated during the last 25 years, at least the same period as it gets worsened is forecast for healing it. [1)] As for targets to be achieved in relation with concrete countermeasures, it will take fairly long period until visible recovering can be observed, so the following plan is proposed to ameliorate eroded land: [1)] R.P.C. Morgan et al, Soil Technology 1997

Only a successful case of range rehabilitation with fairly large area can be seen in southern China, in which it took around two decades to recover from very severe state to acceptable one by the strict official measures of evacuating all livestock from the affected areas through a nation-wide campaign. From these facts, the Study Team has set an assumption as listed in the following:

Current status to	Very serious to	Serious to	Moderately serious to
Targeted one	Serious	Moderately serious	Acceptable
Expected period after action	25 ±5years	15 ±5years	10 ±5years
Major countermeasures	Reforestation	Reduction of herds	Rangeland terracing
Expected improvement	Litter coverage	Grass coverage	Preventing soil loss

The required years to achieve upgrading of current erosion status is set in the above table, based on the expected growth period of indigenous tree species for developing satisfied canopy coverage. Of course, the duration depends heavily on the efforts of the Chiefdoms concerned. Also it's based on the assumption that it will take a decade to reduce herd size to a half (or to increase feed production to double the current feed availability), or two decades to decrease it to a quarter (or to quadruplicate it) that is near the equivalent of the current carrying capacity of rangeland. Period for rangeland terracing to create terraces over one hectare is estimated at five years and average grazing area per household at 2 ~ 3 hectare. In this context, what should be kept in mind is that period requirement is different by Target Area, since climatic and demographic conditions are not the same among agro-climatic regions. It is anticipated that TA-3 has the most favorable conditions to achieve targeted recovery as compared with other two areas, whereas TA-2 has the least favorable ones because of low annual rainfall. It is expected to take 55 years if one makes effort to improve very seriously eroded areas up to acceptable environment, and this period coincides with the period of degradation since 1950s.

A target is also be set for the implementation of preventing measures against further occurrence of gullies within the risky areas delineated for warning by the Study Team (refer to the attached maps in Annex). The measures include healing of bare soil patches and rangeland terracing coupled with rangeland management inclusive of intended reduction of herd size.2)

c. Trends of erosion development and future outlook

A study based on aerial photo-interpretation taken in 1972 and 1990 over the same area by R.P.C. Morgan et al. presented in Soil Technology 11 (1997), This study includes TA-1 and part of TA-3. The result showing trend of gully development is summarized in the table below and the trend in two decades is calculated in the last column. In order to apply to AELDA criteria, the trend of gully development was converted into that of sheet erosion employing the mean rate of gully versus sheet erosion in the criteria of AELDA as shown in the last column of the following table.

Table D.2-7: Sheet erosion in the criteria of AELDA

Degree	Severe	High	Moderate	Low~None	Average
Gully density	1 / 3ha	1 / 5ha	1/ 12.5ha	< 1 / 12.5ha	1 / 8.5ha
1972 level	6.9 %	21.1 %	33.6 %	38.4 %	-
1990 level	13.6 %	26.7 %	28.2 %	31.5 %	-
Trend in 20years	+ 7.0 %	+ 5.9 %	- 5.7 %	- 7.2 %	-
Sheet Erosion Equiv.	+ 35 %	+ 29 %	- 28 %	- 36 %	-

Taking the above shown trend into account and assuming that the same trend will continue ahead, an outlook of erosion status in coming two decades is proposed as the following:

Table D.2-8: Outlook of erosion status

Target Area	year	Very serious	d.o.%	Serious	d.o.%	Moderately serious	d.o.%	Acceptable	d.o.%	Total
TA-1	2001	5,559	29%	4,050	21%	6,061	31%	3,830	19%	19,500
TA-2	current	2,569	22%	977	8%	3,959	34%	4,195	36%	11,700
TA-3	status	4,328	14%	4,152	14%	16,006	52%	6,114	20%	30,600
TA-1	2020	6,976	36%	4,390	22%	4,364	22%	3,769	18%	19,500
TA-2	without	2,910	25%	1,783	15%	2,851	24%	4,156	36%	11,700
TA-3	project	5,781	19%	7,341	24%	11,525	38%	5,954	19%	30,600
TA-1	2020	5,559	29%	2,633	14%	5,531	28%	5,777	29%	19,500
TA-2	with	2,569	22%	635	5%	2,243	19%	6,254	53%	11,700
TA-3	project	4,328	14%	2,699	9%	4,656	15%	18,917	62%	30,600

In the above table, WIP stands for without MP projects and WP f2or with the projects. The latter assumes that all the units under moderately severe erosion shift into acceptable because it takes only 10~15 years, and those under severe erosion are ameliorated into moderately severe one, and the rests still remain in the current percentages.

e. Description of stage-wise strategies and countermeasures against soil erosion in three TAs.

1) Diagnosis of current erosion status to provide notice for public bulletin
2) Basic environmental education of stakeholders for better understanding on erosion
3) Proposal of advisable techniques for countermeasures to prevent / mitigate erosion
4) Forming organization / groups to implement soil conservation measures
5) Instruction of planning and implementing the measures adopted by inhabitants

Measures to tackle sheet and terracette erosion should be given priority, followed by rill training and gully healing though the latter is difficult to treat by inexpensive methods.

As to the targets of measure implementation, the following table shows the short, medium and long-term targets to be achieved in the three TAs. In the light of the necessity of struggling in a long-term approach to improve too degraded environment, a considerate plan will be proposed for more realistic and sustainable implementation.

Table D.2-9: Proposed implementation schedule

Target Area	2001	2002	2003	2004	2005 ~ 2009	2010 ~ 2014	2015 ~ 2020	2020 ~
TA – 1	1)	2), 3)	4)	5)	SA	S	M	VS
TA – 2	1)	2), 3)	4)	5)	SA	S~MA	M	VS
TA – 3	1)	2), 3)	4)	5)	SA	MA	M	VS

Note: 1) to 5) indicate the above procedures, VS stands for the measures to be taken for very seriously eroded areas, S for those to address seriously eroded ones, M for the areas under moderately serious erosion as defined above. A indicates around the Pilot Areas since the motivation becomes stronger in the vicinity of demonstration sites.

f. Necessary approach and methods to realize countermeasures against soil erosion in three TAs

1) Organization of Soil Conservation Group within the concerned chiefdom to establish an implementation frame-work
2) Mutual agreement on the restrictive land use and animal grazing for land conservation
3) Recognition on current erosion status and training on techniques to be applied as countermeasures
4) Provision of concrete project plans, procurement of assistance tools and other inputs and labor service arranged by the Group

g. Concrete countermeasures against erosion and land degradation to be applied to three TAs

g.1 Relationship between current land use and erosion status

Erosion takes place as the result of improper land use, like tillage on slope, overgrazing, careless road construction and fixed cattle tracks etc. Throughout the TAs, serious erosion can seldom be observed over arable tracts, but has been concentrated on rangeland. Rangeland has been located over stony or gravel-rich areas as compared with arable plots because farmers prefer fertile soils free from stone or boulder. This implies that if they try to cultivate improper land, they can hardly gain proper crop yield and they have to waste it sooner or later. Such abandoned crop fields are often seen in TA-2.

g.2 Causes of erosion and land degradation

Since erosion is caused by run off water or wind, any human activities that foster run off or surface exposure to wind may result in heavier erosion. While cropped fields have properly been protected from run off through grass strips, no such measures have been taken for rangeland so far. Overgrazing during rainy season triggers terracette erosion, while cattle tracks where large size cattle herds pass everyday causes larger patches of bare soil surface. Also, preference of livestock to graze only palatable grasses and fodder trees has resulted in thriving of low-valued and impalatable ones that are encroaching and expand over rangeland. This is also a type of land degradation. Finally, field burning before the onset of rainy season gives heavy damages on canopy and grass itself, turning precious humus organic sources into ash and inorganic carbon, thus depriving soil of water retention and percolation capacity.

g.3 Measures against erosion and land degradation

Causes of erosion can suggest us what to do against it. To lessen run off concentration and its velocity is essential to mitigate erosion. This comprises improvement of surface cover with vegetation, contour terracing with readily available material such as pebble and stone, agro-forestry shrub species or grass species that can easily propagated by rhizome or stolon. Measures of erosion control are divided into two categories. One relates to how to curb dynamic impact of raindrops hit to soil surface with buffering such as grass cover, and the other to how to attenuate run-off velocity over slope surface. The former is achieved through

improvement of natural grass cover by proper range management, partial conversion of land use into woodlots or striped alley planting of agro-forestry shrub or browsing fodder trees. The latter is practiced with creation of flat, narrow terraces at the interval of several ten meters depending on the slope gradient.

Here, grass water-way with slope cannot be recommended because of difficulty of treating torrential flow at the end of the channels after heavy rainfall. If such concentrated and enormous flow is released into a valley, it may foster reactivation of stabilized gullies. Narrow and active gullies developed from rill into deeply scoured trenches have steep slope in which rainwater scour soils and decayed saprolite may mass. Stone and pebble packing at the interval of several ten meters depending on the slope angle is necessary to check torrential water velocity at the bottom of gullies.

With regard to reestablishment of grass cover over bare soil patches, fencing of the patches is needed to protect from animals along with amendment of soil pH with lime and preferably with rock phosphate and cow-dung. Then some terracing with pickers is advised as the preparation of planting rhizome of *Cynodon dactilon*, the specie tolerant to acidic soil and aridity.

As concerned developed and active gully training, though it is rather difficult to treat, the countermeasures should be confined to prevent soil loss from inside gullies to outside. Because collapsed earth in ravine gullies mainly consists of silt and clay that are readily solved in water to form solid suspension, it is difficult to make all of the earth sediment in the gullies, but only a half or less can be retained even if some type of checking weirs are installed in the gullies. However, efforts of stopping further incision or development of existing gullies by planting trees over the gully, or by intercepting runoff by channels over it have so far end up in failure, implying that gullies should be trained from inside. Hence, it is proposed to train them for earlier stabilization by heaping sand bags, twigs and branches of wattle trees and stone-packed gabion nets (if stone is available in and around the gullies) inside them to foster sedimentation over the bottom of the gullies.

Lastly, land use conversion into firewood lots or into browsing tree lots is recommended for very stony land where surface soil had been eroded off and stone and gravel derived from former stone lines remain on the surface, since grass yield is poorest to feed livestock even if it is kept as rangeland. Most grass species develop their root system over few decimeters on the surface, and their growth is seriously impeded if the stone content of soils exceed 20 ~ 30%. On the contrary, trees can grow even on such land since it can compete with grass for soil water during dry season over such soils with feeble grass cover.

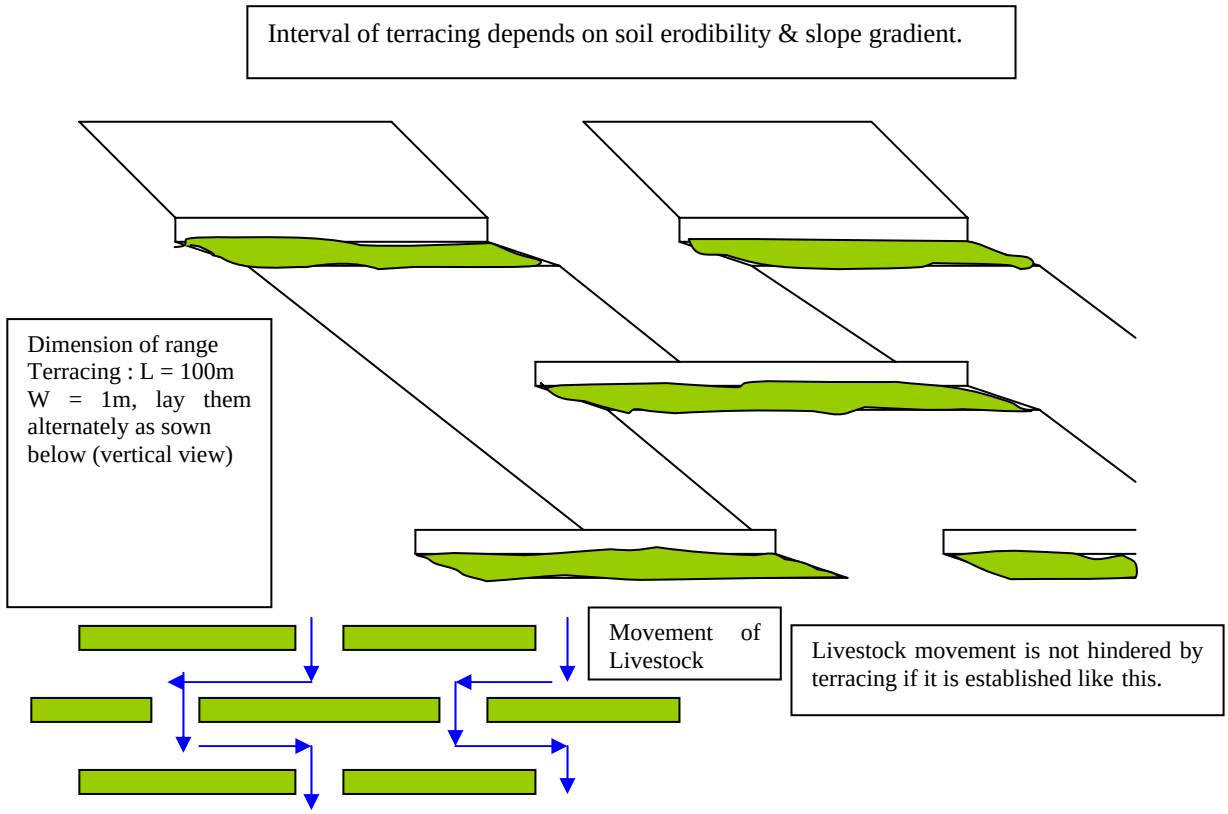
Eradication of encroached problem shrub trees and replacement thereof with useful shrub species are also imperative as a form of land use conversion. This is practiced cutting detrimental, noxious encroachers like Mauritius thorn (*Caesalpinia decapetala*), *Lantana* camara, wild guava (*Psidium guajava*) and burning the stabbles, followed by planting of saplings of useful firewood / fodder species like *Cajanus cajan, Sesbania sesban, Tepfrosia vogelii* and *Gliricidia sepium* with fences made of cut thorn branches.

In addition, it is proposed here that the gullies with perennial water flow at their bottom can be utilized as water reservoirs for procuring animal water or small-scale irrigation. Only stone and earth is necessary to install small dykes at narrowed section of such gullies.

1) Measures for curbing runoff velocity

Runoff over any slope of rangeland affected seriously by sheet or terracette erosion can be treated with small and flat (contour) terrace with grass cover to nullify runoff velocity. However, two problems arise on how to make the terrace flat and how to protect the terrace surface from livestock invasion

during the period for grass establishment. For leveling, either water gauge or hand level can be used for terrace shaping works.



The dimension of terrace is advised at one meter wide and 20~30 cm height (cut section), over which grass rhizome should be transplanted. Desirable vegetation over the terrace necessarily confines to vetiver grass because of acclimatization and availability problems of such particular and exotic species. What are most adaptable to the given condition comprise indigenous grass species like *Cynodon dactilon* since it can readily available everywhere, and can establish over cliff of gullies, on bare soils or saprolites.

The interval distance of terrace depends on the gradient of the slope, every 30 meter at maximum and 20 meter at minimum. After transplanting rhizome or sowing grass seed, the surface of terraces should be covered with cut branches twigs of thorny shrub trees like Mauritius thorn instead of costly barbed wire until grass firmly established over the terraces. The terraces should be contour flat, otherwise water flows along terraces and makes a new gully at the end. Length of a contour terrace should be less than 100 meter, so that grazing livestock can easily move over grazing land.

2) Measures for increasing soil surface coverage with vegetation

This is rather hard to try, because it means fencing or other protection to limit livestock invasion into the practiced area, otherwise the effort will fail in vain. If large area has been bare, without grass cover, as often observed in TA-2, it is better to restore grass cover in order to avoid further erosion. The causes of occurrence of barren field should be considered to rectify the conditions; in some cases reaction of soils or outcropped saprolites is too acidic (pH <5.0) for grasses to grow on soils, aftermath of severe erosion. In other cases grasses have disappeared through too heavy grazing.

In such cases, soil neutralization with limimg is necessary before sowing or transplanting rhizomes. When pH in 1:1 water and soil indicate 5.0, lime requirement comes to 100 grams per square meter, but when it gives pH5.5, 50 grams are enough to amend soil acidity. In many soils in the Study Area, acidity derived from aluminum toxicity has not to account for. *Cynodon dactilon* is again useful to propagate under such dry and acid conditions, judging

from survival rate and proliferation rate point of view. *Vetiveria zizanoides* will also do, but the grass is too tall and bulky to establish in drought.

In some cases in stony areas, planting shrub trees is more successful than grass cover. Fast growing indigenous and exotic species can be introduced through nursery propagation of saplings / scions.

3) Gully training

This is the most difficult trial, and it has low rate of success, but worth challenging. Stabilized gullies always have canopy cover inside them. Since it has been demonstrated that no surface treatment is effective to stop or retard their development, there will be no way other than treating them from inside. First of all, vegetative establishment inside the gullies require favorable ambient conditions for their growth; ventilation, sunshine, soil pH, proper moisture etc. To satisfy these requirements, it is needed to make them as shallow as possible through fostering self sedimentation within the gully bottom. Since half of the particle size component of earth inside them consists of clay, they cannot be retained within them and flow out. So, we expect that gullies can be made shallow up to half of their current depth. So, it will take time to train very deep gullies. The material available in and around them consists of only earth, stone and tree branches. There is no other way than to use sand bags, gabion nets and pins/ branch bundles. Heaping of such material in the narrowest part of the gully bottom should be tried to induce sedimentation at their bottom.

When the gullies become sufficiently shallow, soil amendment and sowing / transplanting can be tried with necessary fencing at their entrances / inlets to keep out livestock. The recommended tree species comprise *Syzygium cordatum, Diospiros lisioides, Pinus patura and Populus leucocephala*.

It is noteworthy that however one makes effort, once eroded soil is impossible to recover as it was there before erosion took place. Hence, what people can do is confined to how to curb or retard erosion process by their efforts and devices. At any rate, natural erosion never disappears even if no artificial activities were done to soil surface. A tentative target is set in a way our efforts should be made so that the erosion rate can be controlled at approximately the same as that of natural erosion occurring over well-developed tree canopy. We assume that this rate to cause sheet.

D.3 Measurement

Table D.3-1: Particle Size Distribution of Saprolite Sampled in Gullies

Location	Sample	Soil texture						Sample	Soil texture					
		2.0~ 0.425mm	0.425~ 0.25mm	0.25~ 0.15mm	0.15~ 0.05mm	0.05~ 0.005mm	< 0.005 mm C		2.0~ 0.425mm	0.425~ 0.25mm	0.25~ 0.15mm	0.15~ 0.05mm	0.05~ 0.005mm	< 0.005 mm C
Engcayini	1A	1	3	10	22	39	25	1A	1	4	14	36	75	100
	1B	1	1	2	28	43	25	1B	1	2	4	32	75	100
	2A	11	9	9	14	32	25	2A	11	20	29	43	75	100
	2B	9	11	9	16	29	26	2B	9	20	29	45	74	100
	3A	11	9	11	25	31	13	3A	11	20	31	56	87	100
	3B	11	10	11	18	36	14	3B	11	21	32	50	86	100
Eni	4E	23	3	4	41	17	12	4E	23	26	30	71	88	100
	4C	18	3	1	41	23	14	4F	18	21	22	63	86	100
	4F	33	15	11	18	16	7	4C	33	48	59	77	93	100
	4D	23	19	18	18	14	8	4D	23	42	60	78	92	100
	1 medium	17	19	16	22	17	9	1 med	17	36	52	74	91	100
	1 lower	19	9	8	29	23	12	1 low	19	28	36	65	88	100
Galile	1A	24	8	9	46	9	4	1A	24	32	41	87	96	100
	1B	19	26	23	16	11	5	1B	19	45	68	84	95	100
	2A	22	15	15	21	20	7	2A	22	37	52	73	93	100
	2B	24	15	16	24	18	3	2B	24	39	55	79	97	100
	3A	21	20	18	23	11	7	3A	21	41	59	82	93	100
	3B	22	22	18	25	9	4	3B	22	44	62	87	96	100
Zikhothen	1A	51	7	6	15	17	4	1A	51	58	64	79	96	100
	1B	44	11	8	13	18	6	1B	44	55	63	76	94	100
	2A	43	8	8	18	18	5	2A	43	51	59	77	95	100
	2B	48	10	8	13	16	5	2B	48	58	66	79	95	100
	3A	44	16	11	11	13	5	3A	44	60	71	82	95	100
	3B	50	12	10	12	13	3	3B	50	62	72	84	97	100
	3AB	48	10	8	13	16	5	3AB	48	58	66	79	95	100
	1AB/2A	44	11	8	13	18	6	1AB/2A	44	55	63	76	94	100
acudvulwi	1A	31	13	12	20	14	10	1A	31	44	56	76	90	100
	1B	15	22	16	17	17	13	1B	15	37	53	70	87	100
	2A	10	11	12	24	34	9	2A	10	21	33	57	91	100
	2B	11	11	11	27	30	10	2B	11	22	33	60	90	100
	3A	2	11	9	20	43	15	3A	2	13	22	42	85	100
	3B	23	7	7	17	37	9	3B	23	30	37	54	91	100
Mbeka	1A	14	13	13	27	26	7	1A	14	27	40	67	93	100
	1B	7	4	4	47	28	10	1B	7	11	15	62	90	100
	2A	22	13	12	22	16	15	2A	22	35	47	69	85	100
	2B	10	15	14	25	29	7	2B	10	25	39	64	93	100
	3A	7	3	3	47	28	12	3A	7	10	13	60	88	100
	3B	12	10	12	28	30	8	3B	12	22	34	62	92	100

Figure D.3-1: Particle Size Distribution Pattern in TA-1

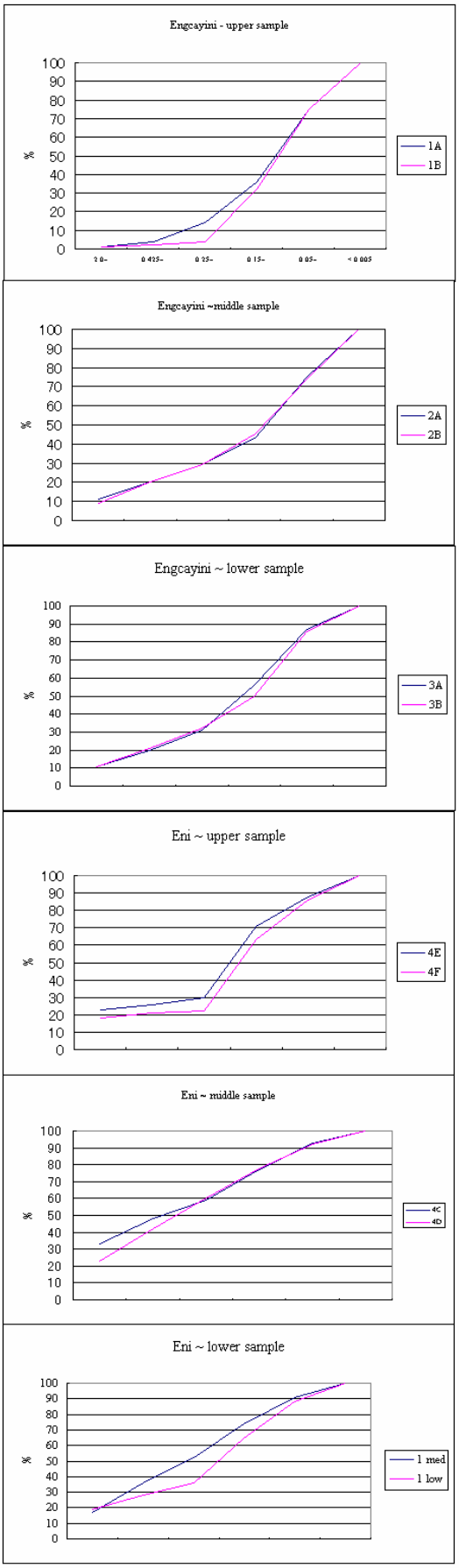


Figure D.3-2: Particle Size Distribution Pattern in TA-2

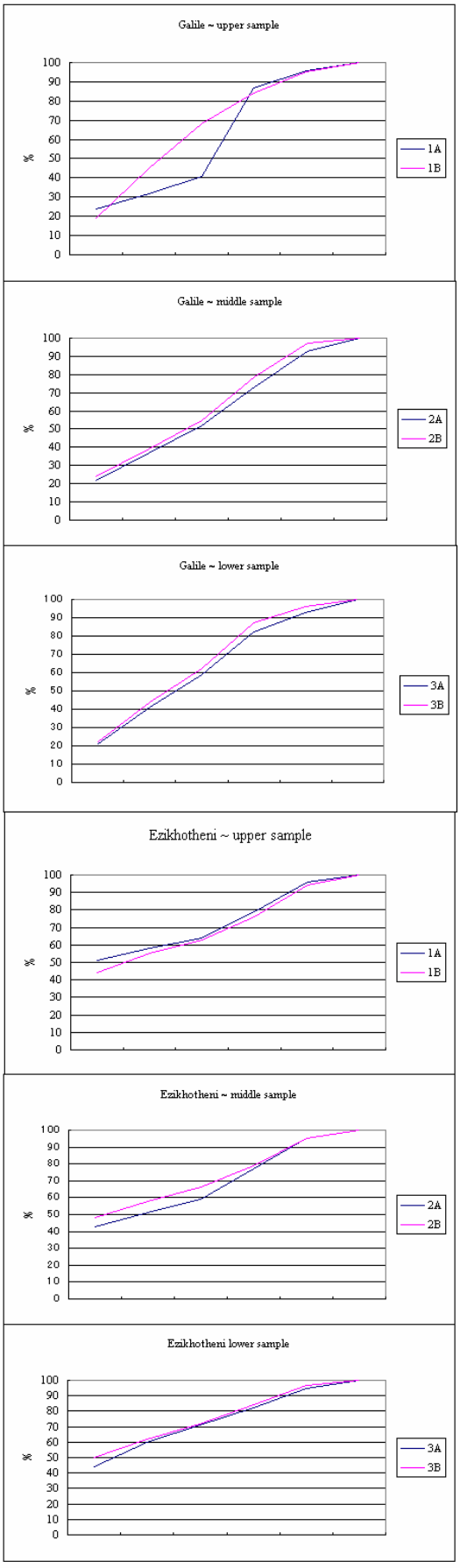


Figure D.3-3: Particle Size Distribution Pattern in TA-3

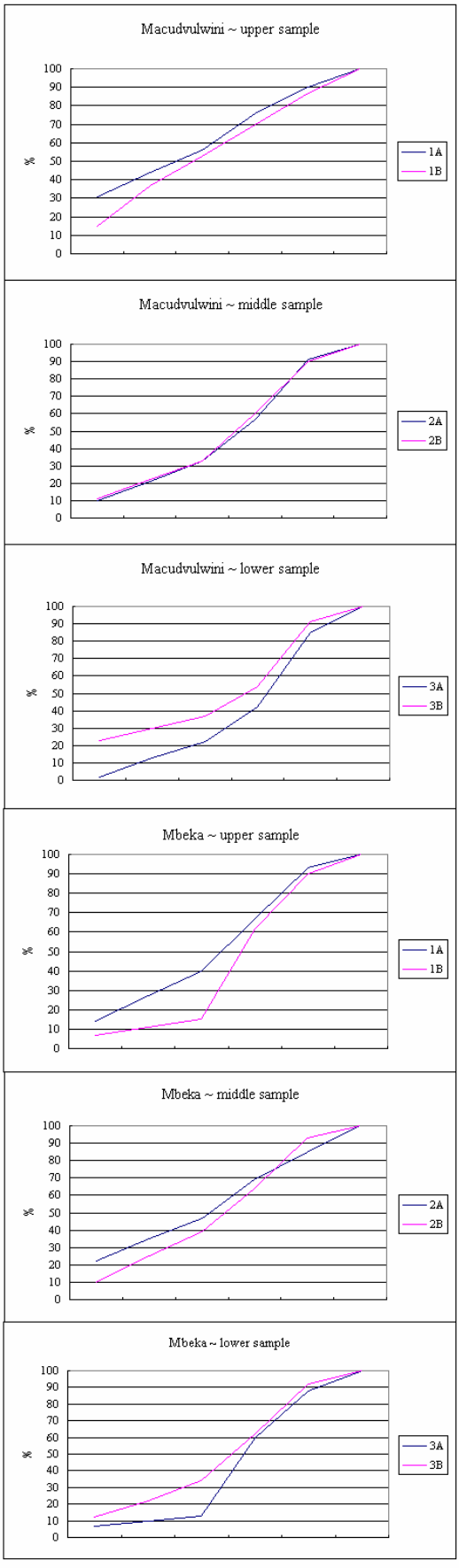
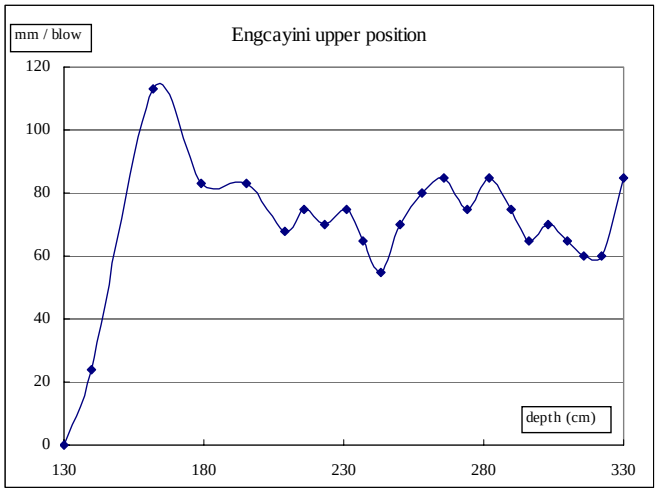
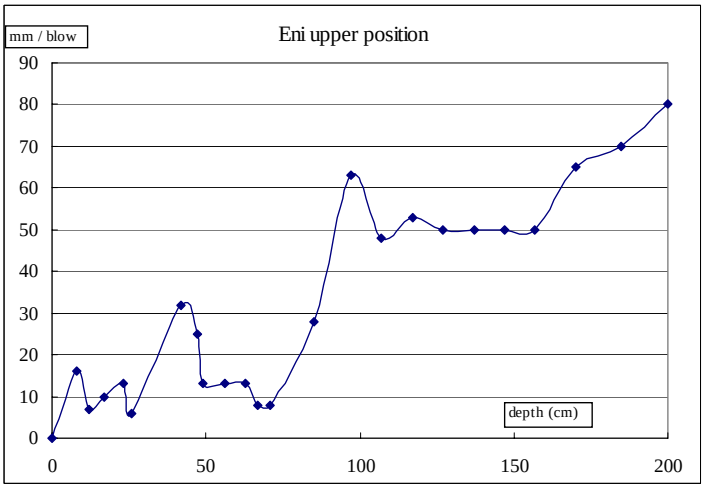


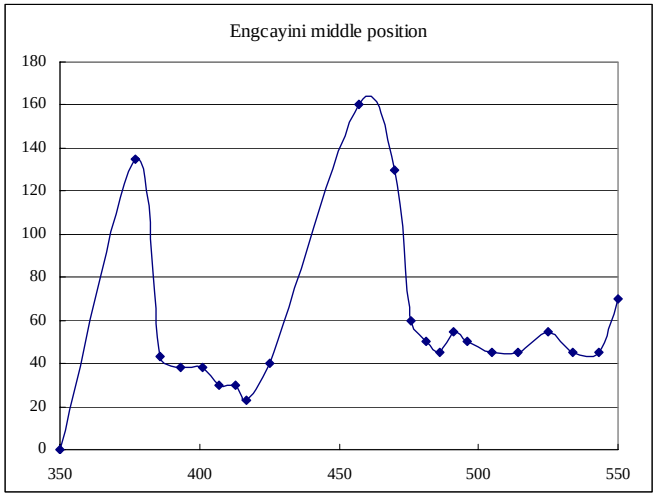
Table D.3-2: N- compaction test results by DCP (Dynamic Corn Penetrometer)

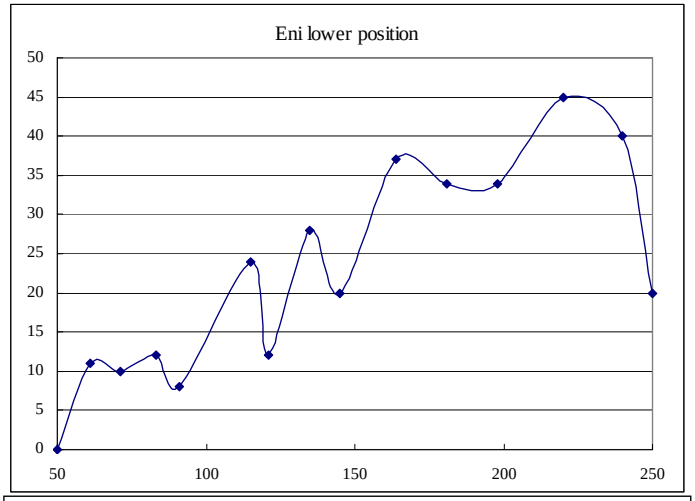
Engcayini	Curve1	Depth	0	9.5	32	48.5	65	78.5	86	93	100.5	107	112.5	119.5	127.5	136	143.5	152	159.5	166	173	179.5	185.5	191.5	200														
		No.of Blows	0	4	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1														
		mm /blows	0	24	113	83	83	68	75	70	75	65	55	70	80	85	75	85	75	65	70	65	60	60	85														
		kPa	0	138	18	27	27	35	31	34	31	37	46	34	28	26	31	26	31	37	34	37	41	41	26														
Engcayini	Curve2	Depth	0	270	355	430	505	565	625	670	750	1070	1200	1260	1310	1355	1410	1460	1550	1640	1750	1840	1930	2000															
		No.of Blows	0	2	2	2	2	2	2	2	2	**2**	**1**	**1**	**1**	**1**	**1**	**1**	2	2	2	2	2	1															
		mm /blows	0	135	43	38	38	30	30	23	40	**160**	**130**	**60**	**50**	**45**	**55**	**50**	45	45	55	45	45	70															
		kPa	0	14	65	76	76	102	102	148	39	12	15	41	52	60	46	52	60	60	46	60	60	34															
Engcayini	Curve3	Depth	0	12	19	26.5	40.5	47	53	58	61	68	86	93	106	112	116.5	119.5	122.5	125.5	128	132	137	143															
		No.of Blows	0	1	1	3	3	5	7	5	5	5	10	5	5	5	5	5	5	5	10	10	10	10															
		mm /blows	0	120	70	25	47	13	9	10	6	14	18	14	26	12	9	6	6	6	3	4	5	6															
		kPa	0	17	34	129	57	303	520	426	827	275	198	275	123	336	488	827	827	827	2585	1402	1049	827															
4	Curve3	Depth	0	8	11.5	16.5	23	26	42	47	49	56	62.5	66.5	70,5	84.5	97	106.5	117	127	137	147	157	170	184	2000													
Engcayini		No.of Blows	0	5	5	5	5	5	5	2	2	5	5	5	5	**5**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**													
		mm /blows	0	16	7	10	13	6	32	25	13	13	13	8	8	**28**	**63**	**48**	**53**	**50**	**50**	**50**	**50**	**65**	**70**	**80**													
		kPa	0	231	677	426	303	827	94	129	318	303	303	569	569	112	39	56	49	52	52	52	52	37	34	38													
5	Curve3	Depth	0	11	21	33	41	65	71	85	95	113.5	130.5	147.5	170	190	200																					
Engcayini		No.of Blows	0	10	10	10	10	10	5	5	5	5	5	5	5	5	5																					
	1B	mm /blows	0	11	10	12	8	24	12	28	20	37	34	34	45	40	20																					
		kPa	0	376	426	336	569	136	336	112	55	78	87	87	60	70	173																					
Galile	1AB	Depth	0	70	125	180	235	280	345	410	485	555	690	790	910	1030	**1160**	**1270**	**1360**	**1490**	**1590**	**1680**	**1770**	**1860**	**2000**													
		No.of Blows	0	5	10	10	10	10	10	10	10	10	10	7	7	7	**7**	**5**	**3**	**3**	**2**	**2**	**2**	**2**	**3**													
		mm /blows	0	14	6	6	6	5	7	7	8	7	14	14	17	17	19	22	30	43	50	45	45	45	47													
		kPa	0	275	927	927	927	1203	746	746	619	677	288	268	211	211	190	153	102	63	52	60	60	60	57													
Galile	2AB	Depth	0	140	260	325	420	495	525	630	710	800	895	1015	1115	1215	1330	1450	1625	**1790**	**1940**	**2000**																	
		No.of Blows	0	2	5	5	5	5	2	5	5	5	5	5	5	5	5	5	5	**4**	**4**	**2**																	
		mm /blows	0	70	24	13	19	15	15	21	16	18	19	24	20	20	23	24	35	41	38	30																	
		kPa	0	34	136	303	185	251	251	162	78	198	185	136	173	173	144	136	83	67	76	102																	
Galile	3AB	Depth	0	150	245	345	430	505	585	680	770	875	990	1110	1250	1405	1565	1720	1880	2000																			
		No.of Blows	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4																			
		mm /blows	0	30	19	20	17	15	16	19	18	21	23	24	28	31	32	31	32	30																			
		kPa	0	102	185	173	213	251	231	185	198	162	144	136	112	98	94	98	94	102																			
Zikhotheni	1AB/2AB	Depth	0	19	30	41	51	60.5	70	78	89	97.5	106.5	113.5	121	127.5	132	138.5	142.5	146	151	160.5	167.5	174	180.5	187	192.5	197.5	200									
		No.of Blows	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	10	10	10	10	10	10	10	7									
		mm /blows	0	38	22	22	20	19	19	16	22	17	18	14	15	13	9	13	8	7	5	10	7	7	7	7	6	5	4									
		kPa	0	75	153	153	173	185	185	231	153	213	198	275	251	303	488	303	569	677	1049	455	677	746	746	746	927	1049	1625									
	3AB	Depth	0	12	18	23	28	32	36	40	44.5	49.5	52	54.5	58	60	64	68	73	77	81.5	87	96	108.5	117	121	124	129.5	135	138	146							
		No.of Blows	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	10	10	20	20	10	10	10	20	20	20	20							
		mm /blows	0	24	12	10	10	8	8	8	9	10	5	5	7	4	8	8	10	8	5	6	5	6	9	4	3	3	3	2	4							
		kPa	0	136	336	426	426	569	569	569	213	426	1049	1049	677	1402	569	569	426	569	1203	927	1203	785	526	1402	2039	2283	2283	5024	1402							
Macudvulwini	DCP1	Depth	0	7	9.5	12.5	14.5	17.5	20	22.5	29.5	34.5	37	37.5	refusal		169	173	179.5	191.5	200		149	154	158	162.5	172	179	189	196.5	200							
		No.of Blows	0	2	2	2	2	2	2	2	5	5	40	20		DCP1	5	5	5	10	5	3AB	20	20	20	20	20	20	2	2	2							
		mm /blows	0	35	13	15	10	15	13	13	14	10	1	0		→	11	8	13	12	17	→	2	3	2	2	5	4	50	38	18							
		kPa	0	83	318	251	426	251	318	318	275	426	15693	51693			376	569	303	336	213		5024	2585	3455	2964	1121	1668	52	76	206							
	DCP2	Depth	0	7	12	18	23.5	31	37.5	43	48	53	58.5	64	69	73	77	80.5	83.5	90.5	97.5	104	111.5	118.5	123.5	131	137.5	147.5	154	159.5	163.5							
		No.of Blows	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5							
		mm /blows	0	35	25	30	28	38	33	28	25	25	28	28	25	20	20	18	15	14	14	13	15	14	10	15	13	20	13	11	8							
		kPa	0	83	129	102	114	76	92	114	49	129	114	114	129	173	173	206	251	275	275	303	251	275	426	251	303	173	303	376	569							
	DCP3	Depth	0	11	15.5	25.5	34	45.5	59	71	84.5	97	107.5	116	124	130	134.5	139.5	144	149	153	157.5	161	165	169	177	184	192.5	200									
		No.of Blows	0	2	2	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	10	10	10	10										
		mm /blows	0	55	23	25	21	23	27	24	27	25	21	17	16	12	9	10	9	10	8	9	7	8	8	8	7	9	8									
		kPa	0	46	148	129	160	144	117	136	117	129	162	213	231	336	488	426	488	426	569	488	677	569	569	569	677	526	619									
Mbeka	1AB	Depth	0	2	11	32	40	60	69	76	80	**95**	**107**	**113**	**118**	**123**	**127**	**130**	141	146	150	157	164	167.5	170	refusal													
		No.of Blows	0	10	10	10	10	10	5	5	5	**10**	**3**	**3**	**5**	**5**	**5**	**5**	10	5	10	10	10	10	10													
		mm /blows	0	2	9	21	8	20	18	14	8	15	40	20	10	10	8	6	11	10	4	7	7	4	3													
		kPa	0	3455	488	162	569	173	198	275	569	251	70	173	426	426	569	827	376	426	1402	677	677	1668	2585													
	2AB	Depth	0	6	12	20	27	41	50	58	62	68	74	78	85	90.5	98	106	112	117.5	123	132	141	151	156.5	166	174	181	188	193	200							
		No.of Blows	0	10	10	10	5	4	2	2	2	2	2	2	5	5	5	5	5	5	5	10	10	10	10	10	10	10	10	10	10							
		mm /blows	0	6	6	8	14	35	45	40	20	30	30	20	14	11	15	16	12	11	11	9	9	10	6	10	8	7	7	5	7							
		kPa	0	827	827	569	275	83	60	70	41	102	102	173	275	376	251	231	336	376	376	488	488	426	927	455	569	677	677	1049	677							
	3AB	Depth	0	9	19.5	39.5	43.5	55.5	65	75.7	87	93	99	104	111	113	115	refusal																				
		No.of Blows	0	5	5	5	5	3	3	3	5	3	3	3	3	2	5																					
		mm /blows	0	18	21	40	8	40	23	36	23	20	20	17	23	10	4																					
		kPa	0	198	162	70	569	70	95	81	147	173	173	219	141	426	1402																					

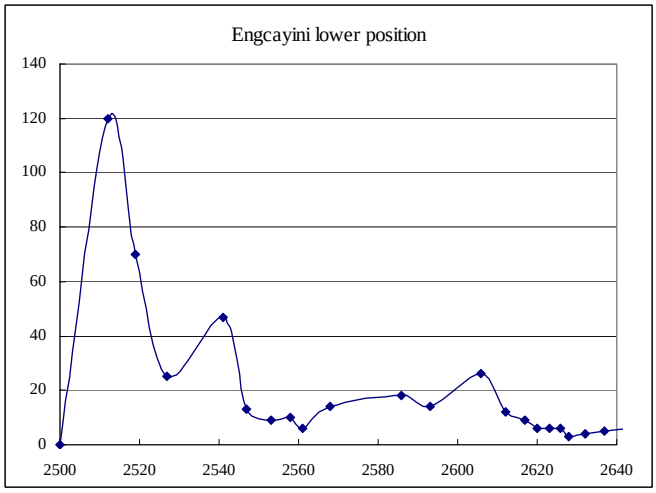
Figure D.3-4: Dynamic Cone Penetrometer mesurement in selected gullies in the Pilot Areas
T A - 1







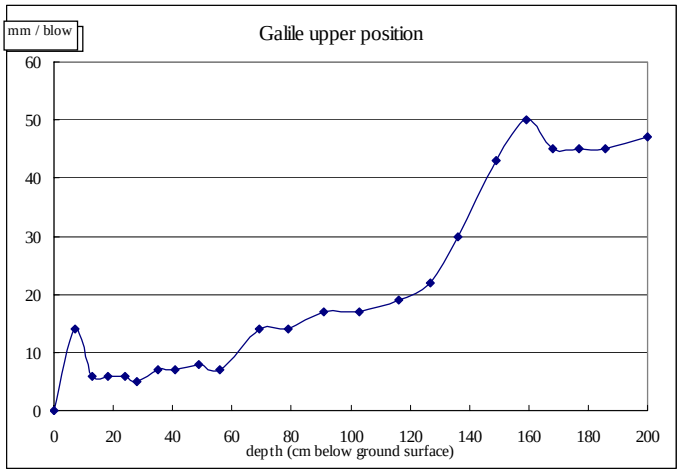


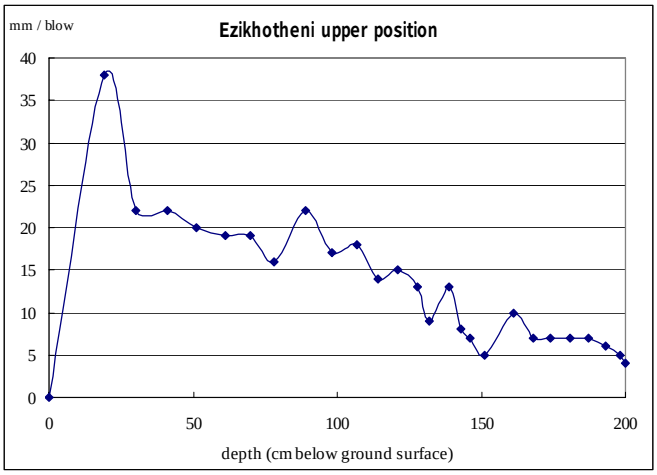


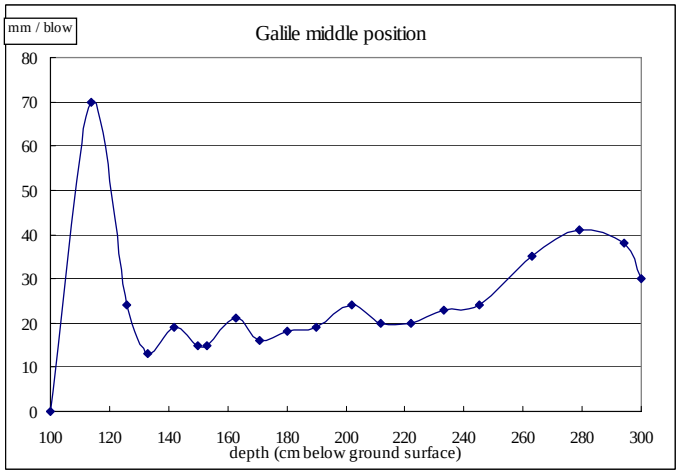
In the Engcayini huge ravine, dendritic gully of about 70 years age, very soft layers in upper ~ lower Saprolites are detected by the DCP measurements. Conspicuous belts are identified at around 150cm, 380cm, 460cm and 25.5m below the groundsurface, where
kaolinite-rich and soft weathered matrice are observed.

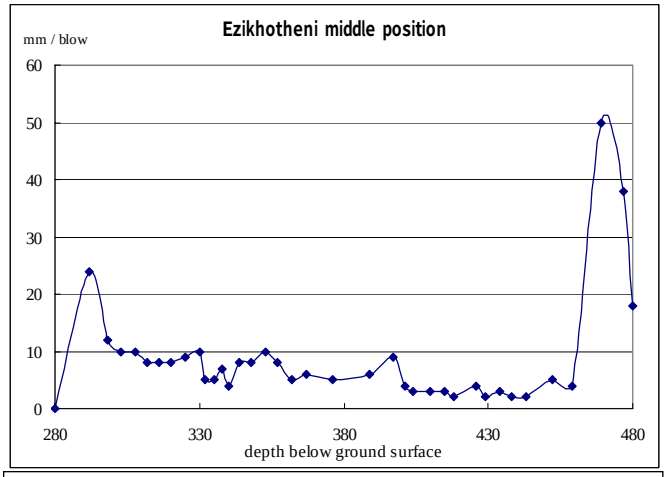
In a open shallow gully in Eni, the bottom (1.7 ~ 2.5m below ground surface) has such soft ewathered saprolite that is clearly claytized. However, the below part has less weathered layers with gneiss rocks that impede furtyher incision of gully bottom.

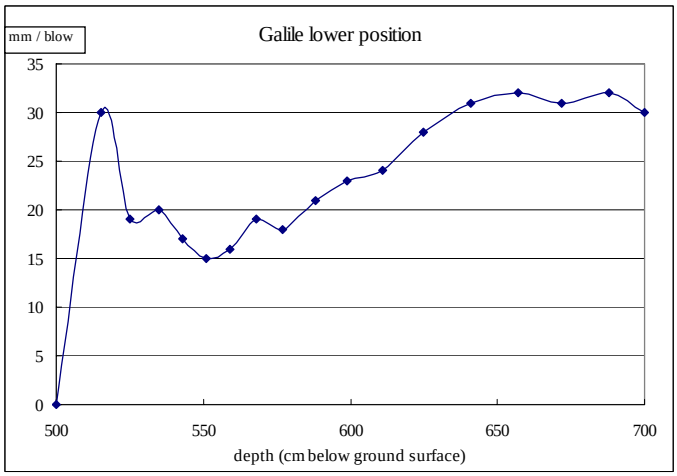
Figure D.3-5: Dynamic Cone Penetrometer mesurement in selected gullies in the Pilot Areas
T A - 2







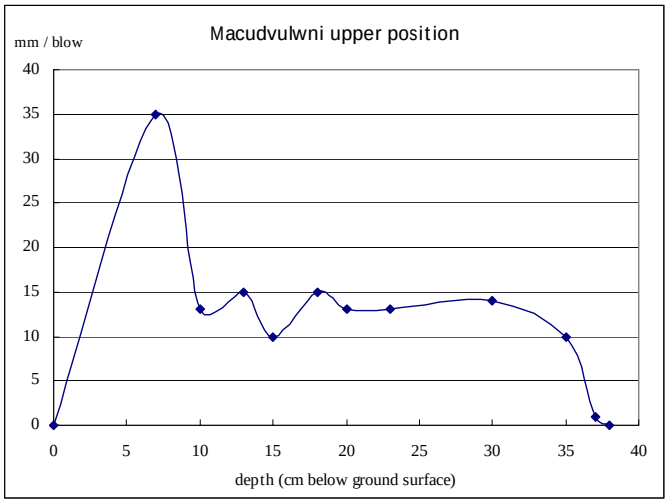


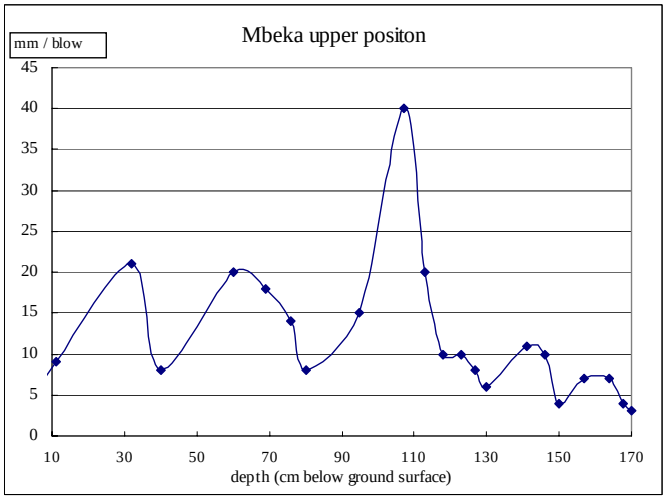


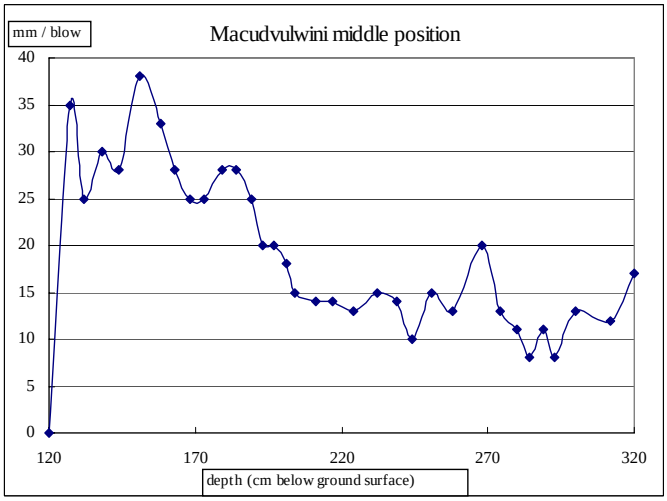
A ravine and dendritic gully in galile foothill has parts of weak load bearing at 1.5 meter ~ 2 meter. It shows a soft layer lying deeper than 6 meter below the ground surface, coinciding with layers containing much kaolinite as white~pink color on the gully wall observed at the bottom.

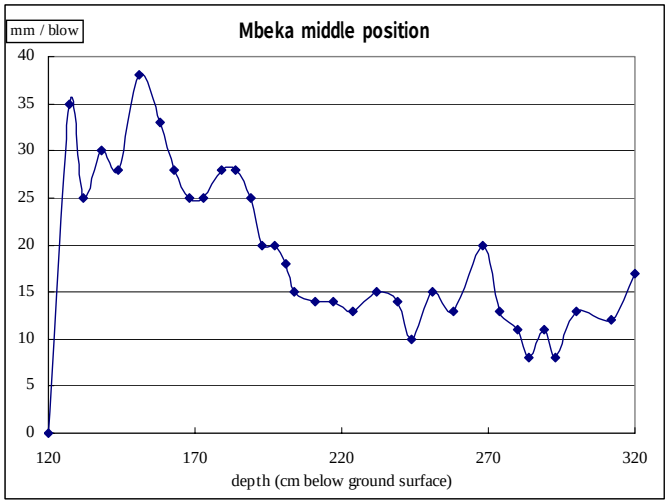
Another one of similar type in Ezikhotheni has friable parts at its surface and below 4.5 meter, but it gives stable bearing capacity at the rest parts of layers up to 5 meter. Unfortunately, the data of lower position is not available to trail the trends below 5 meter.

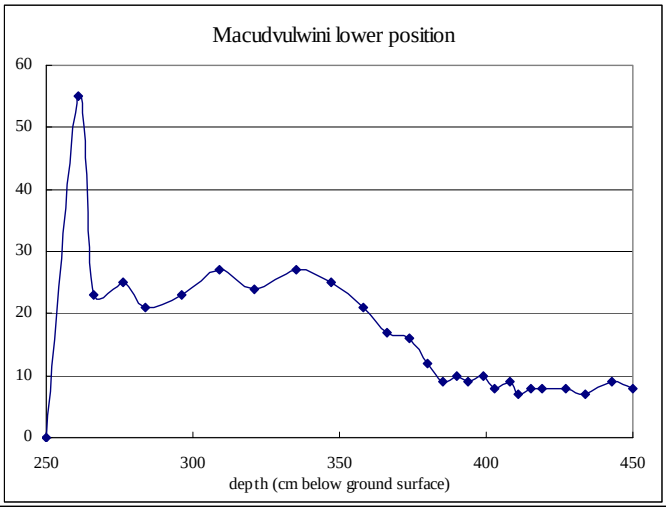
Figure D.3-6: Dynamic Cone Penetrometer mesurement in selected gullies in the Pilot Areas
T A - 3

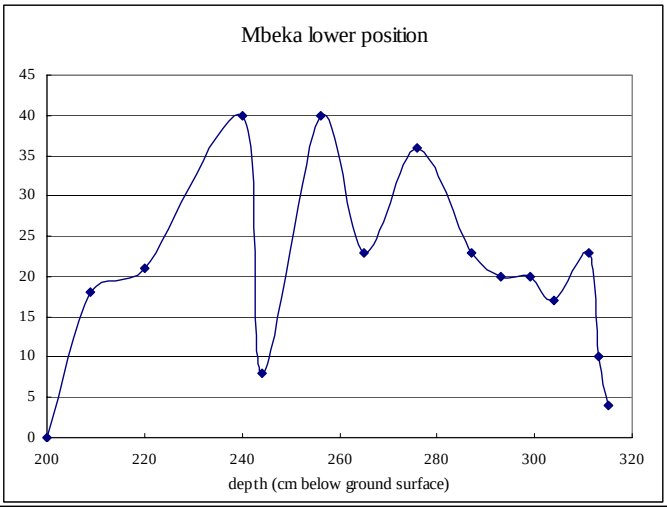












A shallow valley gully in Macudvulwini has friable and low load bearing capacity at 130 ~ 190 cm below the ground surface, but the base is too stony for the gully to develop deeper. Slip type one in Mbeka has soft layer at 230 ~ 280 cm that is identified as kaolinite contained saprolite subject to erosion loss..

Table D.3-3: Falling head permeability test results

Site Testing

	Depth (m)	Moisture Content (%)		Dry density	Coefficient of permeability range			Soil Texture
		before test	after test	(kg / cm^3)	Minimum unit	Maximum unit	Average unit	
Ezikotheni 2A	0.0	4.6	28.1	1,485	2.5×10^{-4}	7.3×10^{-4}	5.3×10^{-4}	
Ezikotheni 3B	0.5	9.2	29.6	1,384	0 E-00	**2.1×10^{-3}**	7.2×10^{-4}	Sandy Loam
Ezikotheni 2B	2.8	3.3	29.7	1,430	**1.7×10^{-3}**	**1.7×10^{-3}**	**1.7×10^{-3}**	
Galile 1A	0.0	7.9	25.2	1,497	5.7×10^{-4}	9.9×10^{-4}	8.3×10^{-4}	
Galile 1B	0.0	10.3	29.8	1,419	**7.6×10^{-4}**	**1.1×10^{-3}**	**9.1×10^{-4}**	
Galile 2A	1.0	9.8	36.8	1,319	2.2×10^{-4}	2.5×10^{-4}	2.3×10^{-4}	Loam
Galile 2B	1.0	9.7	35.7	1,309	4.3×10^{-4}	4.9×10^{-4}	4.6×10^{-4}	
Galile 3AB	5.0	12.0	28.1	1,443	3.8×10^{-4}	4.2×10^{-4}	4.0×10^{-4}	
Macudvulwini 1A	5.0	12.9	29.6	1,408	8.7×10^{-5}	9.4×10^{-5}	9.0×10^{-5}	
Macudvulwini 1B	0.0	12.0	30.5	1,330	1.7×10^{-4}	1.9×10^{-4}	1.9×10^{-4}	
Macudvulwini 2A	1.2	22.8	**38.3**	1,344	1.7×10^{-5}	1.8×10^{-5}	1.7×10^{-5}	Clay
Macudvulwini 2B	1.2	17.2	28.8	1,547	4.9×10^{-6}	5.6×10^{-6}	5.2×10^{-6}	
Macudvulwini 3A	2.5	26.7	40.5	1,270	4.4×10^{-6}	5.2×10^{-6}	4.6×10^{-6}	
Macudvulwini3B	2.5	20.9	**45.5**	**1,255**	2.1×10^{-5}	2.5×10^{-5}	2.3×10^{-5}	
Mbeka 1A	0.0	17.1	29.7	1,348	6.6×10^{-5}	7.0×10^{-5}	6.8×10^{-5}	
Mbeka 1B	0.0	19.7	36.6	**1,238**	3.6×10^{-4}	4.0×10^{-4}	3.8×10^{-4}	
Mbeka 2A	0.5	14.6	36.8	1,317	5.3×10^{-4}	5.7×10^{-4}	5.5×10^{-4}	Clay Loam
Mbeka 2B	0.5	15.1	34.3	1,306	1.7×10^{-4}	1.8×10^{-4}	1.8×10^{-4}	
Mbeka 3A	2.0	19.0	34.6	1,403	5.6×10^{-5}	6.2×10^{-5}	5.9×10^{-5}	
Mbeka 3B	2.0	19.7	32.4	1,419	1.3×10^{-5}	1.7×10^{-5}	1.4×10^{-5}	
Engcayini 1A	3.5	18.9	**41.4**	1,316	8.6×10^{-6}	1.0×10^{-5}	9.7×10^{-6}	
Engcayini 1B	3.5	33.3	**48.4**	**1,225**	8.9×10^{-5}	9.9×10^{-5}	9.4×10^{-5}	
Engcayini 2A	25.0	6.5	51.7	1,148	1.2×10^{-5}	1.7×10^{-5}	1.4×10^{-5}	Heavy Clay
Engcayini 2B	25.0	7.2	**49.0**	**1,161**	5.8×10^{-6}	5.9×10^{-6}	5.8×10^{-6}	
Engcayini 3A	1.3	18.8	37.3	**1,202**	2.3×10^{-6}	2.3×10^{-6}	2.3×10^{-6}	
Engcayini 3B	1.3	22.6	45.9	1,327	2.8×10^{-6}	7.0×10^{-6}	5.1×10^{-6}	
Eni 4AE	0	20.3	34.4	1,369	2.3×10^{-4}	2.9×10^{-4}	2.6×10^{-4}	
Eni 4E	0	22.1	39.0	1,348	**1.0×10^{-3}**	**1.2×10^{-3}**	**1.1×10^{-3}**	
Eni 4BF	2.8	18.1	34.4	1,336	4.9×10^{-4}	6.5×10^{-4}	5.6×10^{-4}	Sandy
Eni 4F	2.8	22.1	38.1	1,314	3.7×10^{-4}	3.8×10^{-4}	3.8×10^{-4}	Clay Loam
Eni 4CD	0.5	17.6	30.8	1,469	1.4×10^{-4}	1.8×10^{-4}	1.6×10^{-4}	
Eni 4C	0.5	23.5	40.1	1,198	3.2×10^{-4}	3.5×10^{-4}	3.4×10^{-4}	

remarks unable to test for Ezikotheni 1B and 3A because they were broken.

Table D.3-4: Liquid Limit, Plasticity Index and Linear shrinkage of the samples

Location	Sample	Depth	Bulk Density		Field	liquid limit	Plasticity	Linear	Bulk density	CoS + CFS
		in mm	Wet density	Dry density	Moisture%		Index	Shrinkage	difference	content %
Engcayini	1A	150	1.282	0.966	32.7%	50	14	7.3	0.316	4%
	1B	150	1.507	1.043	17.8%	40	7	5.1	0.464	20%
	1C	150	1.593	0.988	24.3%	48	13	7.0	0.605	20%
Engcayini	4C	160	1.290	1.011	30.5%	38	16	7.7	0.279	21%
	4E	160	1.593	0.988	24.3%	49	15	8.0	0.605	26%
	1B	160	1.355	1.023	28.6%	55	18	10.2	0.332	2%
Engcayini	4F	150	1.282	0.966	32.7%	47	16	8.4	0.316	48%
	2A	160	1.507	1.043	17.8%	47	15	6.0	0.464	20%
	3B	155	1.593	0.988	24.3%	22	4	2.0	0.605	21%
Eni	2A	160	1.290	1.011	30.5%	47	15	9.0	0.279	42%
	2B	155	1.593	0.988	24.3%	47	15	8.0	0.605	36%
	2C	170	1.355	1.023	28.6%	53	17	10.1	0.332	28%
Galile	1A	155	1.496	1.478	8.0%	29	9	4.4	0.018	32%
	2B	165	1.370	1.236	10.9%	36	11	6.5	0.134	39%
	3AB	150	1.430	1.330	7.5%	30	12	5.6	0.100	41%
Galile	2A	160	1.496	1.478	8.0%	30	11	6.6	0.018	37%
	1B	160	1.370	1.236	10.9%	30	10	6.1	0.134	45%
	3AB	155	1.430	1.330	7.5%	29	11	6.3	0.100	44%
Macudvulwini	1B	170	1.665	1.561	6.6%	35	15	8.1	0.104	37%
	2B	160	1.800	1.722	4.6%	46	19	5.8	0.078	22%
	3A	160	1.557	1.487	4.7%	45	12	5.8	0.070	13%
Ezikhotheni	1B	170	1.665	1.561	6.6%	35	6	2.0	0.104	55%
	2A	160	1.800	1.722	4.6%	38	15	7.3	0.078	51%
	3A	155	1.557	1.487	4.7%	31	7	3.6	0.070	60%
Ezikhotheni	3B	155	1.665	1.561	6.6%	29	7	4.6	0.104	62%
	2B	160	1.800	1.722	4.6%	36	16	6.2	0.078	58%
	1A	155	1.557	1.487	4.7%	34	9	2.5	0.070	58%
Macudvulwini	1AB	150	1.459	1.267	15.1%				0.192	
	2AB	150	1.716	1.376	24.8%				0.340	
	3AB	150	1.672	1.308	27.8%				0.364	
Macudvulwini	1A	155	1.459	1.267	15.1%	44	21	9.8	0.192	44%
	3B	155	1.716	1.376	24.8%	45	14	8.3	0.340	30%
	2A	160	1.672	1.308	27.8%	48	19	9.6	0.364	21%
Mbeka	1AB	150	1.587	1.250	23.9%				0.337	
	2AB	160	1.535	1.254	22.3%				0.281	
	3AB	150	1.419	1.159	22.5%				0.260	
Mbeka	1A	150	1.587	1.250	23.9%	48	19	11.0	0.337	27%
	2B	160	1.535	1.254	22.3%	40	18	10.1	0.281	25%
	3B	150	1.419	1.159	22.5%	39	19	9.5	0.260	22%
Mbeka	2A	160				42	21	10.2		35%
	3A	160				43	20	10.7		10%
	1B	170				38	14	8.8		11%

Table D.3-5: Detecting soft layers in gullies by cone-penetrometer (1)

4	July	(Wed)		place:	TA-1		Ncgayini		Inner-	gully	survey	with	Mr.	Ikemoto				
	coordinate :		S	26	18	192			Using smaller cone									
			E	31	23	180			above the head									
	altitude : ft		2,148						sheet erosion				rill erosion					
	rate of	head	proc.	5	m only	from	pins		width	barren	10	m	small rill		35	m		
		width	proc.	8	m only				width	barren	15	m	w:10	d:30	105	m		
									width	barren	20	m	2 rills	wider	115	m		
	3 heads		from the leftest head,						from head		to entrance:				238	m		
			new gully has ocurred,						from entrance				natural valley		190	m		
			with the length 60 m.			w: 10m	d:3m											
			bottom lays at the head surface.							cone penetrating resistance:								
	parallel gully		shallow one runs in parallel, in kaolinite layer							surface of gully bottom:				14	kg / cm^2			
			1 : 150m		d: 15m		w:8m			40	cm	deep		21	kg / cm^2			
	base rock at gully botom:				kaolinitized granite-saprolite				with multitude of vertical cracks					crystal fissure				
	entrance base-rock				granite		on which 25 year-old P.patura grows					and Jacaranta also.						
	bottom floor with dropped stones					inclined, vertical quartz veins												
	bottom floor with mironitic fault									kaolinitized collapsed granite-saprolite at 5 m above the bottom								
	cone penetrating resistance:									cone penetrating resistance:								
	0	35	45	50	60	80	cm	deep		0	20	40	60	80	cm	deep		
	0	1.5	3.4	4.3	6.2	7.7	kg / cm^2			0	2.3	3.8	6.9	8.9	kg / cm^2			

11	July	(Wed)		place:	TA-1		Mancinyeni	Inner-	gully	survey						
	coordinate :		S	26	20	697		pH of		pH of		pH of		pH of		
			E	31	23	53	surface flowing water			bottom water		kaolin solution		yellow clay solution		
soil profile								19.9	℃	21.1	℃	21	℃	21	℃	
0	N5/0		Using smaller cone					6.8		7.15		7.19		6.93		
	humus	C	2m ahead of gully head surface													
25			0	10	25	50	55	60	65	cm	deep					
			0	3.1	7.4	12.6	16.6	18.5	23.1	kg / cm^2						
	G2/6	C	1m deep at head fringe				1m deep, layer of weak consistency					this layer (Bt) has porous structure				
70	Fe2O3	GWtr	0	40	50	60	70	80	**90**	**100**	**120**	125	130	140	cm	deep
			0	1.5	4.6	6.5	10.0	15.4	20.0	21.5	23.2	35.4	36.3	45.4	kg / cm^2	
100	N5/1	HC	1.5m below the gully head surface													
	kaolin mottle		0	5	10	15	20	25	30	35	cm	deep				
	7.5YR3/1		0	6.2	9.2	13.8	23.7	33.1	36.9	44.6	kg / cm^2					
150	upper		5m below it		7.5YR2/1		HC	with quite a few quartz gravel								
	saprolite		0	5	10	15	20	25	cm	deep						
			0	18.5	27.7	33.8	40.3	44.6	kg / cm^2							
			7m below it, or bottom													
	cm	deep	0	5	10	**15**	**20**	**30**	**40**	45	50	**60**	**70**	**80**	90	100
	kg / cm^2		0	2.3	4.0	8.5	10.8	10.8	10.8	20.0	29.2	34.6	34.6	35.4	42.3	48.5
			the new colluvial deposit on the gully bottom is estimated at 60 cm.													
			transparent water flow at the bottom comes from surface aquifer, or buried colluvial deposits.													

14	July	(Sat)		place:	TA-3		Ebhazeni		Inner-	gully	survey							
	coordinate :		S	26	43	720												
			E	31	6	152												
	altitude : ft		985															
soil profile																		
0	7.5YR		Using smaller cone															
	gravel	SL	ground surface:		0	5	10	12	15	17				cm	hard pan with much st .			
20	albic	horiz.			0	21.5	33.1	40.8	43.7	53.1				kg / cm^2				
	upper		1.5m below g.s.		0	10	30	40	50	**60**	**70**	**80**	90	cm	well-weathered part			
	sapro-	CL			0	10.8	12.3	16.2	18.9	28.0	28.0	28.0	32.3	kg / cm^2				
	lite		3.2m below g.s.		0	5	10	15	**20**	**25**	**30**	35	40	cm	natural wet layer (aquifer)			
			wet layer		0	12.9	19.4	23.4	27.7	29.5	30.8	41.5	47.7	kg / cm^2				
			part only															
					water conductivity of bottom flow:					0.017	mS/cm		in vertisol gully					
	7.5YR3/1						clod surface with crust			0.035	mS/cm		coordinate shown below					
150	upper																	
	saprolite																	
	coordinate :		S	26	44	727		Nkhanyezini plain				vertisol gully						
			E	30	54	301		Mtagane River basin										
	altitude : ft		990															
			vertisol		0	30	40	50	**60**	**80**	**85**	95	100	cm	wet part only			
			4.5m below g.s.		0	5.8	15.4	20.9	24.0	24.6	26.2	29.5	36.9	kg / cm^2				
	coordinate :		S	26	45	165												
			E	30	55	828		Almost all gullies has hard saprolite with iron nodule, so no measurement can										
	altitude : ft		1,000					be made.		Most gullies have water flow at the bottom, granitic quartz veined.								

19	July	(Thu)		place:	TA-3		Macdulwini	road-side		gully	survey	With Mr. Bongani Magombo				
	coordinate :		S	26	40	220										
			E	31	0	532										
	altitude : m		1,000	m												
Using smaller cone			lower gully wall					surface is covered with stones/gravel.					with stone line at 20cm below			
2m below g.s.		0	20	**30**	**50**	70	90						cm	kaolitized layer		
		0	4.6	12.6	12.6	15.5	16.9						kg / cm^2			
1.5m below g.s.		0	5	10	15	20	25	30	35	-			cm	kaolitized layer		
dry condition		0	0	10.0	16.2	16.9	20.0	25.7	26.6				kg / cm^2			
1.5m below g.s.		0	5	10	**15**	**20**	**25**	**30**	35	40	50		cm	kaolitized layer		
watered layer		0	2.3	5.4	16.6	18.5	21.1	22.3	27.4	28.5	36.9		kg / cm^2			
			upper gully wall													
1m below g.s.		0	10	**20**	**30**	**40**	50	60	70	80	90	100	cm	yellow saprolite		
watered layer		0	1.8	4.2	4.5	4.8	8.5	12.6	15.1	27.4	41.4	41.4	kg / cm^2			
	coordinate :		S	26	39	376										
			E	30	56	788										
	altitude : m		1,202	m												
gullies	inside	planted forest														
	cause :	First, cattle path to down dip-tank,					but later forest road was constructed.									
		The road was subject to surface erosion, and only stones and boulders remain on the road surface.														
		Roadside rills are dissected, where depth of rills reach 20 ~ 25cm from the road surface.														
		About 1cm per year was dissected runn off over the road surface.														
		Soil: xantho Ferralsols with dark grey capping in the valley.														
		A developed gully is observed at 1km away from this site at eastern slope above Mbeka primary school.														
		W= 8m,		L= 70m,		D= 7m		V-shaped								

Detecting soft layers by cone-penetrometer (2)

Detecting lost topsoil at the top of plateau

20 July (Fri) place: TA-3 Ngwenpisane road-side gully survey Mr. Philip Mamba guided to gullies

coordinate : S 26 43 330 another gully nearer to the Ngwenpisi River S 26 43 765

E 30 58 838 E 31 4 964

altitude : m 971 m measured gully at the main-road altitude : m 843 m

parallel to road W= 11m, L= 90m, D= 6m U-shaped

Using smaller cone lower gully wall surface is covered with stones/gravel. with stone line at 20cm below

2.5m below g.s.	0	5	10	15	20	25	30				cm			claytized clay layer
wet condition	0	12.3	21.5	28.5	35.4	44.6	gravel				kg / cm²			7.5YR 6/8
1.5m below g.s.	0	5	10	**15**	**20**	**25**	**30**	35			cm			kaolinite layer
wet condition	0	0	10.0	16.2	16.9	20.0	9.2	26.6			kg / cm²			2.5YR 3/6

Ngwenpisane Roadside Gully Wall

coordinate : S 26 43 765

E 30 4 964

altitude : m 842 m 30y.old gully

0		surface quartz gravel			
	humus	SL	7.5YR	6/4	
25					
		C	10R	3/3	
40		quartz	stone line		
		gravel layer			
80		parallel stone line			
		SCL	5YR	5/8	
70		albic horizon			
450		weathered gneiss			
		SC	7.5YR	6/8	
500		pink kaolinite layers			

Pumitile school-yard gully

coordinate : S 26 43 670 250 W:7m D:2.5m L:200m

E 30 55 885 cm since 1971 30year-old g.

altitude : m 1,015 m measured gully at the school-yard

not proceeded from February W= 70m HeadW= 10m L= 200m D=7m W-shaped

4.5m below g.s.	0	**10**	**20**	**30**	**40**	**50**	cm	yellow saprolite			ground surface	0	5	10	15	cm
dry boring	0	7.7	7.7	9.2	10.5	10.8	kg/cm²	7.5YR	8/6		=gravelly pan	0	12.3	20.8	36.9	kg/cm²
4.5m below g.s.	0	10	**25**	**35**	**45**	55	65	70	cm							
wet boring	0	1.8	4.2	4.5	4.8	8.5	12.6	15.1	kg / cm²		kaolinite layer	d = 3.5m ~ 7m				
5m below g.s.	0	**10**	**20**	**30**	**40**	50	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**	weathered quartz vein	
dry boring	0	11.2	11.2	11.2	14.0	23.2	35.2	35.2	37.2	47.7	47.7	47.7	50.0	50.8	vertically running	

Pumitile School Gully Wall

0		surface quartz gravel			
		LiC	2.5YR	3/4	
25					
		C	10R	3/3	
80		parallel stone line			
		C	2.5YR	3/6	
450		weathered gneiss			
			7.5YR	6/8	
500		pink kaolinite layers			
cm					

TA-1 Kanyeni Vergin Soil as sheet erosion key layer

0		surface quartz gravel		
	humus	SCL	7.5YR	2/2
		CL	10YR	3/3
25				
		C	7.5YR	3/2
40		gravel layer		
			2.5YR	3/6
50		weathered gneiss		
			7.5YR	6/8
cm				

TA-3 Macdulwini ~ Mbeka reactivated valley gully

coordinate : S 26 40 910

E 30 58 827

altitude : m 1,222 m reactivated head

0		SL	7.5YR	4/6
	quartz s.line			
40		C	2.5YR	4/8
110		Si /	7.5YR	4/8
		C	2.5YR	7/6
				pH & EC
400		C	10R	6/8	penetrometer

4.0m below g.s. 0 5 10 15 20 25 30 35 cm pink saprolite

dry boring 0 11.5 14.6 15.2 23.4 36.8 41.4 52.6 kg/cm² 7.5R 4/8

21 July (Sat) place: TA-1 Bekinkhosi ~ Nkilidji

coordinate : S 26 18 588

E 31 25 84

altitude : m 659 m measured gully along a village-road soil: ferralsols capped with black mud

3m below g.s.	0	5	10	15	25	35	50	65	70	80	cm		pink	
wet condition	0	12.3	24.0	32.5	32.5	32.5	32.5	32.5	43.2	47.7	kg / cm²		kaolinite layer	

coordinate : S 26 19 415 coordinate : S 26 18 677

E 31 24 715 E 31 23 679

altitude : m 656 m gully near arable plot in range altitude : m 640 m gully near perennial stream

streamside rain scoured fan

2m below g.s.	0	5	10	15	laterite	2.5m below g.s.	0	5	10	grey deposit
wet condition	0	18.5	40.8	56.2	aquifer	wet condition	0	14.0	60.0	impermeable

Soil Horizon of Gully Wall coordinate : S 26 19 167

gully near arable plot in range (above) E 31 27 208

altitude : m 655 m average gradient 7°

Flat Shrub 40m down, eroded slope

0		surface quartz gravel			0		surface granite stones			0			
	fine	SCL	7.5YR	4/1		humus	HC	2.5YR	2/2				
30	gravel	permeable layer										ERODED	
	vertical	CL	2.5YR	6/3	20								
	crack									30			
60		C	10YR	6/3			HC	7.5YR	3/3	0		surface granite stones	
											humus	HC	2.5YR 2/2
					42					12		HC	7.5YR 3/3
		typical Ferralsols					SiC	10YR	4/8			SiC	10YR 4/8
800		C	gully bottom		60		SiCL	5YR	4/6	40			
					cm					cm		SiC	2.5YR 7/6

around 30 cm eroded as compared to the flat, undisturbed ground surface

Table D.3-6: Water Infiltration Test Results

Aug.7 TA-1 Eni Largest Gully

on gully head on small gully 1m from the wall top

g = 1.3 x 10^{-3} cm/sec			g = 3.6 x 10^{-3} cm/sec		
Surface cm	time in min.		Surface cm	time in min.	
0.5	1.0	1.0	0.5	2.0	2.0
1.0	2.5	1.5	1.0	5.8	3.8
1.5	6.0	3.5	1.5	8.2	2.5
2.0	11.5	5.5	2.0	11.8	3.6
2.5	17.5	6.0	2.5	14.3	2.5
3.0	24.0	6.5	3.0	17.8	3.5
3.5	31.5	7.5	3.5	21.2	3.4
			4.5	26.8	5.6
surface water velocity			6.5	34.4	7.6
3.0 m	10.0 sec.		8.0	42.5	8.1
			9.0	47.8	5.3

south 200m shallow guuly (blue pin)

gully head surface

g = 4.4 x 10^{-3} cm/sec		
Surface cm	time in min.	
1.0	2.2	2.2
2.0	4.7	2.5
3.0	7.4	2.7
4.0	10.4	3.0
5.0	13.6	3.2
6.0	16.9	3.3
7.0	20.4	3.5
8.0	24.1	3.7
9.0	27.7	3.6
10.0	31.5	3.8
11.0	35.4	3.9
15.0	40.0	4.6

Aug.8 TA-3 Mbeka Slip Gully

on gully head but on grassed ground

g = 1.2 x 10^{-3} cm/sec					
Surface cm	time in min.				
1.0	1.5	1.5	7.0	38.7	5.5
1.5	2.3	0.8	7.6	43.8	5.2
2.0	3.3	1.0	8.0	52.2	8.3
2.5	4.2	0.8	8.5	57.7	5.5
3.0	6.3	2.1	9.0	65.8	8.1
3.5	9.1	2.8	9.5	71.2	5.4
4.0	12.4	3.4	10.0	79.5	8.3
4.5	15.7	3.2	10.5	87.3	7.8
5.0	19.3	3.6	11.0	97.2	9.9
5.5	23.4	4.2	11.5	103.2	6.0
6.0	28.7	5.2	12.0	107.3	4.1
6.5	33.2	4.5	12.5	112.8	5.6

Aug.9 TA-3 Ngwenpisane east

terracette gully bare soil surface bottom, 2m below gr.sface

g = 2.1 x 10^{-3} cm/sec			g = 2.3 x 10^{-3} cm/sec		
Surface cm	time in min.		Surface cm	time in min.	
1.0	1.2	1.2	1.0	1.2	1.2
2.0	2.3	1.1	2.0	2.1	0.9
3.0	3.3	1.1	3.0	3.3	1.2
4.0	5.5	2.2	4.0	5.4	2.2
5.0	9.3	3.8	5.0	8.5	3.1
6.0	11.2	1.8	6.0	11.2	2.6
7.0	15.4	4.3	7.0	13.9	2.8
8.0	18.3	2.9	8.0	17.7	3.8
9.0	24.3	5.9	9.0	22.2	4.5
10.0	31.0	6.8	10.0	26.9	4.7
11.0	37.5	6.5	11.0	32.4	5.5
12.0	45.2	7.7	12.0	39.5	7.2
13.0	53.8	8.6	13.0	47.4	7.9
14.0	62.2	8.4	14.0	55.5	8.1

Aug.10 TA-2 Hlobane Largest Gully

on gully head **remnant island** surface

g = 9.0 x 10^{-4} cm/sec			
Surface cm	time in min.		gravel layer
1.0	1.0	1.0	
2.0	3.9	2.9	
3.0	8.2	4.3	
4.0	14.3	6.2	
5.0	22.3	8.0	
6.0	29.5	7.2	
7.0	42.3	12.8	
8.0	54.5	12.2	
9.0	69.5	15.0	
10.0	85.4	15.9	
11.0	101.0	15.6	

Aug.11 TA-2 Galile Largest gully

on gully head bare ground surface

g = 1.9 x 10^{-3} cm/sec					
Surface cm	time in min.		Surface cm	time in min.	
1.0	1.0	1.0	12.0	62.7	7.3
2.0	2.3	1.3	13.0	71.3	8.6
3.0	6.5	4.2	14.0	79.4	8.2
4.0	10.4	3.9	15.0	90.8	11.4
5.0	15.5	5.1			
6.0	21.7	6.1			
7.0	26.3	4.6			
8.0	32.2	5.9			
9.0	41.4	9.3			
10.0	47.2	5.7			
11.0	55.4	8.2			

Aug.18 Engcayini Hill ridge

Lat.S 26d18m166s Long.E 31d21m23s 2998 ft

grassed LiC hexagonal cracky bare soil in the gully HC massive

g = 1.5 x 10^{-2} cm/sec						g = 2.2 x 10^{-3} cm/sec					
Surface cm	time in min.					Surface cm	time in min.				
6.0	1.0	1.0	23.0	12.2	1.3	0.5	0.2	0.2	5.5	19.5	3.5
10.0	2.0	1.0	24.0	13.4	1.3	1.0	0.4	0.3	6.0	22.8	3.3
14.0	4.0	2.0	25.0	14.7	1.3	1.5	0.7	0.2	6.5	26.0	3.2
15.0	4.5	0.5	26.0	16.0	1.3	2.0	1.5	0.8	7.0	29.3	3.3
17.0	5.8	1.3	27.0	17.4	1.4	2.5	3.5	2.0	7.5	32.8	3.4
18.0	6.5	0.7	28.0	18.8	1.4	3.0	5.7	2.2	8.0	36.1	3.3
19.0	7.5	1.0	29.0	20.2	1.4	3.5	8.2	2.5	8.5	39.8	3.8
20.0	8.8	1.3	30.0	21.7	1.5	4.0	9.7	1.5	9.0	43.7	3.9
21.0	9.8	1.0				4.5	12.3	2.7	9.5	47.7	4.0
22.0	10.9	1.1				5.0	16.0	3.7	10.0	51.7	4.0
23.0	12.2	1.3				5.5	19.5	3.5			

Water Infiltration Test Results (2)

Aug.20 Eni Hill ridge
Lat.S 26d19m566s Long.E 31d23m151s 2147 ft
on the grass at the head of the gully SCL 2.5YR 4/8

g = 3.8 x 10^{-2} cm/sec

Surface cm	time in min.		Surface cm	time in min.	
1.0	1.0	1.0	11.0	11.2	0.9
2.0	2.1	1.1	12.0	13.3	2.1
3.0	3.4	1.3	13.0	15.5	2.2
4.0	4.7	1.3	14.0	17.8	2.3
5.0	5.8	1.1	15.0	20.3	2.5
6.0	6.8	1.0			
7.0	7.8	1.1			
8.0	8.5	0.6			
9.0	9.3	0.9			
10.0	10.3	0.9			
11.0	11.2	0.9			

Aug.20 Eni Hill ridge
ridge inside the gully 10R3/6
HC

g = 2.0 x 10^{-3} cm/sec

Surface cm	time in min.	
1.0	8.3	8.3
2.0	17.5	9.2
3.0	27.3	9.8
4.0	37.1	9.9
5.0	47.7	10.5
6.0	58.3	10.6
7.0	69.1	10.8

lateral seepage is swifter
than vertical infiltration,
12.1cm in 70 minutes.

Aug.21 Engcayini Hill ridge
on the roadside gully Si 2.5YR5/8 kaolitized
Lat.S 26d17m490s Long.E 31d23m591s 2212 ft

g = 5.9 x 10^{-3} cm/sec

Surface cm	time in min.		Surface cm	time in min.		Surface cm	time in min.	
0.5	1.5	1.5	5.5	16.4	1.9	13.5	48.3	2.5
1.0	2.9	1.4	6.0	18.4	2.1	14.0	51.3	3.0
1.5	4.2	1.3	6.5	20.4	2.0	14.5	54.4	3.1
2.0	5.5	1.3	7.0	22.8	2.4	15.0	57.5	3.1
2.5	6.9	1.4	7.5	25.8	2.9	15.5	60.7	3.2
3.0	8.4	1.5	8.0	28.4	2.7	16.0	63.8	3.2
3.5	10.0	1.6	8.5	31.1	2.7			
4.0	11.6	1.6	9.0	33.9	2.8			
4.5	13.3	1.7	9.5	36.8	2.9			
5.0	14.8	1.6	10.0	39.7	2.8			
5.5	16.7	1.9	13.5	48.3	8.7			

Aug.21 Engcayini Hill ridge
gully head Si 2.5Y 6/2 iron concreted
Lat.S 26d17m258s Long.E 31d29m631s 2152 ft

g = 6.6 x 10^{-4} cm/sec

Surface cm	time in min.	
0.5	4.8	4.8
1.0	13.7	8.9
1.5	30.3	16.6
2.0	47.3	17.1
2.5	67.6	20.2
3.0	82.4	14.8
3.5	102.6	20.2
4.0	122.9	20.3
4.5	143.0	20.1
5.0	163.4	20.4

Aug.22 Nkhanyezini Puntile School large gully
range gully head SiC 10R4/6 rhodic Ferralsol
Lat.S 26d43m833s Long.E 30d54m455s 3177 ft

g = 8.5 x 10^{-3} cm/sec

Surface cm	time in min.		Surface cm	time in min.		Surface cm	time in min.	
0.5	0.5	0.5	6.0	7.4	0.7	13.5	16.6	0.9
1.0	1.1	0.6	6.5	8.2	0.8	14.0	17.5	0.9
1.5	1.8	0.7	7.0	9.0	0.8	14.5	18.5	1.0
2.0	2.4	0.6	7.5	9.7	0.7	15.0	19.5	1.0
2.5	3.1	0.7	8.0	10.6	0.9	15.5	20.5	1.0
3.0	3.8	0.7	8.5	11.4	0.8	16.0	21.5	1.0
3.5	4.4	0.6	9.0	12.2	0.8	16.5	22.5	1.0
4.0	5.1	0.7	9.5	13.0	0.8	17.0	23.6	1.1
4.5	5.9	0.8	10.0	13.9	0.9	17.5	24.6	1.0
5.0	6.7	0.8	10.5	14.8	0.9	18.0	25.7	1.1
5.5	7.4	0.7	11.0	15.7	0.9	18.5	26.8	1.1

Aug.23 Mbeka~Macdulwini reactivated gully
range gully head Silt 7.5R4/8 Leptosols
Lat.S 26d40m910s Long.E 30d58m827s 4073 ft

g = 5.9 x 10^{-3} cm/sec

Surface cm	time in min.		Surface cm	time in min.	
0.5	0.3	0.3	6.0	15.9	1.5
1.0	0.8	0.5	7.0	17.2	17.2
1.5	1.5	0.7	8.0	20.0	2.8
2.0	2.4	0.9	9.0	22.3	2.3
2.5	3.6	1.1	10.0	25.8	3.5
3.0	5.3	1.8	11.0	28.5	2.8
3.5	7.8	2.5			
4.0	9.7	1.8			
4.5	11.3	1.7			
5.0	13.0	1.6			
5.5	14.4	1.5			

Aug.24 Lushikishini Nokuthula school north
range (recent) gully head LoS 2.5Y7/1 Fluvisols
Lat.S 26d47m001s Long.E 30d52m386s 4038 ft

g = 2.7 x 10^{-3} cm/sec

Surface cm	time in min.		Surface cm	time in min.	
0.5	1.2	1.2	6.0	23.4	2.3
1.0	2.3	1.2	6.5	26.3	2.9
1.5	3.7	1.3	7.0	29.0	2.7
2.0	4.9	1.2	7.5	31.7	2.7
2.5	6.3	1.3	8.0	34.8	3.1
3.0	8.5	2.3	8.5	38.2	3.4
3.5	11.1	2.6	9.0	41.7	3.5
4.0	13.9	2.8			
4.5	16.2	2.3			
5.0	18.8	2.6			
5.5	21.2	2.3			

Aug.25 Lushikishini Largest gully 51yrs
range gully head SCL 10R4/8 Rh.Ferralsols
Lat.S 26d46m252s Long.E 30d54m720s 3370 ft

g = 1.9 x 10^{-2} cm/sec

Surface cm	time in min.		Surface cm	time in min.	
0.5	1.5	1.5	6.0	17.8	1.8
1.0	3.2	1.7	7.0	19.9	2.2
1.5	4.8	1.7	8.0	22.3	2.4
2.0	6.0	1.2	9.0	24.6	2.3
2.5	7.2	1.2	10.0	26.7	2.1
3.0	8.3	1.2	11.0	29.1	2.5
3.5	9.7	1.3	11.5	31.3	2.2
4.0	11.2	1.5	12.0	33.7	2.3
4.5	12.5	1.3	12.5	36.5	2.8
5.0	14.2	1.6	13.0	39.3	2.9
5.5	15.9	1.7			

Aug.28 Nzikhoteni Paradise 15 yrs
range gully side SCL 10R4/8 Acrisols
Lat.S 27d12m598s Long.E 31d26m212s 2688 ft

g = 2.2 x 10^{-2} cm/sec

Surface cm	time in min.		Surface cm	time in min.	
1.0	0.7	0.7	12.0	7.2	0.7
2.0	1.2	0.5	13.0	8.0	0.9
3.0	1.7	0.5	14.0	8.9	0.9
4.0	2.3	0.6	15.0	9.8	0.9
5.0	2.9	0.7	16.0	10.5	0.7
6.0	3.5	0.6	17.0	11.4	0.9
7.0	4.0	0.5	18.0	12.4	1.0
8.0	4.7	0.7			
9.0	5.2	0.5			
10.0	5.8	0.7			
11.0	6.4	0.6			

Table D.3-7: Measurement of soil pH and EC

date	latitude			longitude			altitude	location	texture	material	depth (m)	color	pH(1:1)	EC mS/cm	temp.
11-Jul	26	20	697	31	23	53	2,182	Mangcinieni		subsurface flow	0.4	trprt	6.80	-	19.9
11-Jul	26	20	697	31	23	53	2,182	Mangcinieni		subsurface flow	0.5	trprt. Fe	7.02	-	16.8
11-Jul	26	20	697	31	23	53	2,182	Mangcinieni		bottom flow	7.5	trprt.	7.05	-	21.1
11-Jul	26	20	697	31	23	53	2,182	Mangcinieni	SiC	yellow clay	7.5	yellow	6.93	-	21.0
11-Jul	26	20	697	31	23	53	2,182	Mangcinieni	Silt	white kaolin	6.5	white	7.19	-	21.0
18-Aug	26	18	104	31	21	112	2,791	Engcayini	SiC	kaolinite	0.7	pink	4.50	0.008	26.5
18-Aug	26	18	104	31	21	112	2,791	Engcayini	C	kaolin soil	0.4	white	5.12	0.008	25.0
21-Aug	26	19	566	31	23	151	2,147	Eni	rock	saprolite	1.4	10R3/6	5.71	0.011	24.7
21-Aug	26	19	566	31	23	151	2,147	Eni	SCL	kaolitized surf.	0.0	pink	5.71	0.012	24.4
22-Aug	26	17	430	31	23	599	2,212	Engcayini	rock	saprolite	0.4	pink	6.31	0.024	27.0
22-Aug	26	17	430	31	23	599	2,212	Engcayini	SC	kaolitized surf.	0.4	10R5/8	5.81	0.011	26.7
23-Aug	26	45	853	30	54	455	3,171	Nkhanyezini	Silt	gly bottom wall	6.5	10R5/8	5.36	0.011	31.2
23-Aug	26	45	853	30	54	455	3,171	Nkhanyezini	SiC	gly bottom wall	6.5	10YR8/4	6.73	0.011	29.5
24-Aug	26	40	910	30	58	827	4,073	Macdulwini	C	gully bottom	4.0	pink	5.48	0.008	24.7
24-Aug	26	47	1	30	52	381	4,038	Nokuthule	LoS	fluvial deposit	1.6	2.5Y7/1	6.32	0.010	24.6
25-Aug	26	46	252	30	54	726	3,370	Lisikisini E	SCL	surface horizon	0.0	10R4/8	5.50	0.010	24.3
28-Aug	27	12	598	31	26	212	2,688	Paradys	SiCL	surface horizon	0.0	2.5YR3/2	6.41	0.010	25.6

Table D.3-8: Survey Results on Overall Erosion Status

AELDA description method for assessing erosion in Target Areas of the Study

No. site	date day	mth	latitude(S)	longitude(E)	elev. (m)	topo-graphy	land form	grad-ient	slope form	human impact	land use	vegeta-tion	grass cover	not e. erod.	bedrock ex. cover	space	surf. co.fr. cover	size	sfc.thick	sealing cons.	soil depth	principal erosion description (1) type-	code	area	degr.	acti.	dist.	second erosion description (2) type-	code	area	degr.	acti.	dist.	third erosion description (3) type-	code	area	degr.	acti.	dist.	slope length	gully description width	depth	space	shape	rill shape	rill descrip. width	depth	exp. rate	caus. factor	remarks
1	25	6	26 41 687	31 7 154	1,045	U	H I	7	V G	S H E	3 H E	2	3 F		1 B	C	F	S	3	W S		5 M	A		3 M	R		2 S	R		1 M	G		1 M	A	1	200	2	2	1 V	S	-	-		1 O		
2	25	6	north hill top		1,130	U	H I	8	V V	M H E	3 G	3	3 F		1 B	C	F	S	4	W S		5 M	A		3 M	R		3 S	A		2 M	G		1 V	A	2	150	5	2	1 V	S		1	7	3 C	L	
3	25	6	26 43 62	31 15 524	964	U	B A	6	X V	U H E	3 S A	2	2 B		1 M	C	F	S	1	W S		1 V	A		5 M	R		5 S	A		1 M	G		1 S	R	1	200	2	2	1 U	Y	-	-		3 T	V	stony sfc
4	25	6	26 41 222	31 5 482	1,090	U	P T	8	X V	M H E	3 G	3	2 F		2 A	L	F	S	1	W S		5 M	A		3 M	R		2 S	R		2 M	G		1 S	A	1	300	3	3	1 V	S	-	-		3 O		crest
5	26	6	26 45 212	30 58 402	1,012	R	H I	7	S G	C* H E	3 S S	3	2 V		1 C	S	F	S	1	W S		4 S	A		3 W	R		3 S	A		3 W	G		2 E	A	3	10	5	3	1 V	S		4	2	2 C	O	stony sfc
6	26	6	26 41 624	30 57 846	990	R	B A	6	C V	M H E	3 H E	3	2 V		1 M	C	F	S	1	- - -		-	-	-	-	-	-	-	-	-	-	W	G		1 E	A	1	25	5	3	2 U	S	-	-		2 O		stony sfc
7	26	6	26 45 167	30 55 799	1,150	U	B A	6	S F*	H E	3 S T	3	1 V		1 C	S	T	S	4	W S		3 M	A		3 W	S		5 S	A		3 W	G		3 E	A	3	50	3	3	2 V	S	-	-		2 O	C	
8	26	6	26 45 382	30 55 815	1,040	U	B A	6	S G	S A A	4 F	4	3 V		1 F	C	T	S	4	- - -		-	-	-	-	-	-	-	-	-	-	W	G		1 E	R	1	200	5	4	1 V	S	-	-		1 N*		alluv.fan
9	28	6	26 40 116	30 58 282	1,286	R	P T	7	V V	M H E	3 G	4	2 V		2 V	S	F	C	2	W S		3 S	A		1 W	R		1 S	A		1 M	T		2 S	A	1	200	-	-	-	-		2	2	2 -		burnt sfc
10	28	6	26 41 30	30 59 847	1,122	H	P T	8	S B	R H E	3 S A	3	2 F		1 F	S	-	-	1	M T		4 S	A		3 M	L		1 M	A		3	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-	O		
11	28	6	26 41 867	31 0 656	1,177	R	H I	7	X V	S H E	3 G	3	2 V		1 V	S	-	-	3	W S		3 M	A		1 W	S		5 S	A		3 W	G		1 E	H	1	50	2	3	2 U	S	-	-		3 O		
12	28	6	26 41 740	31 0 457	1,206	R	P T	7	S V	S H E	3 G	3	2 V		1	-	-	-	1	W S		2 M	A		3 W	S		1 M	A		3	-	-	-	-	-	-	150	-	-	-	-	-	-	-		2 C		canopy
13	28	6	26 41 434	31 0 320	1,167	U	P T	6	V V	S H E	3 G	3	2 F		2 F	S	-	-	3	W G		1 E	A		1 W	S		1 S	A		1 M	T		1 S	A	1	150	5	5	1 V	S	-	-		2 O		
14	28	6	26 40 252	31 1 98	1,080	R	B A	7	X V	S H E	3 W	3	2 F		1 F	S	-	-	2	W S		1 E	A		1 W	S		2 M	A		1 W	S		4 S	A	1	100	3	2	1 U	S	-	-		2 I	S	road gly
15	28	6	26 43 657	31 2 462	1,085	G	B A	5	V V	S H E	3 G	1	1 V		1 F	S	-	-	3	W G		1 E	A		1 W	S		3 M	A		1 W	S		5 S	A	3	50	4	3	1 V	S	-	-		2 O		
16	29	6	26 45 944	31 2 0	893	R	B A	8	C B	P H E	3 W	4	3 F		1 C	S	T	-	1	- - -		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		no eros.
17	29	6	26 45 944	31 2 0	893	U	B A	6	S G	S A A	4 G	4	2 -	-	-	-	-	-	2	- - -		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		resettled
18	29	6	26 44 645	31 0 570	892	U	B A	6	S V	M A A	4 S T	4	2 F		1 F	S	-	-	3	W G		1 V	R		1 W	S		3 S	A		1 W	S		2	3 R	1	200	3	1	1 V	S	-	-		1 O		village
19	29	6	26 46 97	30 53 174	941	U	B A	7	S V	S H E	3 G	3	2 V		1 V	S	-	-	4	W G		1 E	A		1 W	S		2	5 A		1	-	-	-	-	-	-	50	5	3	1 U	S	-	-		1 O		dip tank
20	29	6	26 46 530	30 57 933	940	R	B A	7	C V	M H E	3 S S	3	2 F		2 F		1	-	2	W G		1 E	A		1 W	R		1 M	A		1 W	S		2 M	A	1	30	5	3	1 U	S		4	3	2 O		gneiss oc
21	29	6	26 44 347	30 54 167	960	A	P L	4	S -	- H E	3 G	4	2 -	-	F	S	-	-	5	W G		1 E	A		3 W	S		2 S	A		1	-	-	-	-	-	-	250	5	3	1 U	S	-	-		3 S	O	vertisol
22	29	6	26 45 583	30 53 105	960	R	B A	8	X V	S H E	3 W L	4	2 F		1 C	S	-	-	1	W G		1 E	A		2 W	S		4 S	A		1 M	T		1 F	A	1	100	5	3	1 V	Y	-	-		2 O		rem.hill
23	29	6	26 44 165	30 52 989	1,016	R	V A	8	C V	M H E	3 S T	2	2 -	-	C	S	-	-	1	W G		1 S	A		1 W	S		1 M	A		1 W	S		4 S	A	3	40	3	3	1 V	S	-	-		2 O		border
101	3	7	27 12 545	31 24 277	775	R	P L	8	S F*	E H E	3 G	3	1 F		1 F	M	M	H	1	W S		2 V	A		1 W	S		5 M	A		3 W	R		1 V	A	3	100	5	4	2 U	Y		5	4	4 O	S	sap exp.
			TA2 western border																	W G		3 V	A		1																							Cassia
102	3	7	27 12 483	31 24 307	795	R	B A	8	S V	S A A	4 P L	3	1 F		1 M	S	M	H	4	W S		1 V	A		1 W	S		1 V	A		1 W	G		2 V	A	3	100	5	4	1 U	S		5	4	3 O	S	Mhloba
103	3	7	27 11 813	31 25 114	740	U	P T	7	S G	S H E	3 S T	3	1 V		1 V	S	-	-	1	W G		2 E	A		1 W	S		2 V	A		1 W	S		1 M	A	1	10	5	5	1 U	Y		5	4	3 O		YongeN
			Hlobane hill road west																	W R		1 M	A		1																							A.tortilis
104	3	7	27 11 212	31 25 305	736	U	P T	7	S V	V A A	4 P L	3	2 V		1 N	C	-	-	3	W G		1 V	A		1 W	S		1 M	A		1 W	S		5 M	A	3	50	3	2	1 U	S	-	-		2 O		abundgrs
105	3	7	27 10 314	31 24 772	667	U	V A	3	S G	S A A	4 P L	2	2 V		1 -	-	-	-	4	W G		1 E	A		3 W	S		1 M	A		1							100	5	4	2 U	S	-	-		2 O		YongeN
106	4	7	27 16 399	31 23 710	759	U	P L	7	S V	X H E	3 G	3	1 V		1 V	S	-	-	4	W G		1 S	A		3 W	S		4 V	A		3 W	S		4 M	A	3	20	4	2	2 U	S		5	4	2 S	O	old plot
107	4	7	27 16 260	31 24 100	780	R	B A	8	S -	- A A	4 P L	3	2 -	-	-	-	-	-	4	W S		2	5 A		1 W	R		3 S	A		1 W	S		1 M	A	1	150	2	3	1 V	Y		4	3	2 S		woodlot
																		-	-	W G		1 V	A		1																						
108	4	7	27 17 137	31 25 895	764	U	P L	7	C E	X H E	3 G	3	2 M		1 M	S	-	-	4	W G		1 E	A		1 W	S		2 M	A		1							100	3	2	1 U	Y	-	-		2 O		
109	4	7	27 17 137	31 25 895	764	U	P L	6	S G	S H E	3 G	3	2 V		1 V	G	-	-	5	W G		1 E	A		2 W	S		2 V	A		1 W	S		2 M	A	2	50	4	2	3 U	Y	-	-		3 O	S	delerite
110	4	7	27 17 706	31 31 28	700	R	P L	8	C G	S H E	3 G	3	2 F		1 M	B	-	-	3	W G		2 E	A		3 W	S		3 V	A		3 W	S		4 M	A	3	100	3	2	2 V	Y	-	-		3 S		riverrac
111	10	7	27 17 597	31 26 248	804	H	P L	8	S V	M H E	3 S T	3	1 V		1 M	L	-	-	1	W S		3 V	A		1 W	S		3 M	A		1 W	G		1 V	A	1	50	3	1	1 V	Y	-	-		2 O		up slope
112	10	7	27 18 17	31 29 682	846	R	H I	9	C V	M H E	3 G	3	1 V		1 F	B	-	-	2	W S		3 V	A		1 W	S		4 M	A		1 W	G		1 E	A	1	30	4	3	3 U	Y	-	-		3 C	O	gneiss oc
113	10	7	27 18 143	31 30 584	836	R	V A	8	S V	M H E	3 S A	3	1 V		1 F	S	-	-	3	W S		1 V	A		1 W	S		2 M	A		1 W	R		1 M	A	1	20	2	1	2 V	S	-	-		2 O	C	dolerite
114	10	7	27 17 89	31 31 737	532	R	H I	7	X V	S H E	3 S T	3	2 -	-	V	S	-	-	1	W S		1 M	A		1 M	T		2 S	A		1							0					-	-		3 O		no gully
115	10	7	27 18 428	31 32 740	562	U	P L	6	C G	S H E	3 S T	3	1 -	-	V	S	-	-	2	W S		2 M	A		1 W	S		3 S	A		1 W	G		1 V	A	1	20	2	2	1 V	S	-	-		2 O		basin
116	10	7	27 15 373	31 30 96	624	R	H I	8	X V	M A A	4 G	3	1 V		1 F	S	-	-	1	W S		2 V	A		1 W	S		3 M	A		3 W	G		1 V	A	1	50	2	2	1 V	Y	-	-		3 O	C	granite
117	27	7	27 15 443	31 26 534	787	U	B A	7	C G	S H E	3 G	3	1 V		1 V	S	-	-	3	W S		4 M	A		3 W	S		3 V	A		1 W	G		1 E	A	3	20	4	2	2 U	Y	-	-		3 O	S	
																			arable	W S		3 M	A		1 W	S		2 S	A		1 W	R		1 M	A	1 for arable land only											
118	27	7	27 10 530	31 26 582	718	R	E S	9	C G	S H E	3 G	3	1 F		2 F	B	-	-	4	W S		4 M	A		3 W	S		2 V	A		1 W	G		2 E	A	3	50	5	5	2 U	Y	-	-		3 O	S	GericoSo

Survey Results on Overall Erosion Status (2)

No. site	date day	mth	latitude(S)			longitude(E)			elev. (m)	topo-graphy	land form		grad-ient	slope form	human influence		land use		vegeta-tion			grass cover not e.	erod.	bedrock ex. cover space	surf. cover	co.fr. size	sfc.sealing thick	cons.	soil depth	sion description (1) type-	code	area degr.	acti.	dist.	second erosion description (2) type-	code	area degr.	acti.	dist.	third erosion description (3) type-	code	area degr.	acti.	dist.	slope length	gully description width	depth	space shape	shape	rill descrip. width	depth	exp. rate	caus. factor	remarks
101	12	7	26	17	807	31	21	325	831	H	H	I	8	X	V	M	H	E	3	G		3	1 V		1 V	S	-	-	4	W	S	3 V	A	1	W	S	3 M	A	1	M	T	4 V	A	2	50	5	3	1 U	Y	-	-	4 O	T	severe
																														M	L	1 V	A	1	W	G	1 E	A	1															
102	12	7	26	17	439	31	21	1	789.6	R	P	L	7	V	V	S	H	E	3	G		2	1 V		1 V	G	-	-	4	W	S	1 V	A	1	W	S	4 M	A	3	M	T	2 M	A	1	5	3	2	2 U	Y	-	-	3 O		
																														W	G	1 E	A	1																				
103	12	7	26	17	517	31	23	732	643.8	U	P	L	6	S	V	S	H	E	3	G		3	2 -	-	V	G	-	-	4	W	S	1 V	A	1	W	S	2 M	A	1	W	G	1 V	A	1	50	2	1	2 V	S	-	-	2 O		severe
																														W	R	1 V	A	1																				
104	12	7	26	17	517	31	23	732	643.8	U	P	L	6	V	V	S	H	E	3	G		3	1 -	-	V	1	-	-	2	W	S	2 V	A	1	W	S	3 M	A	1	W	G	1 E	A	1	20	5	4	1 V	Y	-	-	3 O	S	east hill
105	12	7	26	18	183	31	23	162	639.9	U	P	L	6	V	V	F*	H	E	3	G		3	1 V		1 V	G	-	-	2	W	S	3 V	A	1	W	S	4 M	A	1	W	G	1 E	A	1	20	5	5	1 U	Y	-	-	4 O	C	top hill
106	12	7	26	18	183	31	23	162	639.9	U	P	L	6	S	V	E	H	E	3	S	T	3	1 V		1 -	-	-	-	3	W	S	1 V	A	1	W	S	3 M	A	1	W	G	1 E	A	1	20	3	3	1 U	S	-	-	3 S	T	southhill
107	12	7	26	22	150	31	24	596	634.8	R	P	L	7	V	T	M	H	E	3	S	T	3	1 V		1 V		-	-	2	W	S	1 V	A	1	W	S	3 M	A	1	M	T	2 M	A	2	10	3	2	1 U	S	-	-	2 O		
																														W	G	1 M	A	1																				
208	18	7	26	21	947	31	20	481	942.6	R	P	L	8	V	V	M	H	E	3	G		3	1 V		1 V	S	F	C	3	W	S	1 V	A	1	W	S	3 M	A	1	M	T	3 M	A	1	100 -	-	-	-	-	-	-	2 O	C	northhill
																														M	L	1 V	A	1																				
209	18	7	26	22	745	31	22	48	818.7	R	H	I	8	S	V	M	H	E	3	G		2	1 V		1 V	S	-	-	3	W	S	2 V	A	1	W	S	3 M	A	1	M	T	3 M	A	3	20	5	4	1 U	Y	-	-	2 T	O	
																														W	G	2 E	A	3																				
210	18	7	26	22	207	31	22	454	746.7	R	H	I	8	S	V	E	H	E	3	G		3	1 V		1 V	G	-	-	4	W	S	3 V	A	1	W	S	5 M	A	1	M	L	1 S	A	1	20	5	5	1 U	Y	-	-	4 O	S	long gly
																														W	G	1 E	A	1																				
211	18	7	26	17	853	31	25	73	746.7	H	H	I	9	C	V	E	H	E	3	G		3	1 F		2 -	-	-	-	2	W	S	1 V	A	1	W	S	3 M	A	1	M	T	2 M	A	1	200	3	2	1 V	Y	-	-	2 O		
																														W	G	1 V	A	1																				
212	18	7	26	22	628	31	25	642	646.2	U	B	S	7	S	G	S	H	E	3	G		3	2 V		1 V	G	-	-	4	W	S	1 V	A	1	W	S	4 M	A	1	W	G	1 E	A	1	30	5	5	2 U	Y	-	-	3 O	S	basin
213	18	7	26	25	352	31	28	612	641.1	R	P	L	8	V	V	X	H	E	3	G		3	1 V		1 V	G	-	-	3	W	S	1 V	A	1	W	S	3 M	A	2	W	G	1 V	A	1	80	3	2	1 V	I	-	-	2 O	S	
214	18	7	26	26	529	31	25	760	733.2	H	H	I	9	X	V	S	H	E	3	S	T	3	3 V		1 V	G	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
215	18	7	26	27	698	31	24	716	730.2	R	P	L	8	V	V	M	H	E	3	S	T	3	1 -	-	-	-	-	-	2	W	S	1 V	A	1	W	S	2 M	A	1	M	T	2 M	A	1	10	2	1	1 V	S	-	-	2 T	C	#NAME?
																														W	G	1 V	A	1																				
216	18	7	26	24	193	31	22	927	797.4	H	H	I	9	S	V	M	H	E	3	G		3	1 C		2 C	S	-	-	2	W	S	1 V	A	1	W	S	3 M	A	2	M	T	3 M	A	1	20	5	4	1 U	Y	-	-	2 O	S	
																														W	G	1 V	A	1																				
217	18	7	26	23	479	31	22	877	726	U	P	L	8	S	V	S	H	E	3	G		3	2 -	-	-	-	-	-	2	W	S	1 S	A	1	W	S	3 M	A	1	W	G	1 E	A	1	30	4	4	1 U	Y	-	-	2 O	S	
218	25	7	26	21	331	31	24	733	663.6	R	H	I	8	S	V	S	H	E	3	S	T	3	2 V		1 V	S	H	M	3	W	S	3 M	A	3	W	S	2 V	A	1	M	T	2 M	A	2	20	1	3	1 V	Y	-	-	1 O	S	road ero.
																														W	G	1 E	A	1																				
219	25	7	26	19	463	31	24	863	650.1	U	P	L	7	V	V	M	H	E	3	G		3	1 -	-	-	-	-	-	2	W	S	3 M	A	1	W	S	2 V	A	3	M	T	2 M	A	2	50	5	5	1 U	Y	-	-	2 O	S	
																														W	G	2 E	A	1																				
220	25	7	26	20	716	31	23	305	726	U	P	L	7	V	V	M	H	E	3	G		3	1 -	-	V	G	-	-	3	W	S	4 M	A	3	W	S	3 V	A	2	W	G	2 E	A	3	20	5	5	2 U	Y	-	-	3 O	T	wattle
																														M	T	1 V	A	1																				
221	25	7	26	20	251	31	23	445	666.3	U	P	L	7	V	G	S	H	E	3	G		3	1 V		1 V	1	-	-	3	W	S	3 M	A	3	W	S	2 V	A	2	W	G	1 V	A	1	50	3	3	1 U	S	-	-	2 O	T	rside ero.
222	25	7	26	19	606	31	21	127	881.7	U	P	R	8	V	G	V	H	E	3	G		3	1 V		1 V		-	-	4	W	S	3 M	A	2	W	S	2 S	A	2	W	G	1 V	A	1	30	2	2	1 U		1 -	-	2 O	T	
223	25	7	26	26	125	31	21	78	801.6	R	P	L	8	S	V	S	H	E	3	G		3	1 V		1 V	S	-	-	3	W	S	4 M	A	3	W	S	3 V	A	3	W	G	1 V	A	1	100	4	3	1 U	Y	-	-	2 O	S	
224	31	7	26	33	459	30	57	131	1271.4	H	E	S	10	C	V	E	H	E	3	G		4	2 F		3 F	S	-	-	2	M	T	3 M	A	2	W	S	1 V	A	1	W	G	1 E	A	1	30	3	3	1 V	Y	-	-	2 O	T	
225	31	7	26	40	647	30	59	67	1248	H	E	S	10	V	V	E	H	E	3	G		4	1 V		1 M	S	-	-	3	M	T	3 M	A	2	W	S	3 M	A	1	W	S	1 V	1		20	3	3	1 U	S	-	-	2 O		
																														W	G	4 V	A	1																				
226	31	7	26	40	596	30	51	581	1301.1	U	P	L	7	V	V	E	H	E	3	G		3	2 C		2 C	G	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			no eros.
227	2	8	26	42	659	30	7	378	888.9	R	B	A	8	V	V	S	H	E	3	S	T	3	2 V		1 M	S	-	-	1	W	S	4 M	A	3	W	S	1 V	A	1	W	G	1 V	A	1 -	-	-	-	-	-	-	-	2 O		stabilzd
228	2	8	26	42	871	31	1	739	987	H	H	I	9	C	V	E	H	E	3	G		3	1 F		2 C	B	-	-	2	W	S	4 M	A	3	W	S	2 V	A	1	M	T	3 V	A	2	20	3	2	1 V	S	-	-	2 O		
																														W	G	1 E	A	2	M	L	1 M	A	1															
229	2	8	26	43	662	31	0	43	919.5	U	B	A	7	V	F		H	E	3	S	T	2	1 V		1 V	G	-	-	1	W	S	6 M	A	3	W	S	3 V	A	2	W	G	2 E	A	1	20	5	5	2 U	Y	-	-	3 O		
230	2	8	26	43	662	31	0	43	919.5	R	B	A	8	V	V	M	H	E	3	G		3	2 -	-	-	-	-	-	-	W	S	2 M	A	2	M	T	3 M	A	2	W	G	1 E	A	1 -	-	-	-	-	-	-	-	2 O		NWward
231	2	8	26	47	934	30	51	833	1239	H	P	L	10	V	V	S	H	E	3	G		3	1 F		3 M	S		2 M	1	W	S	3 S	A	2	M	T	4 V	A	3	M	L	1 M	A	1 -	-	-	-	-	-	-	-	3 O		
232	2	8	26	49	46	30	52	337	1217.7	U	P	L	7	S	G	S	H	E	3	G		3	1 -	-	-	-	-	-	4	W	S	2 M	A	1	W	G	1 E	A	1						20	5	5	1 U	Y	-	-	3 S	O	
233	2	8	26	46	422	30	54	746	1179.9	R	P	L	8	V	V	E	H	E	3	G		4	2 V		1 V	S	-	-	4	W	S				W	G	2 E	A							10	5	5	1 U	Y	-	-	2 S	O	
234	2	8	26	43	11	30	52	863	1189.5	R	H	I	9	X	V	E	H	E	3	G		3	1 V		1 -	-	-	-	3	W	S	2 M	A	3	W	S	1 V	A	1	W	G	1 E	A	1	50	3	2	1 U	Y	-	-	2 O		

R remnant C* camping F* fencing T: cattle track N* natural process

Figure D.3-7: Soil Profile of Gully Walls at Physical Measurement Sites

Sheet for Site Survey

AREA TA-1

Date :	7-Aug	Place :east of Sankolweni school			altitude(ft):	2171ft
Coordination S	26	18	448~935	Coordinate E:	31	23	58~216
Topography und		Gradient	5	E Location:	Hillridge	near hilltop
Soil Classification:		Xanthic Ferralsols		Geology: Usutu intrusives	granodiorite	
Gully size: width		75 depth		25 length	430	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	gravel
10							
		2.5YR3/4		**sampled**			
20	CL						
30							
40	C	10R3/6					
50							
130							
240	kaolitized						
350	SiC	10R6/6		**sampled**	3.5m below		
1500	SiC	10R6/6	kaolitized				
110			vein of saprolite				
1700	gneiss saprolite		up to 17m				
	kaolitized						
2500	mother R.	2.5YR7/6		**sampled**	25m below		

Sheet for Site Survey

AREA TA-1

Date :	7-Aug	Place :NEE of New Mbrudzi school			altitude(ft):	2,242
Coordinate:	26	18	336	Coordinate E:	31	22	745
Topography : near hilltop		Gradient	11	SW Location	hillside	rocky/stony
Soil Classification:		Rhodic Ferralsols		Geology: Ngwane gneiss	granitic mass	
Gully size: width		17 depth		1.8 length	145	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
10				**sampled**			gneiss few
20	SCL	10R4/6	blocky	some 1%	yes	no	outcrop on the
30			angular				surface
40							
50				**sampled**			
60							
70	HC	10R4/5	vertical	no			
80			crack massive				
90							
100							
110							
120							
130	Weathered Saprolite	10R4/5	massive	**sampled**			
140							
150							
160							
170							
180							gravelly
190							
200							

Sheet for Site Survey

AREA TA-3

Date :	8-Aug	Place :east of Sankolweni school			altitude(ft):	3,435
Coordinate:	26	40	82	Coordinate E:	30	57	213
Topography : hillside		Gradient	17	S Location	concave	rocky/stony
Soil Classification:		Rhodic Nitisols		Geology: Ngwane gneiss	gneiss with delerite	
Gully size: width		28 depth		2 length	45 40m to strm.	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
10				**sampled**			surface very stony
20	CL	5YR3/4	angular cracky	yes	yes	no stone line	breccia
30							
40	(SiC) transitory	10R4/6	blocky		yes		gravel & stone
50			**sliding face**				
60				**sampled**			
70	HC	10R3/3	vertical		no		few rocks
80			crack				
90						forming terracettes with vertical step	
100						10cm, 30cm & 60cm	
110							
120			sliding face up to 240cm				
130							
140							
150							
160							
170							
180							
190							
200	Saprolite up to 240	10R3/3 cm		**sampled**			

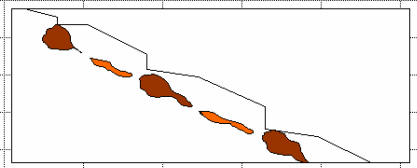
Soil Profile of Gully Walls at Physical Measurement Sites (2)

Sheet for Site Survey

AREA TA-3

Date :	9-Aug	Place :South of Macdulwini school				altitude(ft):	4,167
Coordinate:	26	40	812	Coordinate E:	30	58	640
Topography : near hilltop		Gradient	21	SE	Location	hillridge	rocky/stony
Soil Classiication:		Haplic Acrisols		Geology: Ngwane gneiss		granitic dyke	
Gully size: width		5.5 depth		3.5 length		150	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
10				**sampled**			diorite plenty
20	SiC	7.5YR4/2	typically angular	some 1%	yes	no	outcrop on the
30							surface huge-rock
40				no		saprolite	stone and
50							gravel layer
60	weathered				yes		up 40 55cm
70	gneiss C	2.5YR6/6	vertical	no			
80			crack subangular				
90							
100							
110							
120	talky C	yellowish 2.5Y 5/4		**sampled**			
130							
140							
150							
240							
250	claytized SiC	7.5YR7/8	hexagonal crack	**sampled**			
260	gneiss saprolite		massive				
280							



Sheet for Site Survey

AREA TA-2

Date :	10 Aug	Place :NW of Hlobane school				altitude(ft):	2,422
Coordinate:	27	11	317	Coordinate E:	31	25	200
Topography : near hilltop		Gradient	8	SE	Location	hillside	rocky/stony
Soil Classiication:		Eutic Regosols		Geology:	Nhlangano gneiss,		weathered gneiss
Gully size: width		24 depth		4.8 length		280 island gully	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
A horizon ~ eroded away							from g.
10	SiC	10R4/8	massive	no			surface
20			no crack	**Sampled**	up to 20cm		very rich to the
30							bottom, as breccia
40							component of neiss
50	SC	2.5YR6/6	massive	no			
60				**Sampled**			
70							
80							
gradual shift							
280	LoS	7.5YR6/6	saprolite massive	**sampled**			
480							

Sheet for Site Survey

AREA TA-2

Date :	11.Aug.	Place	Galile			altitude(ft):	2,562
Coordinate:	21	13	81	Coordinate E:	31	24	553
Topography : near hilltop		Gradient		SW	Location	hillside	rocky/stony
Soil Classification:		Geric Ferralsols		Geoloogy:Nhlangano gneiss,		weathered granite/dolerite	
Gully size: width		65 (8.5) depth		11 (6.6) length		500 (450) ( )=branch	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
A horizon eroded away						from the ground	remnant stone line
10							
20	SC	2.5YR3/4	angular	< 1 %	up to 20cm	surfae saprolite	scattered on g.surface
30	weathered granitic			**sampled**			gravel rich
40	saprolite						layer up to the bottom
50						plant: g.surface *Gardenia volkensii*	
60	C	10YR6/8	blocky			*Acacia nilotica* *Combretum inberbe*	
70						*Euphorbia tircalli* *Ficus sur*	
80						*Celtis africana*	
90							
100	HC	10R4/8	granular	**sampled**		in the gully: *Gardenia volkensii*	
110			vertical			*Conbretum inberbe*	
120			crack up to 200 cm				
200	C	10R3/6	massive				
210							
350	SiC	5YR6/8	intruded				
			weathered dolerite				
			to 6.6m				
490							
500	SC	7.5YR6/6		**sampled**			

Soil Profile of Gully Walls at Physical Measurement Sites (3)

Sheet for Site Survey

AREA TA-1

Date :	20-Aug	Place :	Eni			altitude(ft):	2,147
Coordinate:	26	19	566	Coordinate E:	31	23	151
Topography : near hilltop		Gradient	7 deg. SE	SW	Location	hillside valley	rocky/stony
Soil Classification:		Rhodic Ferralsols		Geology: Ngwane gneiss		granitic mass	
Gully size: width		15 depth		5 length		300	

Soil Profile	texture	colour	structure	organic m.	root zone	survey	stone/gravel
10	C	5YR5/6	angular	yes 1~2%		water permeability	
20	SCL	5YR3/3	blocky vertical crack	yes 1%		test	
30						Trees in the gully; cabbage tree	and
40						*Cussonia sphaerocephala* *Ficus ingens*	
50					up to 45cm		
60							
70	SiC	5YR 3/3	block vertical	no			
80			crack				
90							
100							
110							
120	C stony	2.5YR4/8	massive hexagonal			water permeability	pebble and quaetz brecc
130	rock layer		crack			test	
140	C	2.5YR4/8					
150		but partly 10R3/6					
160							
170							stone
180							line quartz vein
190	Silt ~ sand	2.5YR7/6	massive blocky				
200	up to 5.5m						

Sheet for Site Survey

AREA TA-1

Date :	18-Aug	Place :	Engcayini	50m to hill top	on a ridge	altitude(ft):	2,978
Coordinate:	26	18	166	Coordinate E:	31	21	213
Topography : near hilltop		Gradient		SW	Location	hillside	rocky/stony
Soil Classification:		Rhodic Ferralsols		Geology: Ngwane gneiss		granitic mass	
Gully size: width		20 depth		2 length		250	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
10				almost no			
20							
30	C	5YR6/8	hexagonal				
40			crack				stone line
50					up to 50cm		
60	HC	10R3/6	massive				
70							
80							
90	SiC	10R2/4	cracky			saprolite	
100	kaolitized						
110							
120							
130							
140							
150							
160							
170							
180							
190							
200							

Sheet for Site Survey

AREA TA-1

Date :	22-Aug	Place Engayini		with terracette		altitude(ft):	2,212
Coordinate:	26	17	490	Coordinate E:	31	23	599
Topography : hillridge		Gradient	12%	SW	Location	hillside	rocky/stony
Soil Classification:		Rhodic Ferralsols		Geology: Ngwane gneiss		roadtrack gully	
Gully size: width		20 depth		2 length		150	track gully

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
10	SC	5YR7/6	subangular	little			quartz pebble
20							a few
30							
40	LiC	10R5/8	angular				
50			cracky		up to 50cm		
60							
70							
80	C	2.5YR5/8	vertical	pH = 5.81			
90	kaolitized		crack	Eh - 0.011			
100							
110							
120							
130							
140	deep up to 250cm					stone line perpendicular	
150							
160							
170							
180							
190							
200							

Soil Profile of Gully Walls at Physical Measurement Sites (4)

Sheet for Site Survey

AREA TA-1

Date :	22-Aug	Place :Engayini				altitude(ft):		2,152
Coordinate:	26	17	258	Coordinate E:	31	29		631
Topography : near hilltop		Gradient	8% SW	Location		hillside		rocky/stony
Soil Classification:		Rhodic Ferralsols		Geology: Ngwane gneiss		granitic mass		
Gully size: width		36 depth		12.5 length		450		

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
10	SCL	2.5Y 6/2	surface seal coating				much gravel
20			granular & blocky				up tp 30cm
30							
40	saprolite SiC	10YR4/8	iron concretion				
50							
60							
70							
80							
90							
100						trees grown wthin gully	
110						*Syzygium cordatum*	
120							
130							
140							
150							
160	Si	2.5YR6/8	massive	pH = 6.31			
170							
500	crossed stone lines					fossil layer	
600						gneiss	

Sheet for Site Survey

AREA TA-3

Date :	23-Aug	Place :Mgazini	boundary of	TA-3		altitude(ft):		
Coordinate:	26	47	16	Coordinate E:	30	57		122
Topography : near hilltop		Gradient	9 S	Location		hillside		many small
Soil Classification:		Xanthic Ferralsols over Luvisols		Geology: Ngwane gneiss		granitic mass		outcrop
Gully size: width		20 depth		9 length		450		

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
10	SL	10YR4/8					
20							
30							
40							
50	SCL~SC	10YR4/6	massive				
60							
70							
80							
90							
100	Gr	2.5Y7/1					gravel with pebble
110							
450	Si	2.5YR3/8					
		Water ponded	because of	wasted stone			
700	SiC	aquifer				saprolite aquifer	
							on the bottom
	perennial water flow						perennial water flow

Sheet for Site Survey

AREA TA-3

Date :	23-Aug	Place :	Place :Pumitile school gully			altitude(ft):		3,172
Coordinate:	26	43	833	Coordinate E:	30	54		455
Topography : near hilltop		Gradient	7 S	Location		stream side		soil boundary
Soil Classification:		Rhodic Ferralsols		Geology: Ngwane gneiss		granitic mass		to fluvail black soils
Gully size: width		depth		length				

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
10	Silt	10R5/8	blocky	no			fine gravel
20							no outcrop
30					up to 30cm		
40	SiC	10R4/6	subangular			some iron	
50						concretion	
60							
70							
80							
90							
100							
110							
120							
130							
140	SiC	10YR8/4	massive	no			
150			vert crack				
160			horizontal lamella				
170	Saprolite	5YR6/6	massive				
180							
550							

Soil Profile of Gully Walls at Physical Measurement Sites (5)

Sheet for Site Survey

AREA TA-3

Date :	24-Aug	Place :	Nokuthula high-school E		burnt field	altitude(ft):	4,038
Coordinate:	26	47	1	Coordinate E:	30	56	381
Topography : near hilltop		Gradient	10 E		Location	hillside ~	peren.stream
Soil Classification:		Rhodic Ferralsols/Luvisols		Geology: Ngwane gneiss		granitic mass	also terracette
Gully size: width		22 depth		6 length		120	and slip gully

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	[
10							white quartz
20	SCL	2.5YR3/6	granular	no		iron concretion	pebble
30							
40					up to 40 cm		
50							
60							
70							
80							
90							
100							
110	SL	5YR4/4	blocky and			saprolite	
120			massive			granitic	
230	LoS	2.5Y 7/1	massive		pH = 6.32	fluvial deposit	rion
240				permeability	at 24.6C tested		mottled
250							
600							

Sheet for Site Survey

AREA TA-3

Date :	25-Aug	Place :	Lushikishini East		Largest G.	altitude(ft):	3,370
Coordinate:	26	46	252	Coordinate E:	30	54	726
Topography : near hilltop		Gradient	8 E		Location	hilltop	iron concretion
Soil Classification:		Rhodic Ferralsols		Geology: Ngwane gneiss		stabilizing	ravine gully
Gully size: width		25~75 depth		8.5 length		950	brachiated

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
10	SCL	10R 4/8	angular	no	gully head top permeability tested		surface
20							quartz gravel
30							
40	gully head			no	up tp 40 cm		
50							
60						Vegetation inside gully	
70						*P. patura*	
80						*A.mearnsii* Sakaki	
90	SCL	10R4/6	blocky	pH = 5.50	24.3C		
100		down-stream stone line					
110							
120							
130							
140							
150	Si	2.5Y 7/1	massive	pH = 6.79	24.3C		
160			powdery				
170							
180							
190							
200							

stone line

Sheet for Site Survey

AREA TA-1

Date :	22-Aug	Place : Engayini				altitude(ft):	2,152
Coordinate:	26	17	258	Coordinate E:	31	29	631
Topography : near hilltop		Gradient	8% SW		Location	hillside	rocky/stony
Soil Classification:		Rhodic Ferralsols		Geology: Ngwane gneiss		granitic mass	
Gully size: width		36 depth		12.5 length		450	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
10	SCL	2.5Y 6/2	surface seal coating				much gravel
20			granular & blocky				up tp 30cm
30							
40	saprolite SiC	10YR4/8	iron concretion				
50							
60							
70							
80							
90							
100						trees grown wthin gully	
110						*Syzygium cordatum*	
120							
130							
140							
150							
160	Si	2.5YR6/8	massive	pH = 6.31			
170							
500	crossed stone lines					fossil layer	
600						gneiss	

Soil Profile of Gully Walls at Physical Measurement Sites (6)

Sheet for Site Survey

AREA TA-2

Date :	28-Aug	Place :	Paradys			altitude(ft):	2,688
Coordinate:	27	12	598	Coordinate E:	31	26	212
Topography : near hilltop	Gradient		14 S	Location	stream side		
Soil Classification:	Acrisols		Geology: Ngwane gneiss		granitic mass		
Gully size: width		26.5 depth		10 length		350	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
					covered by	*Cynodon dactilon*	
10	SC	5YR3/1	angular	yes			fine gravel
20							outcrop of granite
	SiCL	2.5YR3/2	vertical	no			
30			crack				
40							
50					up to 50cm		
	SL	10YR3/4	subangular				
60			blocky				
70						Stabilizing gully with	
						Syzygium cordatum	
80						*Erithrina lysistemon*	
90						Kapok	
100							
110	SL	5YR5/8	blocky and				
120	up to 120cm	colluvial layer	vert.crack				
130							
140							
150							
160							
170							
180							
190							
200	S	10YR5/3	crack hexagonal				

Sheet for Site Survey

AREA TA-1

Date :	21-Jul	Place :	Luve Summit			altitude(ft):	2,184
Coordinate:	26	19	167	Coordinate E:	31	27	208
Topography : near hilltop	Gradient		7 W	Location	stream side		
Soil Classification:	Acrisols		Geology: Ngwane gneiss		granitic mass		
Gully size: width	Virgin soil			slope length		190 m	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
					covered by	indigenous trees	
10	HC	2.5YR2/2	blocky	yes			boulder
20							outcrop of granite
30	HC	7.5YR3/3	prismy	yes			
40							
42cm							
50							
60	SiCL	5YR4/6	nassive		up to 65cm		
70							
80							
90							
100							
110	SL	5YR5/8	blocky and				
120	up to 120cm	colluvial layer	vert.crack				
130							
140							
150							
160							
170							
180							
190							
200	S	10YR5/3	crack hexagonal				

Sheet for Site Survey

AREA TA-1

Date :	10-Sept.	Place :Lububu Hills		with terracette		altitude(ft):	3,042
Coordinate:	26	24	427	Coordinate E:	31	23	109
Topography : hillridge	Gradient		17%	NE	Location	hilltop	stony (pluton)
Soil Classification:	Rixisols			Geology: Ngwane gneiss		rangeland top	

profile of undisturbed soil on the summit

Soil Profile	texture	colour	structure
			humus >3%
10	C	2.5YR 2/1	blocky
20			
30			root zone
40			still humus
50	HC~SiC	2.5YR 3/6	massive
60			
70	mother rock	7.5YR 2/1	
80			
90			

profile at 50 meter down from it

Soil Profile	texture	colour	structure
			little humus
10	HC~SiC	2.5YR 3/6	massive
20			
30			blocky
40	mother rock	7.5YR 2/1	
50			
60	calcuration:	cm has been lost	
		during these 50 years	
70			
		0.5cm per annum or	
80		65 ton / ha per annum	
90			

Date :	10-Sept.	Place :Eni Hills		with terracette		altitude(ft):	3,081
Coordinate:	26	18	416	Coordinate E:	31	30	935
Topography : hillridge	Gradient		13%	NE	Location	hilltop	stony (pluton)
Soil Classification:	Xanthic Ferralsols			Geology: Ngwane gneiss		rangeland top	

profile of undisturbed soil on the summit

Soil Profile	texture	colour	structure
	C	5YR 3/2	angular
10			humus rich
20	C	5YR 3/6	blocky
27 cm			
30			
	SiC	5YR 5/8	fine gravel
40			
50	more silty		root zone
	SiCL	7.5YR 6/8	fine
60			gravel
70	mother rock		
80	ochre colored gneiss		

profile at 50 meter down from it

Soil Profile	texture	colour	structure
			humus 2-3%
10	Si	5YR 4/3	granular
	12 cm		gravel rich
20			
	C	5YR 3/6	blocky
30			root zone
40	SiCL	5YR 5/8	fine gravel
50			
	Si	5YR 6/8	some gravel
60			
70			
80			

Soil Profile of Gully Walls at Physical Measurement Sites (7)

Sheet for Site Survey

AREA TA-3

Date :	12-Sept.	Place :	Macdulwini ~			altitude(ft):	4,044
Coordinate:	26	40	405	Coordinate E:	30	59	405
Topography : near hilltop		Gradient	6 E	Location	plateau top	*Pinus patura*	
Soil Classification:		Phaeozem		Geology: Ngwane gneiss	granitic mass		
land use:	planted forest	for pulp wood	surrounded by grazing & arable land		no gully observed around		

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
A							
10	L	5YR 3/3	subangular	much >5%	under canpopy		
Al	CL	5YR 4/4	porous	3% or more	leaf litter		
20							
	CL	5YR 4/4	blocky cracky	some 2~3%	ditto		
B							
				humic layer up to 35cm			
40							
	SiCL	5YR 3/2	massive				
50							
Bt		5YR~2.5YR					
60		2/2					
	SiC		weathered				
70	saprolite	5YR 6/8	gravel				
C	rock		mother rock				
80							
90							
	rangeland soil	50 meter	down from	hill-top			
0				no humus			
				some carbon			
10	C ~ SiC	5YR 3/2	massive				
20 Bt	SiCL	5YR 2/2					
			weathered				
30	saprolite	5YR 6/8	gravel				
C	rock						
40							
50							
60							
70							
80							
90							
100							

Sheet for Site Survey

AREA TA-2

Date :	28-Aug	Place :	Paradys	Date :	15-Sep	altitude(ft):	2,688
Coordinate:	27	12	598	Coordinate E:	31	26	212
Coordinate:	27	11	994	Coordinate E:	31	26	210
Soil Classification:		Acrisols		Geology: Ngwane gneiss		altitude(ft):	2,833
Gully size: width		26.5 depth		10 length		350	

Soil Profile	texture	colour	structure	Soil Profile	texture	colour	structure
					CL	2.5YR 4/4	subangular
10	SC	5YR3/1	angular	10			humus rich
20				20	LC	2.5YR 3/2	blocky
	SiCL	2.5YR3/2	vertical				humus yes
30			crack	30	SC	2.5YR 3/1	angular
							humus yes
40					SiCL	2.5YR 3/2	cracky
				40	stone		
50					dolente	2.5YR 4/6	much stony
							at hill top
60	SL	10YR3/4	subangular				
			blocky				
70							
80							
90							
100							
110	SL	5YR5/8	blocky and				
			vert.crack				
120	up to 120cm	colluvial layer					
130							
140							
150							
160							
170							
180							
190							
			crack				
200	S	10YR5/3	hexagonal				

Sheet for Site Survey

AREA TA-3

Date :	24-Aug	Place :	Macdulwini ~	Mbeka		altitude(ft):	4,073
Coordinate:	26	40	910	Coordinate E:	30	58	827
Topography : near hilltop		Gradient	14 SW	Location	plateau top	rocky/stony	
Soil Classification:		Leptosols		Geology: Ngwane gneiss	granitic mass		
Gully size: width		8 depth		6 length		400 reactivated	

Soil Profile	texture	colour	structure	organic m.	root zone	fossil layer	stone/gravel
							much gravel
10							with quartz
20	SL	7.5YR4/6	granular	almost no hs			breccia
	qtz gr layer						
30							
					up to 35cm		
40							
	saprolite					mother rock	
50	C	2.5YR4/8	angular	no			
			vertical				
60			crack				
		mozaic with					
70	Silt	2.5YR4/6	massive	no			
80							
90							
100							
110							
						kaolitized	
120						veins	
130							
140							
150							
160							
170							
180							
					penetrometer	tested	
400	water permiability test at 400 cm			gully bottom	pH 5.48	EC 0.008	24.7C

Table D.3-9: Location List of Huge Ravine Gullies in three pilot area (1)

No.		location							general character of gullie								estim.
TA-	stream	longitude			latitude			altitude	width	length	location	depth	soil class.	shape	end site	land-use	surface	age
I	Mhlambanyoni	26	18	420	31	23	196	800	25	480	hillside	18	Ferralsols	2HBU	stream	grass		75
I	Mhlambanyoni	26	21	180	31	22	865	659	5	120	river bank	3	Ferralsols	SHTV	stream	grass	slip er.	a few
I	Mhlambanyoni	26	21	971	31	22	739	713	35	180	hillside	8	Ferralsols	3HBU	stream	grass		-
I	Matete	26	19	40	31	24	903	847	65	300	hillside	12	Acrisols	MHBU	stream	woodlot		-
I	tr. Mbaluzane	26	23	824	31	25	848	653	38	300	hillside	11	Phaeozem	2HBV	stream	grass		40
I	Mhlambanyoni	26	22	457	31	22	121	713	19	645	hilltop	23	Ferralsols	MHBU	stream	grass		65
I	Mhlambanyoni	26	22	84	31	22	805	783	24	220	hillside	10	Ferralsols	3HBU	stream	grass		20
I	Mhlambanyoni	26	22	78	31	22	502	810	12	40	hillfoot	0.5	Ferralsols	Rectan.	hill slope	grass	track	3
I	Mhlambanyoni	26	18	536	31	22	649	770	93	340	hilltop	17.5	Ferralsols	MHBU	stream	grass		45
I	tr. Mbaluzane	26	23	844	31	25	859	713	49	288	hillside	9	Acrisols	2HSV	stream	grass		30
I	Mhlambanyoni	26	20	61	31	21	713	870	23	140	hilltop	11	Ferralsols	SHSU	stream	grass		-
I	Mhlambanyoni	26	20	709	31	23	105	732	60	280	hilltop	8.5	Ferralsols	MHBU	stream	grass		30
I	Mhlambanyoni	26	20	602	31	23	70	743	45	270	hilltop	10.5	Ferralsols	2HBU	stream	grass		30
I	tr. Mbaluzi	26	19	781	31	21	389	947	8	15	hillside	1	Ferralsols	oval	hill slope	grass		a few
I	Mgwanyane	26	25	777	31	24	462	720	15	110	hillfoot	9	Phaeozem	SHSV	stream	grass		10
I		26	18	172	31	23	180	644	65	300	roads	25	rhodic F.	W	stream	grass	degded	75
I		26	22	56	31	22	428	644	40	735		15	rhodic F.	W	stream	grass	degded	50
I		26	23	222	31	22	298	771	35	250	roads	12	rhodic F.	W	stream	grass	degded	35
I		26	20	697	31	23	57	655	49	280		13	blac-yel	W	stream	grass	degded	45
I		26	26	418	31	21	548	728	25	130	roads	6	rhodic F.	U	stream	grass	degded	-
I		26	21	928	31	20	384	955	5	100		2	rhodic F.	plate	hill slope	grass	degded	100
I		26	20	386	31	23	214	990	60	230		18	blac-yel	W	stream	grass	degded	-
I		26	18	377	31	23	679	880	8	200		10	white	U	stream	grass	degded	-
I		26	19	415	31	24	713	656	7	150	roads	6	rhodic F.	U	stream	grass	degded	50
I		26	20	45	31	21	21	-										
I		26	18	89	31	21	101	1,146			roadside							
I		26	28	124	31	22	538	648			roads		rhodic F.					
I		26	22	745	31	22	48	819	S1km	L.gully		SW1	L.gully	directed	north			
I		26	22	207	31	22	454	747	25	735		8	rhodic F.	U	stream	grass	degded	60
I		26	17	853	31	25	73	747	E1km	white gully								
I		26	22	628	31	25	642	646	15	200	roads	6	blac-yel	U	stream	grass	degded	30
I		26	24	173	31	22	937	797	E0.5k	red gully		SW	slope					
I		26	21	192	31	24	733	623			roads			U	stream	grass	stabild	60
I		26	20	615	31	23	305	668	10	200	track	8	rhodic F.	U	stream	grass	stabing	45
I		26	20	251	31	23	445	666	Mansinyeni NE				rhodic F.		proceeding gully			
I		26	17	807	31	21	325	831	SE.5k	slip gullly								
I		26	18	192	31	23	180	674	8	150	roads	15	rhodic F.	U	range	grass	stabing	70
I		26	20	697	31	23	53	-		60	380	track	9	gleysols	U	stream	grass	degded	60
I		26	19	415	31	24	715	656					gleysols	broad	stream	grass	degded	15
I		26	18	588	31	25	84	659	18	180	roads	6	rhodic F.	U	stream	grass	degded	-
I		26	18	677	31	23	679	640	L gully near perennial stream									
I		26	19	167	31	27	208	655	20	300	roads	7	acrisols	U	stream	grass	degded	-
I		26	18	166	31	21	213	899	8	250	track	1	rhodic.F.	broad	stream	grass	degded	5
I		26	19	566	31	23	151	644	11	350	track	5.5	leptosols	broad	stream	grass	deged	15
I		26	17	258	31	29	631	646	36	450	track	12.5	acrisols	W	stream	grass	reactiv	35
I		26	17	167	31	23	837	624	65	400	terrac	6.5	acrisols	W	stream	grass	reactiv	45
I		26	17	490	31	23	599	664	10	450	roads	6	acrisols	broad	roads	grass	deged	10

F; Ferralsols U: Ushaped section, V: Vshaped section

2H:two heads, S; single, B; brachiated

Location List of Huge Ravine Gullies in three pilot area (2)

No.		location						general character of gullie										estim.
TA-	stream	longitude			latitude			altitude	width	length	location	depth	soil class.	shape	end site	land-use	surface	age
II	Ngwede	27	13	180	31	23	804	920	8	130	plain	3	Ferralsols	SHBV	stream	grass		15
II	Ngwede	27	13	54	31	23	797	870	12	70	hillside	5	Ferralsols	3HBV	hill slope	grass		-
II	Ngwede	27	12	863	31	23	890	923	15	240	hillfoot	6	Ferralsols	SHBV	stream	grass		20
II	Ngwede	27	12	753	31	24	127	880	64	140	hillside	5	Ferralsols	2HBU	stream	grass		-
II	Ngwede	27	12	381	31	25	223	937	20	200	hillside	2.5	Ferralsols	SHBV	stream	grass		25
II	Ngwede	27	12	947	32	25	170	987	15	350	hillside	5	Ferralsols	MHBV	stream	grass		45
II	tr.Ngwabuma	27	11	535	31	25	127	817	35	350	hillside	5	Ferralsols	SHVU	stream	grass		50
II	Ngochane	27	18	832	31	29	563	953	4	100	montside	2	Ferralsols	SHTV	stream	grass		-
II	Mantambe	27	16	532	31	25	607	850	6	110	hillfoot	4	Vertisols	SHBV	stream	grass		-
II	Mantambe	27	16	186	31	27	464	813	7	250	hillfoot	1	Vertisols	3HBV	stream	grass		35
II	Ngochane	27	18	174	31	29	917	747	6	120	hillside	2	Vertisols	SHBV	stream	grass		15
II	tr.Ngwede	27	10	946	31	26	879	880	12	60	hillside	4	Ferralsols	MHBV	hill slope	grass		-
II	Ngwede	27	9	404	31	26	974	717	15	25	hillfoot	4	Ferralsols	RBFC	hill slope	shrub		-
II	Ngwede	27	10	546	31	26	423	793	6	80	hillfoot	4	Ferralsols	SHBU	hill slope	grass		-
II	Ngwede	26	12	348	31	25	241	850	8	280	hillfoot	5	Luvisols	MHBV	stream	grass		30
II		27	11	468	31	24	695	699	2	150		1.5	rhodic F.	V	large gly	no	barren	
II		27	12	827	31	23	994	833										
II		27	12	554	31	24	491	818			roadside		rhodic F.	V	gr.surface			
II		27	12	412	31	24	312	796					rhodic F.	V				
II		27	16	302	31	27	68	778	8	200	fountain	3	blackglei	V	stream	grass		
II		27	16	285	31	29	711	760	4	250		1	blac-yel	V	gr.surface	fallow	degded	few y
II		27	11	813	31	25	114	740	L.gully here									
II		27	12	545	31	24	277	775	L.gully here									
II		27	10	314	31	24	772	667	30	400	roads	10		U	stream	grass	degded	-
III	Tsawela	26	45	560	30	59	624	1,067	7	157	roadside	4.5	Luvisols	SHSV	stream	arable		-
III	Tsawela	26	44	498	30	55	391	1,087	7	150	hillfoot	4	Ferralsols	2HSV	stream	grass		10
III	Ngwenpisi	26	44	183	31	0	39	1,050	27	330	hilltop	8	Ferralsols	4HSV	stream	grass		55
III	Ngwenpisi	26	44	110	31	0	32	1,040	7	75	hilltop	3.5	Ferralsols	2HSV	hill slope	grass		-
III	tr.Ngwenpisi	26	43	425	31	0	51	1,043	45	210	hillfoot	5	Ferralsols	3HSV	stream	grass		25
III	Tsawela	26	45	345	31	0	308	1,077	30	80	plain	25	Luvisols	2HSV	stream	flw.		10
III	tr. Tsawela	26	47	115	30	57	102	1,170	93	450	hillfoot	4	Ferralsols	MHBU	stream	grass		60
III	Ngwenpisi	26	44	410	30	53	527	1,072	16	80	swamp	4	Vertisols	2HSV	hill slope	grass		-
III	Ngwenpisi	26	44	901	30	54	281	1,070	28	125	hilltop	6	Vertisols	MHBU	stream	grass		15
III	Ngwenpisi	26	44	64	30	54	451	1,000	35	180	swamp	5.5	Vertisols	MHBV	stream	grass		20
III	Tsawela	26	45	352	30	57	205	1,173	9	80	hillside	4.5	Ferralsols	SHSV	stream	grass		a few
III	Ngwenpisi	26	44	590	30	57	172	1,080	12	323	hillfoot	3	Luvisols	2HSV	stream	grass		45
III	tr.Ngwenpisi	26	41	462	31	5	894	1,153	6	600	hillside	4.5	Ferralsols	3HBV	stream	grass		70
III	Mtagane	26	45	244	30	55	497	1,120	11	260	hillside	2.5	Luvisols	3HBU	stream	grass		30
III	Mhlatane	26	40	229	31	0	755	1,103	5	250	hilltop	2	Ferralsols	3HBU	stream	shrub		20
III	Ngwenpisi	26	44	77	30	59	932	1,050	22	150	hilltop	3.5	Luvisols	MHBV	stream	grass		10
III	Mhlatane	26	40	185	31	0	915	1,152	5	100	roadside	3	Luvisols	SHSU	stream	shrub		-
III		26	45	160	30	55	763	1,027										
III		26	45	176	30	55	870	1,184	15	270	roadside	6	blac-yel	U	stream	grass		
III		26	44	814	30	57	237	-	7	50		5		V	stream	grass	sheet	
III		26	43	23	30	58	345	997	40	200		8	rhodic F.	U	stream	grass	burnt	30
III		26	34	376	30	56	783	1,202	5	260	roads	3	rhodic F.	U	stream	grass	burnt	25
III		26	40	6	31	1	107	1,082	10	300	roads	5	grey	U	stream	grass	degded	20
III		26	41	222	31	5	54	1,109	15	250		7	rhodic F.	U	stream	woodlot	degded	-
III		26	43	726	31	8	152	925	5	50		3						
III		26	39	376	30	56	788	1,202	15	330	roads	7	blac-yel	U	stream	grass	degded	20
III		26	39	976	30	55	870	1,184	12	400	roads	7.5	xanthicF	U	stream	grass	degded	20
III		26	44	624	30	57	846	999	12	200	track	5	rhodic F.	U	stream	grass	degded	-
III		26	45	167	30	55	799	1,162	20	250		3		broad				
III		26	41	495	31	10	322	-	L.gully here									
III		26	41	434	31	0	320	1,167	15	150	terrac	3	regosols	broad	stream	grass	degded	-
III		26	43	720	31	6	152	985	10	80		7	vertisols	V	stream	grass	degded	-
III		26	40	220	31	0	532	1,000	12	380	roads	6	xanthicF	U	stream	grass	degded	20
III		26	39	376	30	56	788	1,202	8	70	roads	7	regosols	V	stream	grass	degded	15
III		26	43	365	31	4	964	843										
III		26	43	670	30	55	885	1,015										
III		26	44	727	30	54	301	990					vertisols					
III		26	45	165	30	55	828	1,000					vertisols					
III		26	40	568	30	57	694	1,006	5	150	roads	3	xanthicF	U	roads	grass	degded	new
III		26	43	750	30	54	455	953	7	100	strm	4	rhodic F.	V	stream	grass	degded	17
III	waterponded	26	47	16	30	57	122	654	20	450	strm	9	fluvisols	U	stream	grass	degded	25
III		26	45	652	30	55	177	1,161	5	200	strm	5	xanthicF	U	stream	grass	degded	20
III		26	46	252	30	54	720	1,006	85	950	stream	8.5	rhodic F.	U	stream	grass	degded	51
III		26	46	299	30	54	424	1,157	22	250	track	3	xanthicF	V	stream	grass	degded	20
III		26	47	1	30	52	381	1,391	22	120	track	6	xanthicF	U	stream	grass	degded	20

Table D.3-10 : Location List of Fault-side Gullies in the Study Area

Area	stream	location							general character of gullie									estimat-ed age
		longitude	(S)		latitude	(E)		altitude	width	length	depth	location	geology	shape	end site	land-use	surface	
		°	'	"	°	'	"	ft	m	m	m							year
SW	Ngwempisi	26	44	491	30	52	708	3,422	18	350	6	ridge	Ng.gneiss	3HBU	stream	grass l.	S.Eroded	35
W	Lusushwana	26	34	634	31	9	274	2,829	30	260	9	ridge	w.diorite	MHBU	stream	grass l.	terracette	40
CN	Ngwane	26	3	117	31	19	894	3,366	10	75	8	hilltop	gr.diorite	1HSV	slope	grass l.	S.Eroded	15
CN	Ngwane	26	13	676	31	24	635	2,576	13	200	7.5	valley	porphyry	MHBU	stream	grass l.	S.Eroded	30
CN	Ngwane	26	10	297	31	18	421	2,469	15	310	6	ridge	gr.diorite	2HBU	slope	grass l.	terracette	25
CN	Ngwane	26	8	488	31	17	378	2,777	23	280	5	ridge	gr.diorite	SHV	stream	grass l.	terracette	35
N	Nkomati	26	6	101	31	15	519	3,243	17	190	6.5	ridge	Ng.gneiss	SHV	stream	grass l.	S.Eroded	20
C	Usutu	26	33	620	31	24	513	1,325	2	70	5	plain	delluvial	MHBW	stream	marsh	acceptable	5
SW	Ngwempisi	26	40	577	30	56	92	3,844	14	285	4.5	valley	Ng.gneiss	4HBU	stream	grass l.	S.Eroded	30
SW	Ngwempisi	26	40	321	30	56	137	3,442	10	165	4	valley	Ng.gneiss	3HBU	stream	grass l.	terracette	10
W	Ngwempisi	26	40	243	30	56	646	3,440	1	55	0.5	roadside	Ng.gneiss	SHSV	stream	grass l.	S.Eroded	3
W	Ngwempisi	26	22	670	30	53	190	2,327	6	90	2	ridge	Ng.gneiss	3HBV	stream	grass l.	terracette	7
C	Lusushwana	26	17	704	31	26	980	1,868	5	235	4	plain	gr.diorite	2HBV	stream	grass l.	S.Eroded	20
C	Lusushwana	26	17	664	31	26	650	2,120	11	220	5	valley	granites	5HBU	stream	grass l.	slip eros.	25
SW	Mkhondvo	26	45	583	31	17	683	2,827	17	340	7	ridge	gr. gneiss	MHBU	stream	grass l.	terracette	40
SW	Mkhondvo	26	45	290	31	16	509	3,881	2	30	1	hilltop	Nh. gneiss	SHV	grass f.	grass l.	stony gr.	5
SW	Mkhondvo	26	44	765	31	15	367	3,765	7	35	2	hilltop	Nh. gneiss	SHV	grass f.	grass l.	stony gr.	8
CS	Lusutfu	26	46	72	31	28	87	2,565	12	40	2	roadside	Nh. gneiss	SHV	stream	grass l.	terracette	5
CS	Lusutfu	26	46	378	31	28	177	2,745	25	350	5.5	ridge	mylonite	3HBU	stream	grass l.	S.Eroded	50
S	Mhlatuzane	26	47	285	31	27	862	2,504	3	190	3	ridge	Ng.gneiss	SHV	grass f.	grass l.	S.Eroded	20
S	Ngwede	26	58	217	31	20	312	3,306	8	150	4	ridge	Mozaan g.	SHV	stream	grass l.	terracette	15
S	Ngwede	26	57	189	31	21	14	3,144	3	140	2	ridge	Ng.gneiss	SHV	grass f.	grass l.	stony gr.	15
C	Lusutfu	26	32	245	31	6	368	3,826	2	90	1	valley	Ushwana	SHV	stream	grass l.	slip eros.	10
CW	Lusutfu	26	32	593	31	5	680	3,582	27	400	10	hilltop	w.diorite	MHBU	stream	grass l.	terracette	60
CW	Lusutfu	26	32	503	31	5	246	3,499	15	360	6	hilltop	w.gr.diorite	MHBU	stream	grass l.	terracette	55
CW	Lusutfu	26	32	743	31	6	5	3,605	20	150	5	hilltop	w.gr.diorite	MHBU	stream	grass l.	slip eros.	20
CW	Lusutfu	26	33	617	31	3	831	2,850	10	125	4.5	ridge	granites	3HBU	stream	grass l.	terracette	12
CW	Lusutfu	26	34	417	31	4	231	2,949	35	180	7	ridge	w.gr.diorite	MHBU	stream	grass l.	S.Eroded	20
C	Lusushwana	26	27	695	31	15	111	2,395	18	240	6	ridge	w.diorite	3HBU	swamp	grass l.	terracette	30
C	Lusushwana	26	29	319	31	15	119	2,160	11	320	7	ridge	granites	2HBU	stream	grass l.	S.Eroded	45
C	Lusushwana	26	28	786	31	14	864	2,252	8	150	4	ridge	granites	2HBU	stream	grass l.	S.Eroded	25
SW	Mkhondvo	26	48	766	31	16	449	2,913	6	125	3	hilltop	Nh. gneiss	SHV	grass f.	grass l.	stony gr.	15
SW	Ngwempisi	26	42	112	31	14	992	3,508	5	185	2	ridge	Nh. gneiss	SHV	grass f.	grass l.	terracette	20
SW	Mpophona	26	49	0	31	14	303	3,892	8	170	6	ridge	Nh. gneiss	SHV	stream	grass l.	stony gr.	25
SW	Mpophona	26	47	900	31	14	564	3,342	70	90	8	ridge	Ng.gneiss	MHBU	stream	grass l.	terracette	15
C	Lusushwana	26	18	817	31	17	803	3,261	15	135	5	ridge	granites	4HBU	stream	grass l.	S.Eroded	18
C	Mbuludzi	26	23	199	31	26	313	3,125	18	165	5.5	ridge	Ng.gneiss	MHBU	stream	grass l.	terracette	20
NW	Nkomati	26	4	492	31	15	793	2,076	12	140	4	ridge	granites	3HBU	stream	grass l.	S.Eroded	20
W	Ngwempisi	26	36	554	31	7	732	1,914	25	170	4	valley	granites	MHBU	stream	grass l.	terracette	25
CW	Lusutfu	26	37	291	31	15	689	2,442	12	250	10	valley	granites	MHBU	stream	grass l.	terracette	70
W	Ngwempisi	26	36	469	31	16	182	2,547	5	130	3	roadside	granites	SHV	grass f.	grass l.	S.Eroded	18
CW	Lusutfu	26	37	485	31	13	529	2,662	180	350	10	valley	Nh. gneiss	MHBU	stream	grass l.	terracette	45
NW	Nkomati	25	48	969	31	23	884	2,753	20	200	8	ridge	granites	MHBU	stream	grass l.	terracette	25
NW	Nkomati	25	51	887	31	24	134	2,677	12	150	6	valley	granites	4HBU	stream	grass l.	terracette	25
CS	Kukwana	26	45	141	31	14	298	3,605	23	360	9	ridge	granites	MHBU	stream	grass l.	S.Eroded	45
CS	Kukwana	26	49	368	31	7	24	4,129	4	150	1	plain	Nh. gneiss	SHU	stream	grass l.	S.Eroded	15
NW	Nkomati	26	6	900	31	10	364	3,796	40	290	7	roadside	granites	Fanwall	road	grass l.	terracette	35
NW	Nkomati	26	2	334	31	24	765	2,857	20	100	4	ridge	granites	SHU	stream	grass l.	terracette	15
SW	Ndlotane	26	51	205	31	3	330	3,453	18	160	5	hilltop	Nh.gneiss	4HBU	stream	grass l.	S.Eroded	20
SW	Ndlotane	26	52	491	31	3	57	4,005	15	220	6	plain	Nh.gneiss	MHBU	stream	grass l.	S.Eroded	25
NW	Nkomati	26	12	184	31	20	15	4,001	10	130	5	hilltop	granites	SHU	stream	grass l.	S.Eroded	18
NW	Ngwavuma	27	7	849	31	6	652	3,159	13	140	4	ridge	Nh.gneiss	MHBU	stream	grass l.	terracette	20
SW	Sibhowe	26	53	238	31	22	893	2,355	17	220	5	ridge	Nh.gneiss	MHBU	stream	grass l.	S.Eroded	30
SW	Mkhondvo	26	55	619	31	28	215	2,355	10	120	3	plain	colluvium	MHBV	stream	grass l.	S.Eroded	15
SW	Mkhondvo	27	2	134	31	33	524	2,353	7	150	2.5	plain	colluvium	MHBV	stream	grass l.	S.Eroded	20
S	Mvmagwa	27	6	494	31	28	211	2,031	5	80	3	hilltop	Nh.gneiss	SHV	stream	grass l.	stony gr.	10

Nh; Nhlangano f; field F; Ferralsols U: Ushaped section, V: Vshaped section

2H:two heads, S; single, B; brachiated

Annex E

E Natural Resources and Environment

E.1 Monthly Rainfall Totals

(1) Matspha Station (TA1)

Data Type: Precip Total Mly Data measured in : Millimeteres

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total	
1968		38.5	262.4	76.0	5.5	9.4	16.3	30.8	13.8	22.6	135.3	72.4	683.0	
1969	137.5	24.5	202.5	118.5	46.2	0.0	17.0	2.0	127.7	231.1	155.7	122.9	1,185.6	
1970	76.5	121.7	44.2	0.0	56.7	0.0	0.0	78.4	17.2	135.7	110.5	45.9	686.8	
1971	201.0	58.4	68.4	112.2	25.0	0.0	9.3	0.0	31.7	148.5	46.0	210.5	911.0	
1972	233.4	292.1	154.0	0.0	95.3	0.0	3.5	11.0	2.6	49.5	153.8	43.5	1,038.7	
1973	78.2	133.6	41.5	89.0	4.0	0.0	2.1	19.3	197.6	90.4	119.9	177.8	953.4	
1974	205.5	20.5	81.3	106.8	8.1	0.0	46.5	0.0	6.5	66.0	217.6	102.5	861.3	
1975	124.4	151.5	46.0	53.0	0.0	13.0	0.0	0.0	39.5	56.5	127.5	224.5	835.9	
1976	181.5	185.0	112.1	89.0	44.5	0.0	9.0	5.0	3.0	101.0	151.5	119.5	1,001.1	
1977	66.6	164.7	84.2	34.7	4.8	0.0	0.0	17.8	108.8	96.4	104.2	61.9	744.1	
1978	261.5	82.8	229.0	12.8	20.3	1.3	10.7	15.0	82.8	127.4	172.3	99.2	1,115.1	
1979	75.9	33.0	83.7	52.5	3.9	0.0	8.9	46.7	99.7	144.7	122.8	27.9	699.7	
1980	13.2	217.4	7.3	218.5	1.4	0.0	0.0	65.5	116.3	36.8	220.2	209.0	1,105.6	
1981	90.6	351.8	175.8	8.2	27.0	11.8	5.0	41.5	117.2	210.7	139.2	113.8	**1,292.6**	(Max)
1982	148.9	13.3	33.4	86.5	0.8	2.8	3.5	1.2	2.9	127.2	67.0	36.1	**523.6**	(Min)
1983	67.4	69.6	87.5	65.8	25.7	10.5	9.2	73.0	11.9	66.2	266.5	97.8	851.1	
1984	470.1	14.5	147.0	34.2	6.0	24.1	117.7	23.3	37.8	107.4	90.4	91.8	1,164.3	
1985	40.6	360.3	32.6	20.4	15.5	3.6	0.0	1.1	20.6	67.8	131.4	153.0	846.9	
1986	232.0	0.0	100.6	97.1	0.0	11.5	0.0	13.7	18.0	32.1	48.4	203.1	756.5	
1987	95.7	52.5	87.7	45.8	0.0	4.8	0.0	60.2	146.5	101.8	150.9	28.3	774.2	
1988	35.4	403.8	141.6	88.0	6.6	33.1	12.7	23.4	45.1	249.1	53.4	150.6	1,242.8	
1989	48.8	372.4	64.4	31.7	8.9	66.1	2.0	3.1	23.6	158.8	191.8	148.9	1,120.5	
1990	165.1	95.2	85.8	43.0	4.9	0.0	6.0	11.9	14.2	62.9	52.3	158.2	699.5	
1991	270.1	111.0	171.0	0.0	63.5	57.6	5.0	0.8	27.7	37.2	154.6	128.1	1,026.6	
1992	58.5	29.8	46.7	40.6	0.0	8.6	0.0	0.6	31.8	24.9	79.9	204.0	525.4	
1993	87.2	160.4	144.5	23.4	26.9	0.2	1.7	39.5	19.7	126.3	114.3	68.2	812.3	
1994	100.9	144.4	103.1	12.3	0.0	0.6	3.5	15.3	7.9	82.7	104.2	243.3	818.2	
1995	84.1	35.1	107.6	22.8	1.7	0.0	0.0	7.2	1.6	60.8	124.4	302.4	747.7	
1996	301.8	269.9	89.9	38.7	53.9	0.1	29.6	26.5	-	125.4	47.4	147.4	-	
1997	178.6	108.4	173.0	33.2	33.4	34.0	15.8	32.6	52.8	112.1	140.6	64.0	978.5	
1998	189.6	108.7	53.0	20.6	8.8	0.0	12.7	10.4	39.7	141.3	87.1	268.8	940.7	
1999	69.3	139.3	100.3	61.3	17.3	5.7	2.8	32.1	13.5	88.5	67.7	150.6	748.4	
2000	153.2	213.1	96.3	48.7	51.2	5.6	2.8	3.0	34.3	69.2	186.6	131.5	995.5	
2001	40.3	137.2	32.6	34.0	2.9	2.5	-	-	-	-	-	-	-	
Average	138.89	138.66	102.68	53.51	19.73	9.03	10.71	21.57	47.31	101.79	125.32	133.56	902.74	

* -: No Data

(2) Dwaleni Station (TA2)

Data Type: Precip Total Mly Data measured in : Millimeteres

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
1915	-	-	-	-	-	-	-	-	-	-	121.1	155.2	-
1916	71.7	71.8	124.6	32.7	10.5	0.0	0.0	0.0	6.6	67.3	68.5	95.7	549.4
1917	121.2	92.2	65.3	14.5	44.5	10.7	40.2	88.2	68.3	189.0	205.3	138.3	1,077.7
1918	205.5	397.2	69.3	6.9	13.3	0.0	14.7	98.6	45.0	26.7	72.9	103.7	1,053.8
1919	68.6	115.7	44.4	92.7	20.3	0.0	0.0	14.5	20.6	31.3	117.8	47.0	572.9
1920	208.8	65.4	105.3	2.8	10.1	0.0	0.0	1.0	42.0	119.0	142.7	130.3	827.4
1921	47.0	51.9	148.3	21.1	11.9	0.0	0.0	0.0	65.5	108.6	173.6	161.8	789.7
1922	38.7	61.4	79.7	4.3	15.7	14.1	0.0	24.6	25.3	142.9	121.5	105.7	633.9
1923	205.5	116.4	57.3	12.4	0.0	3.0	4.6	4.8	0.0	67.5	41.3	144.0	656.8
1924	33.3	101.6	94.4	26.8	36.9	0.0	0.0	16.7	78.9	74.7	140.9	291.4	895.6
1925	65.3	43.7	441.0	84.7	10.2	8.9	22.9	0.0	117.5	58.0	79.9	132.4	1,064.5
1926	167.7	82.4	125.3	0.0	33.5	3.8	0.0	0.0	75.6	29.9	33.0	113.1	664.3
1927	31.5	89.1	106.1	14.2	9.7	0.0	63.0	2.3	40.1	111.5	70.8	98.3	636.6
1928	81.8	48.7	34.0	31.5	0.0	0.0	0.0	10.7	54.1	22.9	92.7	50.6	427.0
1929	84.9	35.2	138.8	21.0	0.0	42.6	4.5	11.9	111.0	120.8	113.9	77.2	761.8
1930	165.6	109.5	37.7	20.2	0.0	0.0	0.0	27.5	28.6	0.0	95.9	228.3	713.3
1931	36.7	49.3	66.3	58.7	0.0	6.1	31.5	0.0	3.0	52.1	50.0	102.9	456.6
1932	139.6	89.7	88.0	37.3	78.5	20.3	0.0	0.0	20.4	62.1	155.0	181.2	872.1
1933	99.0	62.1	34.2	11.4	0.0	4.1	0.0	0.0	10.2	75.5	179.9	176.7	653.1
1934	195.7	59.5	90.8	36.9	12.5	10.6	36.4	60.9	18.8	35.6	68.2	145.2	771.1
1935	53.0	65.5	53.7	48.7	31.7	6.8	5.1	0.5	24.5	37.6	32.0	89.5	448.6
1936	224.1	101.5	220.6	25.1	104.5	0.0	12.9	0.0	46.0	59.5	273.4	104.6	**1,172.2** (Max)
1937	240.7	234.4	47.5	12.2	11.4	10.7	7.6	0.0	95.3	6.6	40.4	103.0	809.8
1938	95.5	41.4	41.9	155.7	13.7	22.4	0.0	0.0	-	92.1	48.4	116.0	-
1939	160.6	272.2	133.5	0.0	20.3	0.0	39.4	5.1	65.0	35.1	158.8	69.3	959.3
1940	140.7	57.2	32.7	111.9	35.1	85.6	0.0	1.5	51.5	79.5	81.3	118.9	795.9
1941	49.8	41.8	31.3	88.4	0.0	0.0	0.0	0.0	18.3	44.1	97.0	48.7	419.4
1942	131.5	49.3	120.1	14.5	68.3	127.5	3.3	17.6	68.4	117.1	144.5	162.9	1,025.0
1943	37.0	67.0	83.5	188.7	39.4	0.0	74.2	69.9	24.4	204.4	126.7	97.8	1,013.0
1944	126.3	233.3	49.6	11.4	0.0	72.4	0.0	0.0	84.0	101.9	94.8	90.2	863.9
1945	124.2	45.4	252.9	44.3	0.0	0.0	0.0	0.0	7.6	34.5	25.7	89.7	624.3
1946	198.2	165.8	61.1	0.0	8.9	0.0	0.0	0.0	40.9	82.8	175.7	141.5	874.9
1947	148.5	109.2	30.2	47.6	8.4	11.4	12.2	0.0	34.3	81.8	141.3	118.9	743.8
1948	43.2	275.6	44.8	30.3	0.0	0.0	0.0	0.0	73.9	84.2	156.8	60.4	769.2
1949	95.0	79.8	84.9	87.8	38.1	16.5	0.0	0.0	44.2	86.5	122.6	86.8	742.2
1950	85.6	37.1	61.4	4.8	0.0	0.0	0.0	3.6	0.0	47.0	78.0	259.6	577.1
1951	68.4	33.1	97.3	71.5	0.0	0.0	17.5	88.1	11.2	165.8	10.9	184.4	748.2
1952	43.7	50.1		52.6	0.0	11.4	18.0	0.0	14.5	13.4	139.5	117.1	460.3
1953	88.2	81.4	59.4	0.0	0.0	0.0	0.0	9.7	26.4	37.0	85.6	34.2	421.9
1954	72.1	104.7	44.7	41.4	58.4	0.0	0.0	31.6	49.0	55.0	128.0	50.0	634.9
1955	190.2	64.1	66.3	46.0	38.5	13.5	0.0	0.0	0.0	213.7	135.5	186.0	953.8
1956	14.0	234.4	94.5	0.5	37.5	0.0	12.0	0.0	35.5	83.2	127.5	155.5	794.6
1957	94.0	150.5	51.5	155.5	0.0	18.0	74.0	21.7	211.1	101.1	35.7	51.0	964.1
1958	235.2	131.0	25.0	59.0	0.0	0.0	0.0	0.0	87.5	47.9	224.2	97.5	907.3
1959	186.5	80.0	83.3	8.0	83.0	0.0	0.0	11.0	74.0	65.0	72.0	115.0	777.8
1960	52.5	126.5	49.0	38.0	0.0	0.0	0.0	11.8	53.0	92.7	182.1	235.0	840.6
1961	42.5	9.5	55.0	65.7	9.0	40.5	0.0	0.0	49.5	0.0	119.0	101.7	492.4
1962	30.0	0.0	94.5	153.5	0.0	0.0	0.0	0.0	8.5	72.1	175.0	119.5	653.1
1963	75.5	26.5	206.2	74.1	0.0	141.0	133.0	0.0	0.0	0.0	125.0	25.0	806.3
1964	159.5	-	19.0	56.0	0.0	0.0	0.0	0.0	0.0	219.0	147.0	124.3	-
1965	35.2	19.8	10.0	0.0	21.5	0.0	0.0	44.5	16.0	62.5	72.3	6.5	**288.3** (Min)
1966	202.0	54.5	14.0	50.5	28.0	4.0	4.6	11.0	0.0	78.0	89.0	86.1	621.7
1967	90.5	208.0	62.0	2.0	0.0	0.0	0.0	0.0	0.0	78.0	152.5	114.0	707.0
1968	120.2	103.0	116.0	36.9	3.0	0.0	0.0	47.0	0.0	66.0	140.5	69.0	701.6
1969	83.0	12.3	186.9	87.5	50.0	0.0	3.5	0.0	69.5	195.1	74.5	112.9	875.2
1970	64.0	42.5	0.0	40.0	17.5	16.5	1.0	35.0	46.5	96.5	88.0	-	-
1971	-	-	-	72.0	80.5	0.0	11.0	4.0	35.0	124.0	104.7	151.4	582.6
1972	187.2	225.5	79.2	14.2	71.0	12.5	0.0	7.5	16.2	36.7	115.7	56.0	821.7
1973	61.0	-	-	-	-	-	0.0	53.5	115.5	67.5	143.0	122.0	-
1974	191.0	43.5	61.5	76.0	11.0	11.0	61.5	1.5	5.5	43.0	211.0	168.5	885.0
1975	217.5	128.5	66.0	126.5	1.5	6.5	0.0	5.0	83.0	60.0	130.0	168.5	993.0
1976	120.5	150.5	92.0	50.0	54.0	0.0	0.5	7.0	6.0	115.0	84.0	77.5	757.0
1977	155.5	173.0	65.0	26.5	12.5	0.0	0.0		68.0	71.0	75.5	84.5	-
1978	201.0	192.5	113.0	48.0	21.0	2.5	20.5	27.0	39.0	166.0	126.0	103.5	1,060.0
1979	59.0	40.5	52.0	73.0	14.0	0.0	13.0	36.0	58.0	84.0	155.5	133.5	718.5
1980	145.0	149.5	14.5	18.0	16.0	0.0	0.0	13.0	75.0	24.5	174.0	134.0	763.5
1981	162.5	107.0	16.5	9.5	89.0	20.5	0.0	0.0	78.0	77.5	111.5	58.5	730.5
1982	97.5	54.0	94.0	109.5	0.5	2.0	14.0	0.0	5.5	142.5	89.5	86.0	695.0
1983	59.0	15.0	82.5	96.0	23.5	5.5	8.5	67.0	-	-	-	-	-
1984	-	-	-	-	-	-	94.0	46.0	28.0	134.0	75.0	117.5	-
1985	100.0	354.0	45.0	9.5	0.0	0.0	0.0	0.0	29.0	117.5	26.5	69.0	750.5
1986	148.5	83.5	64.5	41.5	0.0	23.0	0.0	0.0	11.9	35.5	83.0	-	-
1987	58.1	44.1	130.9	79.5	0.0	18.5	0.0	75.8	169.5	131.0	147.1	30.0	884.5
1988	121.0	187.5	84.6	38.5	9.0	24.0	15.0	17.6	29.6	179.4	31.2	312.8	1,050.2
1989	66.2	259.2	39.5	0.0	25.1	72.7	0.0	0.0	91.8	127.2	185.7	184.4	1,051.8
1990	143.6	-	95.3	-	0.0	0.0	0.0	27.5	-	-	72.5	146.4	-
1991	106.2	215.0	108.0	-	104.0	62.5	-	-	-	28.2	113.0	-	-
1995	-	-	-	-	-	-	-	-	-	110.1	188.4	221.8	-
1996	174.3	-	-	-	-	-	-	-	-	69.0	-	-	-
1997	-	-	-	-	17.5	30.2	18.5	-	-	-	-	-	-
1998	-	73.0	17.1	-	-	-	-	-	-	-	115.5	162.5	-
1999	17.4	43.7	31.1	34.4	-	2.3	0.0	37.9	10.1	-	96.9	253.8	-
2000	239.2	653.9	469.7	65.5	-	-	-	-	-	-	-	-	-
Average	114.29	112.76	86.09	46.33	21.12	13.37	11.59	15.97	44.06	82.58	112.93	121.89	782.98

* -: No Data

(3) Mankayane Station (TA3)

Data Type: Precip Total Mly Data Measered In: Milimetres

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total	
1961	5.0	83.0	71.5	53.5	16.0	24.0	5.0	11.0	35.0	82.5	135.5	99.4	621.4	
1962	75.5	29.9	101.5	59.0	0.0	0.0	0.0	19.3	55.4	126.5	154.5	139.2	760.8	
1963	150.0	144.5	58.0	39.0	0.0	147.4	83.0	0.0	7.5	110.1	142.5	40.5	922.5	
1964	181.7	81.8	19.0	47.9	0.0	2.5	0.0	0.5	3.0	97.0	71.5	55.0	559.9	
1965	18.0	14.0	30.0	29.0	0.0	0.0	0.0	41.5	35.5	54.5	92.5	100.3	**415.3**	(Min)
1966	196.4	189.0	2.5	41.5	33.0	35.5	0.0	15.5	27.0	64.5	116.5	137.2	858.6	
1967	114.0	307.0	90.5	92.5	5.5	3.5	13.5	0.0	9.0	46.5	77.0	67.7	826.7	
1968	229.9	38.0	135.0	44.5	4.0	8.0	0.0	33.0	6.5	15.0	165.0	81.5	760.4	
1969	105.5	46.5	195.5	115.5	53.0	0.0	14.5	0.0	110.0	230.8	108.5	362.5	1,342.3	
1970	28.9	158.5	18.0	13.0	57.0	6.0	3.5	39.7	28.5	111.0	67.8	85.3	617.2	
1971	239.3	86.0	137.0	76.0	62.5	12.0	16.6	0.0	25.1	166.6	88.8	127.0	1,036.9	
1972	203.5	245.0	130.5	13.0	97.8	12.0	0.0	9.0	15.0	25.4	120.5	54.0	925.7	
1973	103.5	252.0	57.0	84.0	1.0	2.6	0.0	25.5	93.1	72.0	138.0	171.5	1,000.2	
1974	206.5	33.3	58.0	142.0	0.0	11.0	74.0	0.0	0.0	37.0	196.5	212.5	970.8	
1975	156.5	120.5	94.0	45.6	0.0	3.0	2.5	0.0	30.7	53.5	153.5	179.0	838.8	
1976	94.0	215.5	94.5	87.5	45.5	0.0	5.5	0.0	0.0	100.0	83.5	58.5	784.5	
1977	72.0	161.5	98.0	30.5	4.0	0.0	0.0	0.0	107.5	11.0	158.5	41.5	684.5	
1978	273.5	124.5	96.5	84.0	17.5	0.0	49.5	14.0	70.5	107.5	185.0	56.0	1,078.5	
1979	117.0	78.0	103.5	59.5	0.0	0.0	6.0	53.5	44.0	100.0	212.0	166.1	939.6	
1980	117.1	233.4	36.9	32.0	10.0	0.0	0.0	19.0	97.5	35.5	171.4	111.0	863.8	
1981	122.0	116.5	80.0	7.0	31.0	23.5	0.0	33.0	36.6	43.0	113.0	68.0	673.6	
1982	98.1	98.9	32.5	84.0	0.0	0.0	6.1	0.0	0.0	92.9	59.0	66.5	538.0	
1983	93.0	50.0	142.5	35.0	36.5	0.0	6.5	68.5	0.0	36.5	232.5	84.5	785.5	
1984	630.5	9.0	105.5	24.0	1.6	26.0	79.9	21.5	33.0	142.2	130.3	97.1	1,300.6	
1985	136.5	287.0	64.5	4.5	14.5	0.0	0.0	0.0	54.5	89.5	88.2	145.5	884.7	
1986	181.3	92.5	119.0	97.0	8.0	11.0	0.0	5.5	14.7	52.5	41.0	176.5	799.0	
1987	93.5	27.0	163.5	51.6	0.0	13.5	0.0	72.5	147.3	142.0	154.0	85.5	950.4	
1988	53.5	204.1	84.0	50.0	6.0	24.5	18.5	7.5	38.5	236.5	53.0	344.5	1,120.6	
1989	100.0	251.0	70.0	6.5	26.0	71.0	0.0	0.0	9.0	108.0	162.0	75.5	879.0	
1990	116.0	114.5	105.0	115.0	4.5	0.0	0.0	19.0	-	49.0	49.0	-	-	
1991	273.0	276.9	170.5	0.0	41.0	66.0	27.0	0.0	17.0	50.5	104.0	167.0	1,192.9	
1992	46.0	78.5	86.5	33.5	0.0	15.0	0.0	0.0	26.5	-	74.0	109.7	-	
1993	94.5	155.0	170.5	15.5	29.0		1.5	119.0	16.5	84.5	92.5	120.0	898.5	
1994	119.5	13.0	113.5	28.0	11.5	0.0	0.0	-	21.0	39.0	95.0	189.5	-	
1995	129.0	26.5	77.0	26.0	2.5	8.0	0.0	0.0	3.5	156.0	135.5	248.3	812.3	
1996	200.0	281.9	111.3	40.9	27.2	0.0	34.0	15.0	6.7	118.7	34.9	92.0	962.6	
1997	176.7	80.0	104.3	27.0	0.0	50.5	4.0	15.5	37.5	110.8	182.5	53.8	842.6	
1998	223.0	106.0	167.0	43.0	10.5	0.0	10.5	10.0	63.0	153.3	216.8	295.5	1,298.6	
1999	83.9	71.0	54.1	23.8	10.3	0.5	6.3	31.2	31.0	74.9	165.6	175.9	728.5	
2000	253.7	319.0	193.7	86.5	71.6	12.2	2.0	0.0	59.2	69.0	335.2	367.8	**1,769.9**	(Max)
2001	14.5	140.7	78.1	115.1	12.6	0.0	-	-	-	-	-	-	-	
Average	144.54	132.70	95.62	51.30	18.32	14.73	11.75	17.94	36.32	89.63	128.93	136.12	877.90	

* -: No Data

E.2 Daily Rainfall

(1) Matspha Station (TA1)

Year 1996

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	0.0	0.0	1.6	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
2	0.0	0.0	0.0	4.8	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
3	0.0	0.0	46.4	3.0	0.0	0.0	0.0	6.6	0.2	0.0	0.0	0.2
4	0.0	0.0	12.2	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.6
5	0.0	0.0	0.0	0.2	5.1	0.0	0.0	0.0	0.0	0.0	0.0	11.4
6	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.2	0.1
7	0.0	0.0	0.0	0.0	0.0	0.0	18.7	0.0	0.0	0.0	0.0	75.6
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	7.6	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.8	0.2	5.4
10	5.8	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
11	3.5	9.8	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	9.6	83.6	6.2	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
13	0.0	1.4	0.4	0.0	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	15.0	12.2	3.4	0.0	0.3	0.0	0.0	0.0	2.0	0.2	17.9	0.0
15	28.0	6.3	0.0	0.0	23.6	0.0	0.0	0.0	0.0	0.0	3.8	5.7
16	1.5	12.8	0.4	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	17.7
17	0.0	4.6	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	5.9	0.0
18	1.1	0.0	0.0	12.7	0.0	0.0	0.0	2.4	0.0	0.0	0.1	5.4
19	47.3	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	13.1	14.0
20	10.6	0.0	0.0	0.0	0.0	0.0	0.0	10.6	0.0	3.1	6.0	0.2
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
22	5.6	7.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	1.2
23	0.0	0.8	8.5	0.0	0.0	0.0	4.8	0.0	0.0	50.3	0.0	5.6
24	0.0	97.8	0.0	0.0	0.0	0.0	4.4	0.0	5.8	4.8	0.5	0.0
25	0.0	3.5	0.0	0.0	0.1	0.0	0.0	0.0	0.4	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
27	0.0	4.2	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0
28	166.2	0.3	0.0	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
29	0.0		0.0	7.7	0.0	0.0	0.0	0.0	0.0	0.9	0.2	0.0
30	0.0		0.0	0.0	0.0	0.0	1.7	0.0	0.0	8.5	0.0	0.0
31	0.0		0.0		0.0		0.0	0.0		5.4		0.4
Total	301.8	265.6	89.9	38.7	53.9	0.1	29.6	26.5	8.4	125.4	53.7	148.9

(1) Matspha Station (TA1)

Year 1997

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	0.0	0.0	0.9	0.6	0.0	0.0	14.8	0.2	6.9	0.0	0.0	7.4
2	31.5	15.5	0.0	0.2	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0
3	0.7	9.4	0.0	2.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
4	0.3	0.0	6.4	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	1.2
5	2.8	0.0	41.2	2.0	1.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0
6	1.8	0.0	12.5	0.0	0.0	0.0	0.0	23.4	0.0	0.0	0.0	12.5
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
8	0.0	20.1	3.5	0.0	0.0	0.0	0.0	0.0	9.2	1.4	3.8	7.9
9	0.0	34.1	1.1	0.0	5.8	0.0	0.0	0.0	16.1	27.2	0.0	3.7
10	44.0	0.5	21.3	20.3	0.0	0.0	0.0	0.0	3.7	7.9	1.7	0.0
11	15.2	0.0	4.1	0.0	0.3	0.0	0.0	0.0	1.8	0.0	3.1	3.5
12	54.4	0.0	0.6	0.0	0.0	3.2	0.0	0.0	1.1	8.2	11.4	16.8
13	6.4	5.9	2.8	0.0	0.0	11.2	0.0	0.0	6.6	3.4	12.2	0.0
14	0.5	3.2	1.2	0.0	0.0	0.0	0.0	0.0	5.1	3.4	1.1	0.0
15	8.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	7.2	2.1	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.6	0.0	0.0
17	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	3.4	1.6	0.0
18	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.4	4.4
19	2.5	0.0	0.0	0.0	0.0	0.0	8.3	0.0	2.1	0.0	0.6	5.3
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0
21	0.0	0.0	21.6	8.2	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
22	0.0	0.0	24.3	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0
23	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0
24	2.8	2.0	0.0	0.0	0.0	0.0	0.0	2.3	0.8	0.0	0.0	0.0
25	0.0	0.0	11.5	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.0	0.0
26	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	12.5	11.2	0.3
27	0.7	12.2	1.9	0.0	4.7	0.0	0.0	0.0	0.0	1.6	24.7	4.3
28	0.0	4.2	2.7	0.0	0.0	0.0	0.7	0.0	0.0	0.4	7.9	3.1
29	0.0		8.4	0.0	17.6	0.0	0.0	0.0	0.0	7.8	16.7	0.0
30	0.0		0.0	0.0	0.7	4.8	6.6	0.0	0.3	0.0	25.7	0.0
31	0.0		0.3		0.0		0.0	0.0		0.0		0.0
Total	178.6	107.5	167.8	33.8	33.4	19.2	30.4	25.9	64.7	111.9	140.2	70.9

(1) Matspha Station (TA1)

Year 1998

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	34.7	0.8	5.4	2.7	0.0	0.0	0.0	0.2	0.0	2.0	1.2	1.5
2	5.8	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	1.6	1.4	1.5
3	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	35.9
4	0.0	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.5
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
6	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	2.4	0.0
7	37.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	24.4	0.0
8	7.0	0.0	0.8	10.4	0.0	0.0	0.0	0.0	0.0	19.3	0.0	29.1
9	1.2	0.8	2.1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.9
10	0.0	0.2	3.7	0.0	0.0	0.0	0.3	0.0	0.0	0.0	14.2	0.2
11	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	23.2
12	0.0	0.1	4.4	0.0	0.0	0.0	0.0	0.0	7.8	3.8	1.5	0.4
13	3.7	0.0	5.3	0.0	0.0	0.0	0.0	0.0	1.7	1.3	0.0	7.0
14	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.9	0.0	26.5
15	0.0	0.0	0.7	0.6	0.0	0.0	0.0	0.0	0.0	55.5	0.0	28.2
16	0.0	9.4	0.0	2.2	2.1	0.0	0.0	0.0	0.0	11.1	0.0	0.0
17	0.0	16.6	0.6		0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
18	0.0	23.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1.0	8.7	0.0
19	2.7	23.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.2	0.5
20	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0
21	42.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	41.5
22	0.0	12.2	0.0	0.0	0.0	0.0	6.6	0.0	0.0	3.2	4.0	0.0
23	10.2	9.4	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.0	0.0	0.2
24	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
25	3.6	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	0.0
26	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.7	13.9	3.8	3.6
27	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	4.6	0.6
28	0.0	1.0	0.0	0.0	6.7	0.0	0.0	0.0	0.2	0.0	0.0	2.5
29	0.0		2.3	0.0	0.0	0.0	0.6	0.0	15.0	0.0	0.0	0.0
30	30.9		0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	1.0	16.4
31	0.0		0.0		0.0		0.0	0.0		0.5		2.6
Total	189.6	108.7	53.0	20.6	8.8	0.0	12.7	0.2	37.8	143.1	103.0	247.1

(1) Matspha Station (TA1)

Year 1999

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	2.5	28.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.5	0.0	0.0
3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	88.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4
5	0.0	18.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
6	0.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.3
7	14.3	0.0	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3
8	1.2	27.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	1.6
9	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0
10	0.0	0.9	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
11	2.4	0.0	0.4	6.9	0.0	0.0	1.8	0.0	0.0	0.0	0.0	1.6
12	0.8	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8
13	0.0	0.0	2.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	3.6
14	0.0	0.0	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8
15	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	8.0	0.0	11.5	0.0	0.0	0.0	0.0	0.0	2.7	0.0
17	0.0	0.0	18.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	2.6	0.0	2.4	0.0	0.0	5.7	0.0	0.0	0.0	1.2	2.1	0.0
19	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0
20	1.0	18.2	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	14.0	0.0
21	0.0	12.0	2.6	0.0	3.4	0.0	0.0	0.0	0.0	1.8	0.0	24.2
22	9.5	0.4	0.0	4.0	0.0	0.0	0.0	0.0	7.3	9.6	0.0	22.3
23	0.0	0.0	2.6	2.2	0.0	0.0	0.0	19.8	0.0	0.0	0.0	0.0
24	0.0	0.0	19.6	0.0	0.0	0.0	1.0	9.8	0.0	0.0	0.0	3.5
25	0.0	0.0	3.2	3.0	0.0	0.0	0.0	0.0	0.0	44.8	2.6	0.0
26	0.0	0.0	0.4	4.8	0.0	0.0	0.0	0.3	0.0	17.5	0.3	11.6
27	1.9	0.0	0.0	19.7	0.0	0.0	0.0	0.0	3.0	9.2	0.7	14.5
28	0.0	0.0	0.0	18.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8
29	0.0		0.6	2.0	0.0	0.0	0.0	0.0	0.4	0.5	24.3	7.5
30	4.4		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	1.5
31	28.9		3.6		0.0		0.0	0.0		0.0		0.0
Total	71.8	200.6	103.5	61.3	17.3	5.7	2.8	32.4	13.5	88.5	66.2	138.6

(1) Matspha Station (TA1)

Year 2000

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	13.5	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
2	3.6	0.0	1.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
3	6.6	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	3.5	0.0
4	2.5	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	1.6	14.0	2.3
5	0.7	0.0	0.0	23.6	3.9	1.0	0.0	0.1	0.0	0.1	0.0	0.0
6	15.7	16.8	0.0	14.8	21.9	0.0	0.0	0.0	0.0	5.8	0.3	0.0
7	11.1	53.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
8	38.4	22.4	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.4
9	10.2	10.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	2.5
10	0.0	13.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	1.4
11	0.0	15.4	3.2	0.0	0.0	0.0	0.0	0.0	0.2	1.8	45.5	5.6
12	0.0	5.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0	2.6	0.0	21.0
13	0.0	2.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	3.5	0.0
14	0.0	23.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.6	0.0	0.0	0.8	0.0	0.0	0.0	0.0	1.5	0.0	2.4	0.0
16	26.0	7.2	6.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0
17	24.8	3.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.4	0.0
18	1.4	0.5	21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
19	0.0	0.4	18.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	21.5	0.0
20	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	10.4	0.0	10.4	0.0
21	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	16.3	0.0	7.0	15.5
22	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.4	2.2	1.4	14.7
23	0.0	0.3	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0
24	0.0	8.6	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	23.2	0.0	0.0	6.2	0.0	0.0	0.0	0.0	6.5	26.5	12.7
26	0.0	3.5	0.0	0.0	17.5	0.0	0.0	0.0	0.0	23.5	0.6	40.8
27	0.7	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.8
28	4.2	1.3	0.0	3.8	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0
29	4.5	2.8	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	1.8		10.5	0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.9	0.0
31	0.0		7.4		0.0		0.0	0.0		4.4		0.0
Total	166.3	213.1	93.7	51.8	51.2	5.6	2.8	0.1	34.3	59.6	192.6	117.7

(2) Nhlagano Station (TA2)

Year 1996

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	0.0	0.0	0.0	1.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.9	3.7	0.0	0.0	0.0	0.0	0.0	1.2	1.6	0.0
3	0.0	16.5	47.0	1.1	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
4	0.0	0.0	12.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	11.8
5	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	2.5	0.0
6	0.0	0.0	0.0	0.1	0.4	0.0	10.7	0.0	0.0	0.0	0.7	41.5
7	1.2	0.0	0.0	0.0	0.0	0.0	16.5	0.0	0.0	0.0	0.4	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
9	15.0	10.3	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	3.8
10	0.0	11.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
11	0.0	113.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	2.5	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	10.5	0.0
13	20.3	11.2	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
14	0.0	8.0	0.5	0.0	0.0	0.0	0.0	0.0	0.4	0.0	1.8	1.2
15	0.0	3.5	3.3	0.0	19.8	0.0	0.0	0.0	0.0	1.2	0.0	20.1
16	10.7	0.7	0.0	0.0	17.3	0.0	0.0	0.0	0.0	0.0	5.7	0.0
17	2.3	0.0	0.0	1.2	0.4	0.0	0.0	0.0	0.0	0.0	22.2	1.5
18	0.0	0.2	0.0	13.2	0.0	0.0	0.0	3.0	0.0	0.0	0.0	9.5
19	12.7	0.0	0.0	0.0	0.0	0.1	0.0	1.3	0.0	0.7	0.0	0.0
20	10.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.5	0.6	50.2	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.4	19.5
22	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	50.0	0.0	0.0
23	0.0	24.0	0.6	0.0	0.0	0.0	0.0	0.0	1.5	17.0	0.0	0.0
24	43.2	0.5	7.8	0.0	1.5	0.0	0.0	0.0	0.0	1.8	0.6	10.2
25	18.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	31.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	0.0
27	16.3	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.0
28	0.4	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	6.2	0.0	0.0
29	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.7	0.0	0.0
31	0.0		0.0		0.0		0.0	0.0		0.0		32.0
Total	182.1	202.2	103.0	26.6	40.8	0.3	30.4	10.5	2.4	105.5	107.3	154.1

(2) Nhlagano Station (TA2)

Year 1997

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	7.0	0.0	0.0	0.0	0.0	0.0	13.7	0.0	7.0	-	-	-
2	0.0	0.0	3.4	5.4	0.0	0.0	0.0	7.6	1.5	-	-	-
3	3.5	0.0	0.1	28.2	2.7	0.0	0.0	2.5	0.0	-	-	-
4	5.0	0.0	1.5	0.0	0.5	0.0	0.0	0.0	0.0	-	-	-
5	0.0	0.0	20.2	21.0	0.0	0.0	0.0	0.0	1.2	-	-	-
6	0.0	0.0	5.5	0.0	0.0	0.0	0.0	19.6	0.0	-	-	-
7	0.0	0.0	75.0	0.0	0.0	0.0	0.0	0.0	1.7	-	-	-
8	0.0	15.0	4.5	0.0	0.0	0.0	0.0	0.0	7.5	-	-	-
9	23.6	9.0	19.0	0.0	7.0	0.0	0.0	0.0	6.4	-	-	-
10	22.5	0.0	2.8	0.0	0.0	0.0	0.0	0.0	5.4	-	-	-
11	42.2	0.0	0.0	0.0	4.2	0.0	0.0	0.0	1.6	-	-	-
12	0.0	4.5	0.0	0.0	0.0	5.5	0.0	0.0	4.4	-	-	-
13	0.0	28.0	2.4	0.0	0.0	13.5	0.0	0.0	3.0	-	-	-
14	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	-	-	-
15	3.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-
16	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-
17	3.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-
18	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-
20	0.0	0.2	0.0	29.7	0.0	0.0	0.0	0.0	0.0	-	-	-
21	0.0	0.0	25.0	29.5	0.0	0.0	0.0	0.0	0.0	-	-	-
22	47.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-
23	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	-	-	-
24	0.0	1.5	0.0	0.0	0.0	0.0	0.0	1.2	-	-	-	-
25	0.0	0.0	12.2	0.0	0.0	0.0	0.0	0.0	-	-	-	-
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-
27	0.0	16.5	0.0	0.0	5.4	0.0	0.0	0.0	-	-	-	-
28	2.5	1.0	0.0	0.0	0.0	0.0	2.5	0.0	-	-	-	-
29	0.0		0.0	1.0	10.5	0.0	0.0	0.0	-	-	-	-
30	0.0		0.0	0.0	0.0	23.0	5.5	0.0	-	-	-	-
31	0.0		0.0		0.0		0.0	0.0		-		-
Total	162.6	78.3	172.6	114.8	30.3	42.0	21.7	30.9	43.9	0.0	0.0	0.0

* - : No Data

(2) Nhlagano Station (TA2)

Year 1998

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	35.5	0.0	20.4	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	4.5
2	1.1	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	4.8	0.0	7.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.2	0.0
6	36.5	0.0	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.5	0.0
7	16.5	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	19.6	44.7	0.0
8	17.2	0.0	43.5	0.0	0.0	0.0	0.0	0.0	0.0	16.2	0.0	1.0
9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	7.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
11	0.0	0.4	6.4	0.0	0.0	0.0	0.2	0.0	7.0	0.0	0.4	7.2
12	0.0	0.6	1.7	0.0	0.0	0.0	0.0	0.0	1.7	29.0	0.0	0.0
13	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3
16	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.5	0.0	0.0
17	0.0	21.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0
18	0.0	18.5	0.1	0.0	0.0	0.0	0.0	0.0	2.0	0.0	5.0	0.0
19	6.0	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	6.5	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	40.0
21	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	13.7
22	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	9.9	0.2
23	4.0	0.8	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.1
24	2.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.3
25	0.0	0.0	9.8	0.0	0.0	0.0	0.0	1.7	0.0	0.0	4.5	0.0
26	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.0	0.0
27	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	1.5	0.5
29	0.0		0.0	0.0	10.0	0.0	0.0	0.0	11.6	0.2	0.5	0.0
30	0.0		0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	2.0	19.6
31	0.0		0.0		0.0		0.3	0.0		0.0		0.0
Total	131.2	61.8	91.8	3.8	14.0	0.0	9.9	1.7	34.8	117.8	171.5	210.5

(2) Nhlagano Station (TA2)

Year 1999

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	3.1	7.5	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
2	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
6	0.0	0.0	3.5	0.0	0.7	0.0	0.0	0.0	0.0	0.0	4.0	4.0
7	21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5
8	2.5	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	2.0	0.0	1.5
9	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
11	0.0	0.0	0.0	14.0	0.0	0.0	0.4	0.0	0.7	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	12.0
13	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.0
14	0.2	0.0	0.0	0.0	0.0	0.0	0.0	10.5	0.0	0.0	0.0	0.7
15	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	0.0
17	0.0	0.0	5.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
19	6.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
20	0.8	14.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	7.0
21	0.0	1.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	42.2
22	0.0	0.0	0.0	0.0	21.3	0.0	0.0	0.0	11.0	45.0	0.0	19.0
23	0.0	1.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.0
24	0.0	0.0	3.2	0.0	0.0	0.0	0.0	11.5	0.0	4.0	0.0	1.5
25	0.0	0.0	1.8	0.0	0.0	0.9	0.6	22.5	0.0	16.0	24.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.5	5.0	0.0
27	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	3.0	31.0	0.0	0.0
28	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.0
29	0.0		0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	31.0	15.0
30	0.0		1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0
31	0.0		2.2		0.0		0.0	0.0		0.0		0.0
Total	40.2	29.5	32.7	39.9	28.4	0.9	1.0	49.5	15.9	118.5	125.3	218.2

(2) Nhlagano Station (TA2)

Year 2000

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	13.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	15.2	0.0
2	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.5	0.0
3	0.0	9.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.5	0.0
4	9.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.5	3.5	0.0	1.6
5	1.5	0.0	0.0	23.0	4.0	2.5	0.0	0.0	0.0	0.0	0.0	0.5
6	11.2	3.5	0.0	18.2	17.5	0.0	0.0	0.0	0.0	49.5	0.0	0.0
7	6.0	19.0	3.2	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	114.5	8.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	52.0
9	0.2	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	15.5	0.0
10	0.0	11.5	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.5	0.0
11	0.0	18.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	2.0	9.5	0.0
12	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	30.5
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.3	12.5	0.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0
15	1.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0
16	43.5	38.0	1.3	8.5	0.0	0.0	0.0	0.0	0.0	0.0	10.5	0.0
17	20.0	2.2	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0
18	1.5	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.5	0.6	6.0	0.8	0.0	0.0	0.0	0.0	6.0	4.0	3.0	0.0
20	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	21.2	0.2	26.5	0.0
21	0.0	0.0	9.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	25.0	27.4
22	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	1.0	0.7	2.3	25.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.5	0.0
24	0.0	7.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	25.2	0.0	0.0	6.7	0.0	0.0	0.0	0.0	0.6	2.0	0.0
26	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.5	0.0	0.0
27	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	40.0
28	1.8	3.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
29	0.0	1.7	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0
30	0.0		9.2	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.3	0.0
31	0.0		30.2		0.0		0.0	0.0		1.5		0.0
Total	232.7	183.8	77.4	84.4	31.7	8.0	0.0	0.0	54.6	105.8	242.7	177.0

(3) Mankayane Station (TA3)

Year 1996

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	5.0	55.5	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
6	0.0	6.6	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	3.5	0.0
7	0.0	6.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	26.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.5
11	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	10.5	146.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	4.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	13.3	0.0	0.0
14	0.0	14.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0
15	0.0	10.0	3.4	7.0	0.0	0.0	0.0	0.0	0.0	3.5	7.0	0.0
16	0.0	24.5	3.0	0.0	0.0	0.0	0.0	0.0	1.2	2.5	0.0	14.0
17	10.5	4.5	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	10.5	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	26.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0
21	0.0	0.0	2.5	0.0	0.0	0.0	0.0	2.4	0.0	1.5	0.0	0.0
22	41.6	1.6	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	7.4	0.0	0.0	1.2	0.0	0.0	0.0	0.0	41.0	0.0	22.5
24	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	34.5	0.0	0.0
25	0.0	0.0	11.9	0.0	0.0	0.0	5.0	0.0	0.0	10.5	0.0	0.0
26	77.5	23.5	0.0	0.0	0.7	0.0	0.0	0.0	5.5	0.0	0.0	0.0
27	0.0	25.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0
28	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	56.2		3.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9	1.0	0.0
30	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0	0.0
31	0.0		0.0		0.0		0.0	0.0		12.5		0.0
Total	200.8	279.0	111.3	36.5	27.2	0.0	34.0	15.0	6.7	145.2	34.9	92.0

(3) Mankayane Station (TA3)

Year 1997

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-
2	34.5	0.0	0.0	19.5	-	-	-	-	-	-	-	-
3	1.0	0.0	5.5	0.0	-	-	-	-	-	-	-	-
4	0.0	0.0	8.4	13.5	-	-	-	-	-	-	-	-
5	0.0	0.0	9.0	0.0	-	-	-	-	-	-	-	-
6	16.5	0.0	0.5	0.0	-	-	-	-	-	-	-	-
7	0.0	0.0	0.0	3.0	-	-	-	-	-	-	-	-
8	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-
9	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-
10	45.0	12.5	19.5	-	-	-	-	-	-	-	-	-
11	0.0	0.0	8.0	-	-	-	-	-	-	-	-	-
12	0.0	0.0	4.5	-	-	-	-	-	-	-	-	-
13	48.5	0.0	2.5	-	-	-	-	-	-	-	-	-
14	0.0	2.0	0.5	-	-	-	-	-	-	-	-	-
15	1.4	0.0	0.0	-	-	-	-	-	-	-	-	-
16	1.5	0.0	0.0	-	-	-	-	-	-	-	-	-
17	4.5	0.0	0.0	-	-	-	-	-	-	-	-	-
18	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-
19	0.0	0.0	27.0	-	-	-	-	-	-	-	-	-
20	10.4	0.0	0.0	-	-	-	-	-	-	-	-	-
21	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-
22	0.0	0.0	5.4	-	-	-	-	-	-	-	-	-
23	11.0	0.0	7.5	-	-	-	-	-	-	-	-	-
24	2.4	2.0	1.5	-	-	-	-	-	-	-	-	-
25	0.0	0.0	4.5	-	-	-	-	-	-	-	-	-
26	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-
27	0.0	60.5	0.0	-	-	-	-	-	-	-	-	-
28	0.0	3.0	0.0	-	-	-	-	-	-	-	-	-
29	0.0		0.0	-	-	-	-	-	-	-	-	-
30	0.0		0.0	-	-	-	-	-	-	-	-	-
31	0.0		0.0		-		-	-		-		-
Total	176.7	80.0	104.3	-	-	-	-	-	-	-	-	-

* - : No Data

(3) Mankayane Station (TA3)

Year 1998

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	30.0	0.0	69.0	2.0	0.0	0.0	0.0	0.0	0.0	13.5	0.0	51.5
2	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.0
4	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
6	67.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.0	0.0
7	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0
8	22.5	0.0	14.0	12.5	0.0	0.0	0.0	0.0	0.0	9.5	0.0	17.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	58.5
10	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	6.0	0.0	11.5	0.0
11	0.0	0.0	30.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
12	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	9.5	0.0	0.0
13	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	11.0	0.0	0.0
14	1.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	52.0
15	0.0	0.0	28.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.5
16	0.0	18.5	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	33.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
19	3.5	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.5	5.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	0.0
21	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.0
22	0.0	2.5	0.0	0.0	0.0	0.0	6.0	0.0	0.0	3.0	0.0	0.0
23	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	50.5	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	2.5
25	20.5	0.0	18.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.0	20.5	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.8	0.0
28	0.0	0.0	0.0	0.0	10.5	0.0	0.0	0.0	24.0	0.0	0.0	17.1
29	0.0		0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0
30	14.5		3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.5	25.0
31	0.0		0.0		0.0		0.0	0.0		0.0		2.0
Total	213.0	106.0	167.0	43.0	10.5	0.0	6.0	10.0	49.5	166.8	165.3	346.6

(3) Mankayane Station (TA3)

Year 1999

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	0.0	38.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	4.0	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0
5	0.0	27.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
7	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
8	0.0	2.9	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.9	3.5
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	3.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11.0	0.0	0.0	3.4	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0
13	18.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
15	0.0	1.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	7.5	0.0
17	0.0	0.0	15.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	3.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	6.0	0.0
19	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
21	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	36.5
22	0.0	25.9	0.0	0.0	0.0	0.0	0.0	0.0	25.0	15.0	1.8	18.0
23	0.0	3.5	7.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.9
24	0.0	0.0	2.5	0.0	0.0	0.0	0.0	7.0	0.0	0.0	3.9	0.0
25	0.0	0.0	2.0	0.0	0.0	0.0	1.8	22.5	0.0	41.0	5.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	11.0	7.0	0.0
27	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	5.0	2.4	0.0	0.0
28	4.0	0.0	0.0	9.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	26.0
29	0.0		0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	103.5	15.5
30	0.0		1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.5	0.0
31	0.0		7.5		0.0		0.0	0.0		0.0		41.4
Total	45.9	109.0	54.1	23.8	10.3	0.5	6.3	31.2	31.0	74.9	166.1	217.3

(3) Mankayane Station (TA3)

Year 2000

date/month	J	F	M	A	M	J	J	A	S	O	N	D
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	7.5
3	0.0	0.0	83.4	1.8	0.0	0.0	0.0	0.0	0.0	0.0	34.0	0.0
4	41.4	4.9	5.5	0.0	6.5	0.0	0.0	0.0	0.0	2.5	0.0	0.0
5	1.0	0.0	0.0	44.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	27.0	0.0	0.0	0.0	0.0	0.0	7.5	26.2	0.0
7	9.0	47.5	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	12.5	4.0	0.0	27.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	15.5	0.0
10	93.5	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	46.0	0.0
11	0.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	55.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	35.5
13	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	62.4	0.0
14	0.0	97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	6.0	0.0
16	0.0	50.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.8	0.0
17	86.5	0.0	0.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	20.7	0.0
18	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	9.5	0.0	0.0	0.0
20	0.0	0.0	49.4	0.0	0.0	0.0	0.0	0.0	19.5	1.2	49.5	0.0
21	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	27.3	0.0	0.0	0.0
22	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0	29.5	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
24	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	31.0	0.0	0.0	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	21.9	11.2	0.0	0.0	0.0	29.5	0.0	0.0
27	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	4.0	0.0
28	2.0	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	6.5	29.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0		14.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	14.6	0.0
31	1.3		7.0		0.0		0.0	0.0		8.2		277.3
Total	253.7	319.0	193.7	86.5	71.6	12.2	2.5	0.0	59.2	69.0	335.2	375.3

E.3 Temperature

(1) Mean Min at MATSPHA(TA1)

Data measured in : Degree C

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
1968		20.0	18.1	15.9	11.4	9.3	9.3	9.9	12.9	15.6	16.7	17.5	14.2
1969	18.8	17.5	17.1	13.9	11.9	6.4	9.5	10.5	12.9	14.2	15.4	18.3	13.9
1970	18.9	17.4	17.1	13.9	12.5	9.0	9.5	10.3	13.1	13.8	17.0	17.8	14.2
1971	18.2	17.7	18.0	15.9	11.2	8.1	8.6	10.0	13.7	14.4	14.8	16.9	14.0
1972	18.3	17.3	16.5	15.4	11.6	7.8	7.9	9.8	12.1	15.2	15.0	18.2	13.8
1973	18.7	17.5	18.7	14.2	11.1	8.7	8.4	9.6	12.3	14.3	15.8	16.8	13.8
1974	19.0	18.5	17.6	13.6	11.4	8.5	9.1	10.6	11.4	16.0	17.0	17.9	14.2
1975	18.2	18.4	16.1	14.4	12.2	8.3	8.0	10.1	14.0	13.7	16.0	17.0	13.9
1976	18.1	18.5	18.0	14.1	10.9	8.9	8.3	9.1	13.3	-	16.7	17.9	14.0
1977	18.2	19.1	17.0	15.9	11.1	9.5	7.9	10.4	13.9	-	16.4	18.9	14.4
1978	18.5	18.5	18.4	13.8	12.2	7.1	9.3	13.4	13.5	15.0	15.9	-	14.1
1979	17.9	19.0	16.9	15.3	11.7	9.4	8.4	11.4	12.9	15.6	16.2	16.8	14.3
1980	17.3	18.5	17.4	14.7	11.3	7.6	7.0	10.8	13.1	14.6	17.4	17.9	14.0
1981	20.5	19.0	17.2	14.7	11.8	7.8	9.4	10.6	12.4	12.6	17.6	17.3	14.2
1982	18.7	18.8	17.6	14.8	11.9	8.3	9.1	11.3	13.0	13.6	14.9	17.8	14.2
1983	18.7	18.3	17.5	16.2	13.0	10.2	9.9	9.7	13.4	14.3	-	18.0	14.5
1984	18.2	18.3	17.3	14.4	11.8	8.6	10.6	10.6	13.5	15.8	15.4	17.5	14.3
1985	17.6	19.1	18.0	15.2	11.8	9.6	9.1	11.3	13.8	15.7	16.8	17.9	14.7
1986	18.2	18.1	17.4	15.3	12.0	9.3	9.0	11.9	13.4	15.3	15.9	18.2	14.5
1987	18.6	20.2	18.3	16.4	13.0	9.2	8.8	10.6	13.9	14.0	17.0	19.7	15.0
1988	19.6	19.6	19.2	16.2	12.6	9.2	9.2	11.7	13.3	14.5	15.6	17.0	14.8
1989	18.2	18.1	18.3	14.7	12.9	10.5	9.6	12.1	12.8	14.5	16.2	17.8	14.6
1990	18.3	18.4	18.2	16.2	12.1	9.6	10.6	10.0	12.4	15.6	16.2	18.1	14.6
1991	19.4	18.9	17.7	13.8	12.5	10.0	9.8	10.5	14.5	16.1	16.9	17.8	14.8
1992	18.9	19.5	17.7	16.8	12.8	10.4	9.9	10.8	15.1	16.8	17.1	19.4	15.4
1993	19.1	18.8	17.7	16.4	13.7	9.2	11.3	11.0	14.1	16.4	16.7	18.4	15.2
1994	18.0	18.4	17.7	16.1	11.1	9.3	8.0	10.1	13.4	13.4	17.5	17.7	14.2
1995	19.3	19.2	18.3	15.2	11.4	9.4	9.7	12.2	14.2	16.5	16.9	17.0	14.9
1996	-	19.5	16.8	14.4	13.1	10.6	8.9	10.4	14.1	16.2	17.4	18.4	14.5
1997	18.8	18.9	18.4	14.0	8.3	9.7	10.3	11.8	14.8	14.5	16.7	17.9	14.5
1998	19.1	19.6	19.0	16.2	12.4	9.2	10.0	-	14.0	15.4	17.5	17.8	15.5
1999	19.3	18.1	18.4	15.9	12.8	9.7	9.6	11.1	13.3	13.8	17.9	19.3	14.9
2000	18.1	19.7	19.1	14.4	10.7	10.4	9.2	10.7	13.9	16.3	16.9	18.6	14.8
2001	18.6	18.6	18.7	17.0	12.9	10.6	-	-	-	-	-	-	16.1
Average	18.6	18.7	17.8	15.2	11.9	9.1	9.2	10.8	13.4	15.0	16.5	17.9	14.5

* -: No Data

(2) Mean Max at MATSPHA(TA1)

Data measured in : Degree C

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
1968		32.0	27.0	25.4	22.7	22.2	22.3	24.4	25.1	25.8	27.3	27.7	25.6
1969	29.6	27.9	24.6	22.3	23.6	19.9	22.8	23.1	25.0	26.9	24.4	29.3	25.0
1970	29.7	27.9	28.2	27.4	25.5	22.1	23.2	25.3	27.3	24.9	27.9	30.8	26.7
1971	28.5	27.5	29.0	26.1	23.4	21.7	23.2	24.9	26.4	26.1	25.0	26.9	25.7
1972	27.7	23.1	25.6	25.6	23.3	20.7	22.2	23.0	26.3	26.2	24.6	29.8	24.8
1973	28.5	27.7	28.3	23.7	23.6	22.4	22.6	23.3	24.8	25.8	25.6	25.5	25.2
1974	28.8	28.1	27.8	23.6	24.0	22.8	21.9	24.1	26.7	28.1	27.4	27.4	25.9
1975	27.3	25.7	25.5	25.3	24.8	22.1	22.8	23.7	24.7	24.3	25.6	25.9	24.8
1976	26.4	26.9	27.4	25.0	22.4	22.6	23.1	23.1	27.1	-	27.6	29.3	25.5
1977	31.1	28.2	25.2	26.8	25.6	24.3	23.1	23.2	25.6	-	27.2	29.7	26.4
1978	26.4	28.7	27.0	25.0	25.3	21.4	21.8	25.5	25.8	24.6	26.3	-	25.3
1979	28.7	30.8	27.8	27.3	24.3	22.8	21.6	24.6	23.8	26.2	26.5	27.6	26.0
1980	27.4	29.3	27.3	27.2	25.0	22.6	21.9	23.7	23.1	26.1	27.4	28.9	25.8
1981	31.1	26.7	26.9	26.8	23.2	22.2	22.6	22.2	22.9	23.3	27.3	27.0	25.2
1982	28.0	29.0	28.1	24.5	24.4	23.2	22.5	24.4	25.3	25.2	25.8	29.9	25.9
1983	29.7	28.7	28.7	28.0	24.9	23.3	23.1	22.7	27.5	24.4	-	27.9	26.3
1984	27.2	23.9	26.0	24.6	24.7	21.6	21.5	22.5	24.4	25.5	24.9	29.4	24.7
1985	28.9	29.0	27.8	26.5	23.1	23.3	22.8	25.2	-	28.2	-	27.4	26.2
1986	27.7	-	28.1	25.8	25.7	22.7	23.0	26.1	25.4	26.8	27.1	29.0	26.1
1987	28.5	31.1	28.0	26.0	26.3	21.7	22.0	22.9	23.0	23.2	25.8	28.6	25.6
1988	30.1	29.6	27.6	25.0	23.9	22.0	22.6	24.8	25.5	23.8	25.3	25.7	25.5
1989	27.6	25.7	27.9	25.4	24.8	22.1	22.8	26.5	25.6	26.0	25.8	27.6	25.7
1990	27.5	26.8	27.6	25.6	23.7	23.4	22.6	22.8	25.5	26.9	28.0	27.5	25.7
1991	28.8	28.4	26.0	26.6	24.2	20.7	22.4	24.3	25.6	27.8	28.6	27.3	25.9
1992	29.6	31.2	29.7	29.0	26.8	23.9	23.6	23.4	27.6	26.7	27.8	29.6	27.4
1993	29.5	27.4	26.3	26.7	24.7	22.8	23.3	23.0	27.3	24.5	26.2	29.0	25.9
1994	27.7	27.7	28.0	26.3	25.5	24.2	22.6	24.4	26.9	23.8	28.2	27.5	26.1
1995	28.6	29.8	27.5	25.0	23.1	22.8	23.2	22.3	27.5	27.4	26.0	25.9	25.8
1996		27.5	25.9	24.0	22.9	23.3	20.1	25.0	27.5	27.2	28.2	29.0	25.5
1997	28.5	27.6	26.4	24.7	19.9	23.7	21.5	-	23.9	24.7	26.5	27.0	24.9
1998	27.7	28.7	28.5	27.4	26.0	24.8	23.2	24.5	26.6	24.3	27.1	26.1	26.2
1999	28.9	28.1	26.9	25.7	25.5	21.7	23.2	24.4	25.1	25.2	27.6	27.0	25.8
2000	25.7	25.6	27.1	24.6	22.9	24.2	21.4	-	25.6	24.9	25.4	27.8	25.0
2001	27.8	27.6	27.5	25.8	24.6	22.6	-	-	-	-	-	-	26.0
Average	28.4	28.0	27.3	25.7	24.2	22.6	22.5	24.0	25.6	25.6	26.6	28.0	25.7

* -: No Data

(3) Mean Min at Nhlagano (TA2)

Data measured in : Degree C

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
1961	-	11.2	-	9.0	-	2.4	4.2	6.0	11.3	11.5	13.8	14.5	9.3
1962	15.4	14.6	14.6	11.9	8.2	6.5	6.2	9.1	11.0	13.8	14.0	15.3	11.7
1963	15.3	13.6	13.0	11.4	7.7	6.3	6.4	6.8	11.6	13.3	13.9	15.1	11.2
1964	15.8	14.7	15.9	11.7	9.1	5.6	-	7.1	9.8	12.2	13.1	14.7	11.8
1965	14.8	14.6	15.0	12.7	8.9	0.1	6.2	10.2	11.0	9.2	12.4	15.2	10.9
1966	17.0	13.7	14.0	10.4	8.3	7.2	7.6	8.4	9.3	12.2	13.2	15.2	11.4
1967	16.1	14.2	14.4	13.2	9.8	6.0	3.9	8.1	9.3	12.6	12.4	13.3	11.1
1968	12.7	9.8	5.6	-	-	3.3	8.1	9.1	10.5	13.2	12.3	16.4	10.1
1969	17.1	16.1	15.6	13.2	9.5	7.1	7.6	8.3	10.5	13.3	14.3	15.1	12.3
1970	16.9	13.8	14.5	11.5	10.2	6.7	6.8	8.9	11.7	11.8	14.4	16.3	12.0
1971	16.3	13.8	16.3	13.4	9.0	6.3	6.3	8.6	11.9	12.7	12.6	15.5	11.9
1972	16.1	14.1	14.9	13.4	9.4	5.1	6.5	7.9	9.6	13.2	12.1	16.4	11.5
1973	16.7	13.9	16.7	11.3	9.2	5.8	6.5	7.6	10.1	12.4	13.4	14.9	11.5
1974	16.9	14.9	15.6	11.1	8.9	6.1	7.0	8.9	11.0	13.8	-	-	11.4
1975	-	14.6	13.9	12.1	10.9	6.0	5.4	7.7	-	11.5	12.8	14.6	11.0
1976	14.7	14.9	15.5	11.7	8.1	5.4	-	6.9	10.4	12.3	13.4	15.9	11.7
1977	17.0	14.7	13.8	11.1	8.4	6.5	5.8	8.0	12.6	13.9	13.6	17.2	11.9
1978	19.4	16.8	16.9	11.7	9.3	-	6.6	-	-	12.5	-	-	13.3
1979	-	-	14.9	12.6	10.5	7.2	5.2	8.6	9.6	13.7	13.7	-	10.6
1980	-	-	15.0	11.4	9.0	5.5	4.8	7.6	8.9	12.3	14.4	14.8	10.4
1981	15.4	15.4	14.5	-	9.0	5.5	6.4	-	7.8	-	-	-	10.6
1982	-	-	15.6	-	-	6.6	7.0	8.9	10.8	12.0	-	16.0	11.0
1983	17.1	16.2	15.5	-	-	8.4	7.8	7.7	11.7	13.0	15.8	15.6	12.9
1984	15.0	15.5	15.0	12.0	9.6	6.9	7.6	8.3	11.1	13.8	12.6	14.2	11.8
1985	13.6	16.7	15.5	12.7	8.7	6.7	6.3	11.2	12.6	12.9	14.5	-	11.9
1986	-	15.1	15.2	-	10.2	7.2	6.9	10.2	-	12.4	13.5	15.4	11.8
1987	17.0	18.0	15.7	14.4	11.3	6.4	6.0	8.9	-	11.3	15.6	17.3	12.9
1988	-	16.2	-	14.3	10.0	6.9	6.5	10.0	11.8	13.0	13.7	15.3	11.8
1989	16.0	-	-	-	11.0	8.1	7.7	-	10.3	11.8	-	-	10.8
1990	15.6	15.6	15.5	13.5	9.4	7.0	7.6	6.5	9.9	12.4	13.0	15.3	11.8
1991	16.6	15.9	14.6	10.9	9.4	6.7	6.8	8.0	11.8	12.9	13.7	14.9	11.8
1992	-	-	14.1	14.1	9.3	7.1	-	-	-	-	14.3	16.6	12.6
1993	16.1	16.3	15.2	14.0	11.2	7.0	8.6	8.6	12.1	14.1	13.8	15.9	12.7
1994	15.5	15.8	14.9	12.8	9.5	-	5.3	7.1	10.9	11.0	14.7	14.6	12.0
1995	16.6	16.7	15.3	12.2	9.4	7.1	7.3	8.7	11.2	13.8	14.3	14.4	12.2
1996	16.9	16.9	14.3	11.5	10.3	7.2	5.9	7.7	11.3	13.4	14.7	15.7	12.1
1997	16.6	16.5	16.0	-	-	-	-	-	-	-	-	-	16.3
1998	16.2	16.8	16.4	13.4	9.4	7.5	7.5	8.2	11.7	13.3	15.0	15.3	12.6
1999	16.6	16.3	15.2	13.5	10.3	7.8	6.9	8.5	10.7	11.6	14.5	16.6	12.4
2000	15.3	17.0	16.3	12.2	8.0	-	6.3	8.7	-	-	-	-	12.0
Average	16.1	15.5	15.0	12.5	9.6	6.6	6.7	8.4	10.9	12.7	13.9	15.6	12.0

* -: No Data

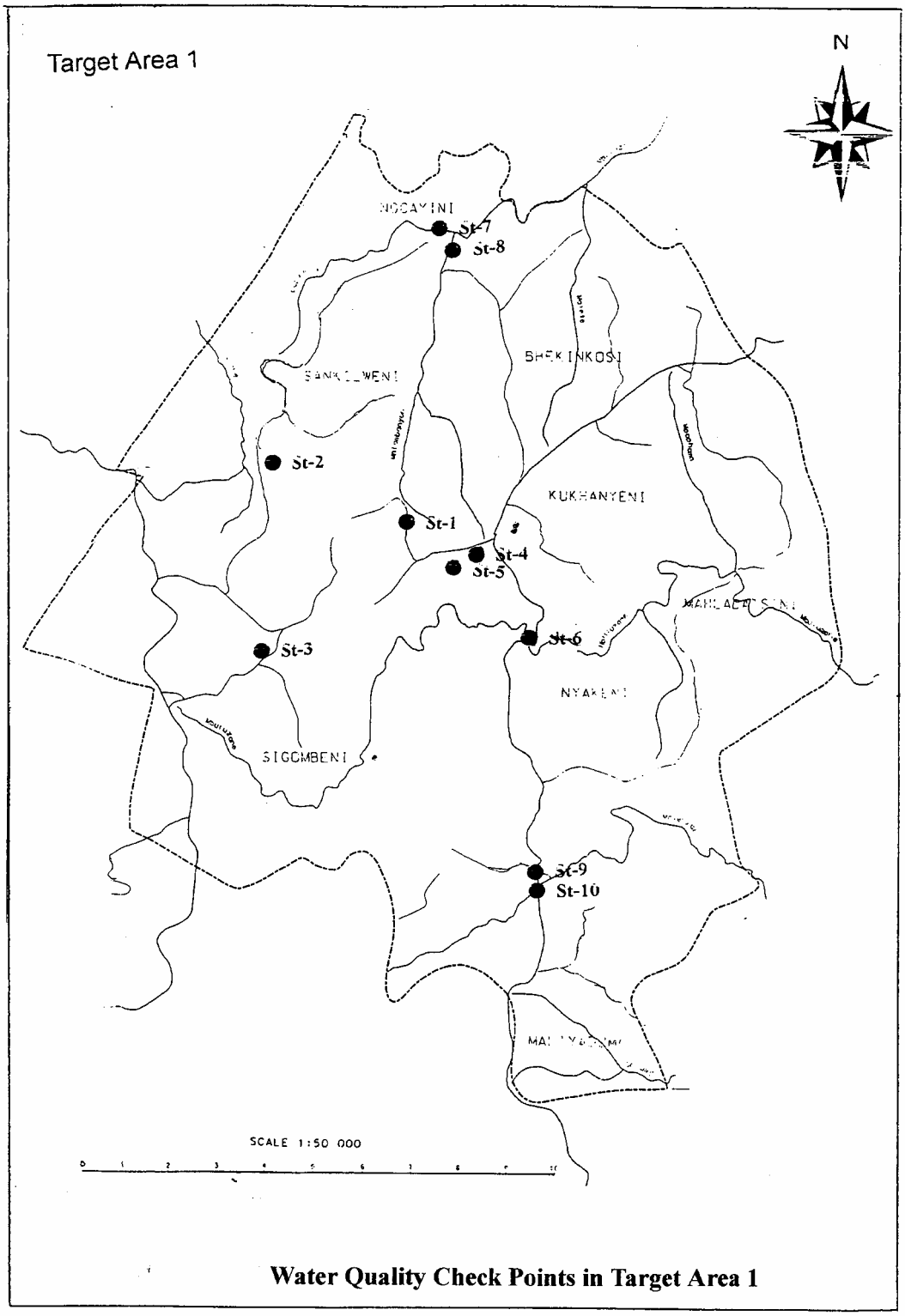
(4) Mean Max at Nhlagano (TA2)

Data Type: Mean Max Data measured in : Degree C

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
1990	25.3	24.0	25.0	23.9	21.3	21.1	21.1	20.8	23.2	23.5	25.5	25.3	23.3
1991	-	25.5	23.3	24.4	22.2	18.2	20.6	22.1	23.1	24.9	25.5	24.7	23.1
1992	-	28.0	26.5	26.6	24.4	21.1	-	-	-	-	25.5	27.0	25.6
1993	27.6	25.0	24.0	25.0	23.4	20.4	20.7	20.7	25.2	22.2	23.1	25.5	23.6
1994	24.7	24.8	25.2	23.6	22.8	-	21.1	21.1	25.3	22.1	26.4	26.4	24.0
1995	27.0	27.8	25.7	22.8	20.8	20.6	20.4	22.8	24.9	24.2	23.2	23.5	23.6
1996	25.0	24.9	23.4	21.6	21.0	20.4	17.7	20.0	25.4	24.4	25.2	25.7	22.9
1997	25.2	25.6	24.0	-	-	-	-	-	-	-	-	-	24.9
1998	24.5	26.1	26.2	24.6	24.7	22.4	20.4	22.3	24.0	21.6	24.1	23.4	23.7
1999	26.3	26.0	25.4	24.3	23.1	21.3	20.8	22.5	23.5	22.1	21.1	25.6	23.5
2000	23.0	24.2	24.4	22.5	20.3	-	20.1	22.9	-	-	-	-	22.5
Average	25.4	25.6	24.8	23.9	22.4	20.7	20.3	21.7	24.3	23.1	24.4	25.2	23.5

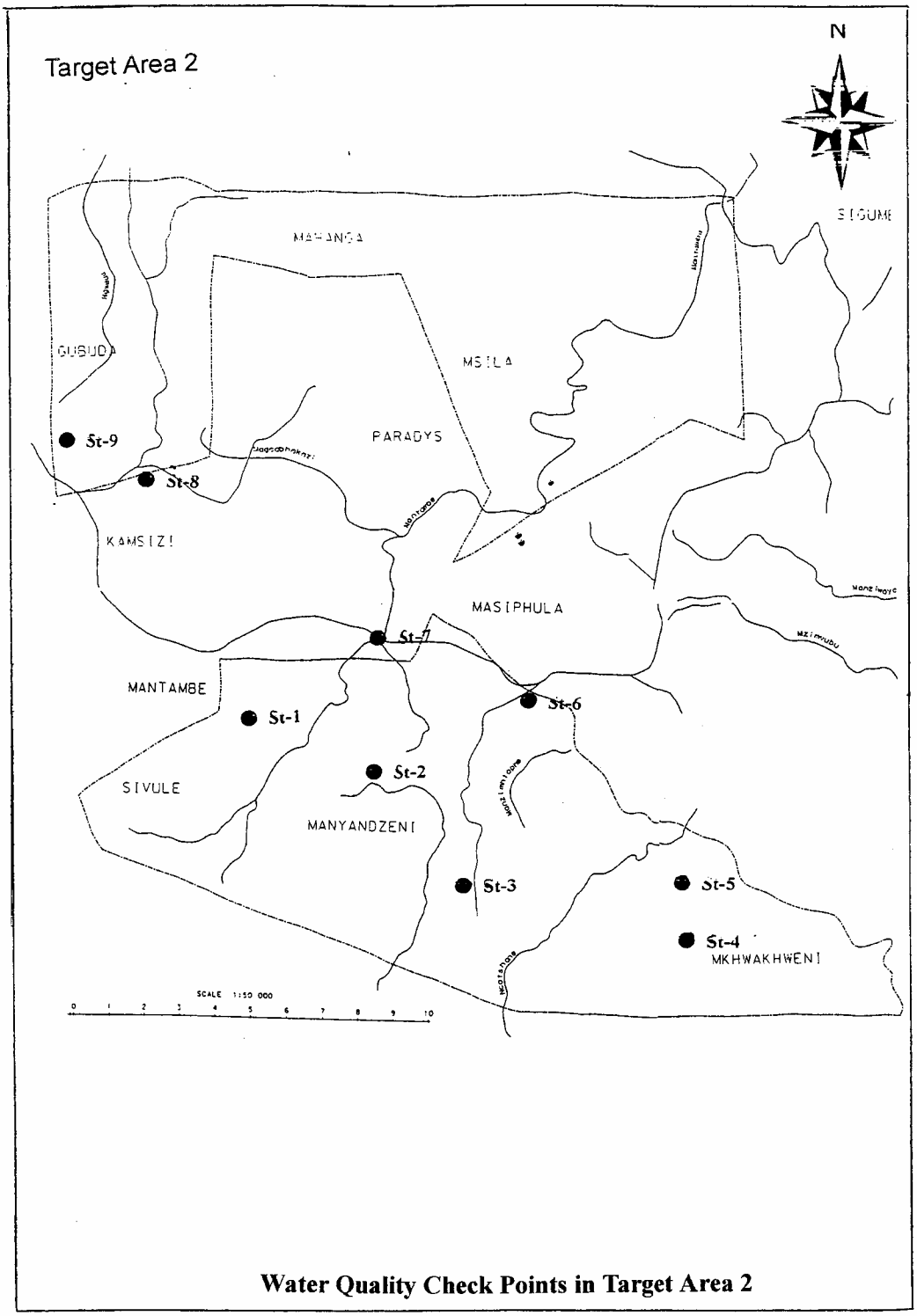
* -: No Data

E.4 Water Quality Check Point (TA1)



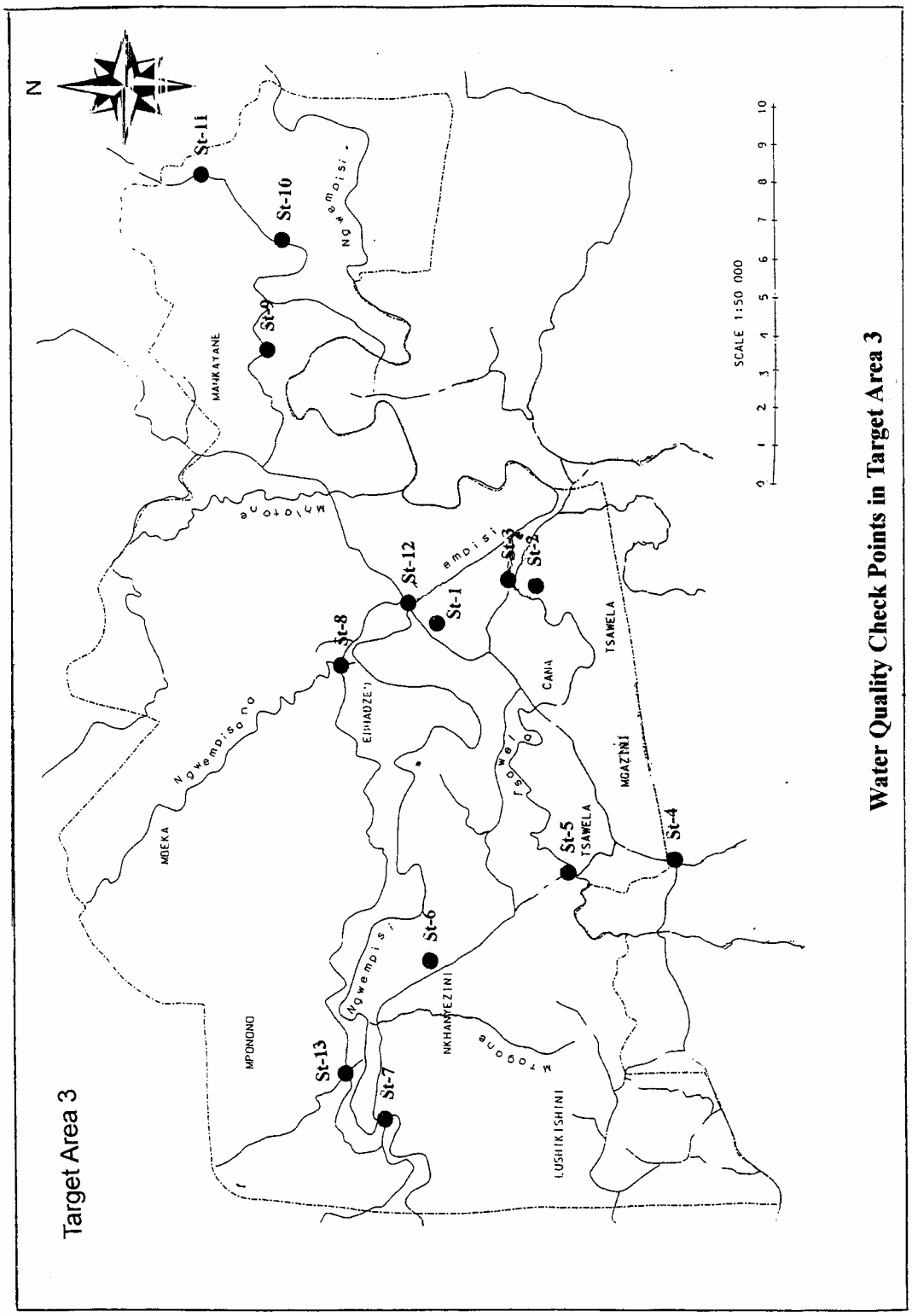
Water Quality Check Points in Target Area 1

Water Quality Check Point (TA2)



Water Quality Check Points in Target Area 2

Water Quality Check Point (TA3)



E.5 Water Quality Check Results

Water Quarity Check Results (1)

Wether:5th, 6th,7th Feb. ;fine 19th; rain 20th, 22th; cloudy

Date Unit	Target Area No.	No.	Water Resource	River Name	Village Name/Location	Use	Air Temperature ℃	Water Temperature ℃	pH	EC mS/cm	TDS	Visibility cm	Colon Bacillus	Mn^{2+} mg/l	COD mg/l	NO_3-N mg/l	NH_4-N mg/l	Fe^{2+} mg/l	PO_4^{2-} mg/l	Water flow (m^3/s)
WHO Standard									6.5～9.2	-	-	-	0/100ml	<0.5	-	<50	-	-	-	
5th Feb.2001	I	1	River	Mhlambamyon	Sakohweni	drinking	26.0	24.0	7.5	0.08	0.03	9.0	63	<0.5	6.5	0.23	0.08	<0.2	<0.2	0.242
19th Feb.2001	I	1	River				24.5	24.0	7.3	0.03	0.01	1.0	34	<0.5	6.0	0.23	0.08	0.2	0.2	1.022
5th Feb.2001	I	2	Spring	Phowe	Senga	drinking	25.0	22.0	7.3	0.05	0.02	>30.0	33	0.5	1.0	0.23	0.08	<0.2	<0.2	0.004
19th Feb.2001	I	2	Spring				22.0	22.0	7.6	0.01	0.00	1.0	36	<0.5	8.0	0.23	0.16	<0.5	0.2	-
5th Feb.2001	I	3	River (alga breeding)	Phowe	Senga	drinking	28.0	25.0	8.0	0.05	0.02	16.0	36	<0.5	5.0	0.23	<0.08	<0.2	<0.2	0.116
19th Feb.2001	I	3	River				22.0	22.0	7.5	0.02	0.00	1.0	44	0.5	6.0	0.23	0.08	0.5	0.2	2.871
5th Feb.2001	I	4	Borehall (Tap)	-	Ekukhanyeni High school	drinking	28.0	24.0	6.7	0.14	0.07	>30.0	5	<0.5	1.0	1.15	<0.08	<0.2	<0.2	-
19th Feb.2001	I	4	Borehole				26.0	24.0	6.8	0.15	0.07	>30.0	5	<0.5	6.0	1.15	0.08	0.5	<0.2	-
5th Feb.2001	I	5	Well	-	Ekukhanyen High school	drinking	28.0	24.0	6.7	0.14	0.06	>30.0	0	<0.5	0.0	0.46	0.08	<0.2	<0.2	-
19th Feb.2001	I	5	Well				25.0	24.8	6.9	0.16	0.08	>30.0	5	<0.5	1.0	1.15	0.08	<0.2	0.2	-
5th Feb.2001	I	6	River	Mbuluzane	Nyakeni	drinking	28.5	26.0	7.9	0.08	0.04	21.5	83	<0.5	0.0	0.23	<0.08	<0.2	<0.2	0.503
19th Feb.2001	I	6	River				26.0	22.5	7.8	0.05	0.02	1.5	55	<0.5	7.0	0.03	0.08	0.5	<0.2	2.250
5th Feb.2001	I	7	River	Ngcayeni	Ngcayeni	drinking	28.7	26.0	8.0	0.07	0.03	11.0	88	0.5	4.0	0.23	0.12	0.2	<0.2	0.063
19th Feb.2001	I	7	River				28.0	23.0	7.7	0.04	0.02	1.5	45	<0.5	7.0	0.23	0.08	0.5	<0.2	0.541
5th Feb.2001	I	8	River	Ngcayeni	Ngcayeni	washing	28.7	28.0	7.9	0.08	0.03	6.0	40	0.5	1.0	0.23	0.16	0.2	<0.2	0.473
19th Feb.2001	I	8	River				24.5	23.5	7.8	0.03	0.01	0.8	47	<0.5	6.0	0.23	0.08	0.5	<0.2	1.444
5th Feb.2001	I	9	River	?	?	?	27.5	24.0	8.2	0.13	0.06	11.0	70	<0.5	2.0	0.46	0.12	<0.2	<0.2	0.043
19th Feb.2001	I	9	River				28.0	22.0	8.0	0.06	0.03	1.5	70	<0.5	7.0	0.23	0.08	0.5	<0.2	0.404
5th Feb.2001	I	10	River	?	?	?	27.5	25.0	7.9	0.14	0.06	23.0	46	<0.5	2.0	0.46	0.16	0.2	<0.2	0.025
19th Feb.2001	I	10	River				24.0	22.0	8.0	0.06	0.03	2.0	58	<0.5	7.0	0.23	0.16	1.0	<0.2	0.493

Water Quarity Check Results (2)

Wether:5th, 6th,7th Feb. ;fine 19th; rain 20th, 22th; cloudy

Date Unit	Target Area No.	No.	Water Resource	River Name	Village Name/Location	Use	Air Temperature ℃	Water Temperature ℃	pH	EC mS/cm	TDS	Visibility cm	Colon Bacillus	Mn^{2+} mg/l	COD mg/l	NO_3-N mg/l	NH_4-N mg/l	Fe^{2+} mg/l	PO_4^{2-} mg/l	Water flow (m^3/s)
WHO Standard									6.5～9.2	-	-	-	0/100ml	<0.5	-	<50	-	-	-	
6th Feb.2001	Ⅱ	1*	Spring	-	Mantambe	drinking	28.5	23.0	6.7	0.16	0.08	16.0	73	<0.5	6.5	0.23	0.40	0.5	0.2	-
20th Feb.2001	Ⅱ	1	Spring				24.0	22.5	6.7	0.17	0.08	21.0	12	<0.5	7.0	0.23	0.08	0.2	<0.2	-
6th Feb.2001	Ⅱ	2	Spring	-	Manyanozeni	drinking	32.0	27.0	7.8	0.19	0.09	>30.0	75	0.5	8.0	0.23	0.16	0.2	0.2	-
20th Feb.2001	Ⅱ	2	Spring				24.5	23.5	7.8	0.15	0.07	>30.0	15	<0.5	8.0	0.23	0.16	<0.2	<0.2	-
6th Feb.2001	Ⅱ	3**	Spring	-	Thandizuwe	drinking	34.0	25.0	6.3	0.11	0.05	>30.0	11	0.5	1.0	1.15	0.08	0.2	0.2	-
20th Feb.2001	Ⅱ	3	Spring				26.0	22.0	6.4	0.12	0.05	>30.0	28	<0.5	6.0	0.46	0.16	0.2	<0.2	-
6th Feb.2001	Ⅱ	4	Spring(from pond)	-	Nomngwish	drinking	29.5	24.0	6.8	0.19	0.09	>30.0	17	0.5	2.0	4.60	0.16	0.2	0.2	0.001
20th Feb.2001	Ⅱ	4	Spring				23.0	22.5	7.0	0.20	0.10	>30.0	43	<0.5	1.0	4.60	0.16	<0.2	<0.2	0.0001
6th Feb.2001	Ⅱ	5	River	Ncotshane	Ncotshane	washing	33.5	33.0	8.8	0.23	0.11	>30.0	44	0.5	8.0	<0.23	<0.08	<0.2	<0.2	0.145
20th Feb.2001	Ⅱ	5	River				25.0	23.5	8.5	0.20	0.10	9.0	21	<0.5	7.0	0.23	0.16	0.2	0.2	0.222
6th Feb.2001	Ⅱ	6	Spring		Mashiphula inside of highschool	drinking	34.0	25.0	6.7	0.22	0.11	>30.0	11	0.5	1.0	1.15	0.16	0.2	<0.2	-
20th Feb.2001	Ⅱ	6	Spring				24.0	22.5	6.8	0.24	0.12	>30.0	52	<0.5	6.0	1.15	0.16	<0.2	0.2	-
6th Feb.2001	Ⅱ	7	River	Mantambe	?	?	27.0	31.0	8.9	0.29	0.14	25.0	40	0.5	4.0	<0.23	0.08	0.2	<0.2	0.090
20th Feb.2001	Ⅱ	7	River				23.5	23.0	8.5	0.23	0.11	16.0	42	<0.5	8.0	0.23	0.16	0.2	0.2	0.209
6th Feb.2001	Ⅱ	8	Spring	-	Ezikhotheni	drinking	26.2	22.0	7.0	0.15	0.07	29.0	98	0.5	8.0	2.30	0.12	<0.20	<0.2	0.001
20th Feb.2001	Ⅱ	8	River				22.0	21.0	7.0	0.16	0.08	8.0	40	<0.5	1.0	2.30	0.08	0.2	0.2	0.002
6th Feb.2001	Ⅱ	9	Borehall	-	Ezikhotheni	drinking	26.5	22.0	6.7	0.15	0.07	>30.0	0	0.5	1.0	0.46	0.08	0.2	0.2	-
20th Feb.2001	Ⅱ	9	Borehole				22.5	2.2	6.7	0.18	0.09	>30.0	27	<0.5	1.0	2.30	0.16	<0.2	0.5	-

*:avairable in only rainy season **:water flow decreases in dry season

Water Quarity Check Results (3)

Wether:5th, 6th,7th Feb. ;fine 19th; rain 20th, 22th; cloudy

Date Unit	Target Area No.	No.	Water Resource	River Name	Village Name/Location	Use	Air Temperature ℃	Water Temperature ℃	pH	EC mS/cm	TDS	Visibility cm	Colon Bacillus	Mn^{2+} mg/l	COD mg/l	NO_3-N mg/l	NH_4-N mg/l	Fe^{2+} mg/l	PO_4^{2-} mg/l	Water flow (m^3/s)
WHO Standard									6.5～9.2	-	-	-	0/100ml	<0.5	-	<50	-	-	-	
7th Feb.2001	Ⅲ	1	Borehall(tap)	-	Ngwempisipda	drinking	28.0	26.0	7.0	0.31	0.15	>30.0	55	<0.5	2.0	1.73	<0.08	0.2	0.2	-
22th Feb.2001	Ⅲ	1	Borehall(tap)				30.0	26.0	7.1	0.34	0.17	>30.0	10	<0.5	6.0	1.15	0.08	<0.2	0.2	-
7th Feb.2001	Ⅲ	2	Communal Borehall(tap)	-	Tsaweza	drinking	29.0	26.0	7.4	0.48	0.20	>30.0	11	<0.5	1.0	1.15	<0.08	0.2	<0.2	-
22th Feb.2001	Ⅲ	2	Borehole				31.0	26.0	7.7	0.52	0.26	>30.0	13	<0.5	5.0	4.60	0.08	<0.2	0.2	-
7th Feb.2001	Ⅲ	3	River	Tsawela	Tsaweza	washing	30.0	27.0	8.3	0.20	0.10	28.0	37	<0.5	6.0	0.23	<0.08	0.2	<0.2	0.690
22th Feb.2001	Ⅲ	3	River				28.0	30.0	8.2	0.21	0.10	20.0	78	<0.5	1.0	0.23	0.08	0.2	0.5	0.743
7th Feb.2001	Ⅲ	4	Spring	-	Mgazini	drinking	31.0	25.0	7.3	0.28	0.14	>30.0	62	0.5	1.0	2.30	0.16	0.2	0.2	-
22th Feb.2001	Ⅲ	4	Spring				26.5	25.5	7.2	0.31	0.15	>30.0	9	<0.5	4.0	2.30	0.08	<0.2	0.2	-
7th Feb.2001	Ⅲ	5	River	?	?	?	30.0	31.5	8.4	0.15	0.07	19.0	73	0.5	6.0	0.46	<0.08	0.2	<0.2	0.347
22th Feb.2001	Ⅲ	5	River				25.5	31.0	8.1	0.17	0.08	16.0	52	<0.5	6.0	0.46	0.08	<0.2	0.2	0.428
7th Feb.2001	Ⅲ	6	Spring	-	Musi	drinking	30.0	22.0	6.8	0.18	0.09	>30.0	69	0.5	2.0	0.46	<0.08	<0.2	0.2	-
22th Feb.2001	Ⅲ	6	Spring				29.0	24.0	6.7	0.21	0.10	>30.0	9	<0.5	6.0	1.15	0.16	0.2	0.2	-
7th Feb.2001	Ⅲ	7	River	Ngwempisi	Sidzakeni	drinking	29.0	28.0	8.6	0.10	0.05	>30.0	55	0.5	6.0	0.23	<0.08	0.2	<0.2	5.380
22th Feb.2001	Ⅲ	7	River				26.0	26.0	8.1	0.10	0.05	27.0	27	<0.5	7.0	0.23	0.08	<0.2	0.2	8.322
7th Feb.2001	Ⅲ	8	River	Ngwempisana	Ngwempisana	drinking	31.5	31.5	8.3	0.05	0.04	>30.0	68	<0.5	3.0	<0.23	<0.08	<0.2	<0.2	0.539
22th Feb.2001	Ⅲ	8	River				30.0	28.5	7.9	0.10	0.05	21.0	27	<0.5	6.0	0.23	0.08	<0.2	0.2	0.872
7th Feb.2001	Ⅲ	9	Borehall (Tap)	-	Velezizweni	drinking	29.0	26.5	7.4	0.09	0.04	>30.0	9	0.5	2.0	0.46	<0.08	<0.2	0.2	-
22th Feb.2001	Ⅲ	9					24.0	23.5	7.3	0.12	0.06	>30.0	10	<0.5	6.0	0.23	0.08	<0.2	0.2	-
22th Feb.2001	Ⅲ	10	River				23.0	22.0	8.2	0.26	0.13	2.5	25	<0.5	10.0	0.46	0.16	0.2	0.2	0.031
22th Feb.2001	Ⅲ	11	River				24.0	25.5	8.1	0.22	0.11	>30.0	25	<0.5	6.0	0.46	0.08	<0.2	0.2	0.043
22th Feb.2001	Ⅲ	12	River	Ngwempisi			28.5	25.0	7.9	0.10	0.05	20.0	8	<0.5	8.0	0.23	0.16	0.2	0.2	12.296
22th Feb.2001	Ⅲ	13	River				31.5	27.5	7.8	0.09	0.04	24.0	11	<0.5	7.0	0.23	0.16	0.2	0.5	1.570

E.6 Results of interview for Environmental Resource Management

Annex E- 6 (1) Resultes of interview for Environmental Resource Management in Grazingland

Target Area	Chiefdom	Cattle	Goat	Sheep	Dip tank	Deterioration	Countermeasure/rule for conservation of grazingland	Initiative for rule
TA1	Nkiliji 1	6	0	0	Embotoma	No	no rule	-
	Nkiliji 2	0	4	0	Embotoma	No	no rule	-
	Nkiliji 3	2	0	0	Embotoma	Yes	50ha/homestead has been allowed to browse from 20 years ago	community
	Nkiliji 4	19	0	0	Embotoma	Yes	Establishment of any rules are under discussion (including other chiefdom people)	community (including other chiefdom)
	Nkiliji 5	35	0	0	Mhlambanyoni	no (inside of fence)	under construction of fence funded by people	chief
	Nkiliji 6	0	0	0	Mhlambanyoni	No	under construction of fence funded by people (those who don't have cattle have to pay)	chief
	Ngcayni 1	19	0	0	Mhlambanyoni	Yes	no rule	-
	Saukolweni 1	20-25	0	17	Kumbenso	Yes	no rule	-
TA2	Zikhotheni 1	15	0	7	Ngwede	Yes	no rule	-
	Zikhotheni 2	14	0	2	Ngwede	Yes	fence funded by NGO, annual rotation system in grazing land	rotation system is decided by community
	Zikhotheni 3	6	0	3	Ngwede, Mlokotfwa	Yes		
	Zikhotheni 4	11	0	9	Ngwede, Mlokotfwa	Yes	no rule	-
	Zikhotheni 5	11	3	2	Mlokotfwa	Yes	no rule	-
	Zikhotheni 6	30	7	0	?	?	Fence was placed in 1993, restriction within 10 cattle to browse (people don't keep the rule and steal fence)	community
	Mayandzeni 1	19	0	0	Mantanbe	Yes	fence	chief
	Mayandzeni 2	18	0	0	Mantanbe	Yes	no rule	-
	Mayandzeni 3	16	0	0	Mantanbe	No	no rule	-
	Mayandzeni 4 (chief)	23	0	0	Mantanbe	Yes	fence (funded by Red Cross in 1999) , A part of it was stolen. Rule for conservation is under discussion.	chief
TA3	Macudvulwini 1	6	0	13	Ngwempisana	Yes	no rule	-
	Macudvulwini 2	3	0	0	Ngwempisana	Yes	no rule	-
	Macudvulwini 3	13	0	12	Ngwempisana	Yes	no rule	-
	Macudvulwini 4	4	0	4	Ngwempisana	Yes	no rule	-
	Macudvulwini 5	7	0	4	Ngwempisana	Yes	no rule	-
	Khabonia 1	30	0	2	Ekhabonia	Yes	no rule	-
	Khabonia 2	13	0	0	Ekhabonia	Yes	no rule	-
	Khabonia 3	16	0	60	Ekhabonia	Yes	no rule	-
	Khabonia 4	1	0	0	Ekhabonia	Yes	no rule	-
	Mgazini 1	3	0	0	Sdzakeini	Yes	no rule	-
	Mgazini 2	0	0	6	Sdzakeini	Yes	no rule	-
	Mgazini 3	9	0	0	Sdzakeini	Yes	They are not allowed to browse before 11 o'clock in the morning	chief ?

Annex E- 6 (2) Resultes of interview for Environmental Resource Management in Forest

		Communal Forest			Indivudual forest	Way to get firewood
Target Area	Chiefdom	Natural or Planted	Countermeasure / rule for conservation	Initiative for rule	Yes	individual forest
TA1	Nkiliji 1	no communal forest	-	-	Yes	individual forest
	Nkiliji 2	no communal forest	-	-	No	stealing, purchase
	Nkiliji 3	no communal forest	-	-	Yes	individual forest
	Nkiliji 4	no communal forest	-	-	Yes	individual forest
	Nkiliji 5	natural forest	no rule	-	No	communal forest
	Nkiliji 6	natural forest	only twigs are allowed to be cut	chief	Yes	individual forest
	Ngcayni 1	no communal forest	-	-	Yes	individual forest
	Saukolweni 1	natural forest	no rule	-	Yes	individual forest
TA2	Zikhotheni 1	no communal forest	-	-	No	purchase
	Zikhotheni 2	no communal forest	-	-	No	purchase
	Zikhotheni 3	no communal forest	-	-	No	purchase
	Zikhotheni 4	no communal forest	-	-	No	purchase
	Zikhotheni 5	no communal forest	-	-	No	purchase
	Zikhotheni 6	planted forest	only twigs are allowed to cut	community	?	communal forest
	Mayandzeni 1	natural forest	not cut seedlings, fruit trees and medicinal trees, there is penalty that offender must construct fence	Imsumbe (elder)	No	communal forest
	Mayandzeni 2	natural forest		chief	No	communal forest
	Mayandzeni 3	natural forest		Imsumbe (elder)	No	communal forest
	Mayandzeni 4 (chief)	natural forest		Imsumbe (elder)	No	communal forest
TA3	Macudvulwini 1	natural forest	-	-	No	communal forest
	Macudvulwini 2	natural forest	not cut fruit tree and medicine	chief	No	communal forest
	Macudvulwini 3	planted forest	no rule	-	No	communal forest
	Macudvulwini 4	natural forest	not cut fruit tree and medicine	chief	yes	individual forest
	Macudvulwini 5	natural forest	no rule	-	yes	individual forest
	Khabonia 1	natural and planted forest	no rule	-	No	communal forest
	Khabonia 2	natural and planted forest	no rule	-	No	communal forest
	Khabonia 3	natural and planted forest	no rule	-	No	communal forest
	Khabonia 4	natural and planted forest	not cut natural trees	chief	No	communal forest
	Mgazini 1	no communal forest	-	-	yes	individual forest
	Mgazini 2	no communal forest	-	-	yes	individual forest
	Mgazini 3	no communal forest	-	-	yes	individual forest

E.7 Possible Environmental Impact Matrix

Environmental Elements		Class I						Class II		Class III			Class IV			Class V					Class VI			Class VII										Class VIII				Class IX			Class X						Class XI					Class XII
Proposal projects and Programs		1. Planned residential settlement	2. Involuntary resettlement	3. Substantial changes in the way of life	4. Conflict among communities and people	5. Impact on native people		6. Population increase	7. Drastic change in population composition	8. Changes in bases of economic activities	9. Occupational changes and loss of job opportunities	10. Increase in income disparities	11. Adjustment & regulation of water or fishing rights	12. Changes in social and institutional structures	13. Changes in existing institutions and customs	14. Increased use of agrochemicals	15. Outbreak of endemic diseases	16. Spreading of endemic diseases	17. Residual toxicity of agrochemicals	18. Increase in domestic and other human wastes	19. Impairment of historic remains and cultural assets	20. Damage to aesthetic sites	21. Impairment of buried assets	22. Changes in vegetation	23. Negative impact on important or indigenous fauna and flora	24. Degradation of ecosystems with biological diversity	25. Proliferation of exotic and/or hazardous species	26. Destruction of wetlands and peatlands	27. Decrease of tropical rain forests and wildlands	28. Destruction or degradation of mangrove forests	29. Degradation of coral reefs	30. Soil erosion	31. Soil salinization	32. Deterioration of soil fertility	33. Soil contamination by agrochemicals and others	34. Devastation or desertification of land	35. Devastation of hinterland	36. Ground subsidence	37. Change in surface water hydrology	38. Change in ground water hydrology	39. Inundation and flooding	40. Sedimentation	41. Riverbed degradation	42. Impediment of inland navigation	43. water contamination and deterioration of water quality	44. Water eutrophication	45. Sea water intrusion	46. Change in temperature of water	47. Air pollution
Land Rehabilitation	Pilot Project	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Master Plan	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	○○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range Management	Pilot Project	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-
	Master Plan	-	-	-	-	-		x	-	-	-	x	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-
Agro-Forestry Management	Pilot Project	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Master Plan	-	-	-	-	-		x	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	○	-	○○	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agriculture Management	Pilot Project	-	-	-	-	-		-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Master Plan	-	-	-	-	-		x	-	-	-	x	-	-	-	x	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Improved Cooking Stove	Pilot Project	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Environmental Elements

I. Social issues II. Demographic issues III. Economic activities
IV. Institutional and custom related issues V. Health and sanitary issues
VI. Cultural asset issues VII. Biological and ecological issues
VIII. Soil resources IX. Land resources X. Hydrology
XI. Water quality and temperature XII. Atmosphere

Environmental impact Score

ooo: Important positive impact
oo: Some positive impact
o: Extent of positive impact and know

xxx: Serious negative impact
xx: Some negative impact
x: Extent of negative impact not known
#: No Impact

Possible Environmental Impact Matrix

Environmental Elements	Proposal projects and Programs	Land Rehabilitation		Range Management		Agro-Forestry Management		Agriculture Management		Improved Cooking Stove		Capasity Building at administration	
		P/P	M/P	P/P	M/P	P/P	M/P	P/P	M/P	P/P	M/P	P/P	M/P
Social issues	1.Planned residential settlement	-	-	-	-	-	-	-	-	-	-	-	-
	2.Involuntary resettlement	-	-	-	-	-	-	-	-	-	-	-	-
	3.Substantial changes in the way of life	-	-	-	-	-	-	-	-	-	-	-	-
	4.Conflict among communities and people (jealousy or offence to success)	-	-	x	-	-	-	x	-	-	-	o	o
	5.Impact on native people	-	-	-	-	-	-	-	-	-	-	-	-
Demographic issues	6.Population increase	-	-	-	x	-	x	-	x	-	-	-	-
	7.Drastic change in population composition	-	-	-	-	-	-	-	-	-	-	-	-
Economic activities	8.Changes in bases of economic activities	-	-	-	-	-	-	-	-	-	-	-	-
	9(1)Occupational changes and loss of job opportunities	-	-	-	-	-	-	-	o	-	-	-	-
	9(2)Increase of work	-	-	x	x	-	-	-		oo	oo		
	10.Increase in income disparities	-	-	x	x	-	-	x	x	-	-	-	-
Institutional and custom related issues	11.Adjustment & regulation of water or fishing rights	-	-	-	-	-	-	-	-	-	-	-	-
	12.Changes in social and institutional structures	-	-	-	-	-	-	-	-	-	-	-	-
	13.Changes in existing institutions and customs	-	-	-	-	-	-	-	-	-	-	-	-
Health and sanitary issues	14.Increased use of agrochemicals	-	-	x	x	-	-	x	x	-	-	-	-
	15.Outbreak of endemic diseases	-	-	-	-	-	-	-	-	-	-	-	-
	16.Spreading of endemic diseases	-	-	-	-	-	-	-	-	-	-	-	-
	17.Residual toxicity of agrochemicals	-	-	-	-	-	-	-	-	-	-	-	-
	18(1)Increase in domestic and other human wastes	-	-	-	x	-	x	-	x	-	-	-	-
	18(2)Increase of cattle dung to be treated	-	-	x	x	-	-	-	-	-	-	-	-
Cultural asset issues	19.Impairment of historic remains and cultural assets	#	#	#	#	#	#	#	#	-	-	-	-
	20.Damage to aesthetic sites	-	-	-	-	-	-	-	-	-	-	-	-
	21.Impairment of buried assets	-	-	-	-	-	-	-	-	-	-	-	-
Biological and ecological issues	22.Changes in vegetation	-	-	-	-	-	o	-	-	-	o	-	-
	23.Negative impact on important or indigenous fauna and flora	-	-	-	-	-	o	-	-	-	o	-	-
	24.Degradation of ecosystems with biological diversity	-	o	-	-	-	oo	-	-	-	o	-	-
	25.Proliferation of exotic and/or hazardous species	-	-	-	-	-	-	-	-	-	-	-	-
	26.Destruction of wetlands and peatlands	-	-	-	-	-	-	-	-	-	-	-	-
	27.Decrease of tropical rain forests and wildlands	-	-	-	-	-	-	-	-	-	-	-	-
	28.Destruction or degradation of mangrove forests	-	-	-	-	-	-	-	-	-	-	-	-
	29.Degradation of coral reefs	-	-	-	-	-	-	-	-	-	-	-	-
Soil resources	30.Soil erosion	o	oo	-	o	-	-	-	-	-	-	-	-
	31.Soil salinization	-	-	-	-	-	-	-	-	-	-	-	-
	32.Deterioration of soil fertility	-	-	-	-	-	o	-	-	-	-	-	-
	33.Soil contamination by agrochemicals and others	-	-	-	-	-	-	-	-	-	-	-	-
Land resources	34.Devastation or desertification of land	-	-	-	-	-	-	-	-	-	-	-	-
	35.Devastation of hinterland	-	-	-	-	-	-	-	-	-	-	-	-
	36.Ground subsidence	-	-	-	-	-	-	-	-	-	-	-	-
Hydrology	37.Change in surface water hydrology	-	-	-	-	-	-	-	-	-	-	-	-
	38.Change in ground water hydrology	-	-	-	-	-	-	-	-	-	-	-	-
	39.Inundation and flooding	-	-	-	-	-	-	-	-	-	-	-	-
	40.Sedimentation	-	o	-	-	-	-	-	-	-	-	-	-
	41.Riverbed degradation	-	-	-	-	-	-	-	-	-	-	-	-
	42.Impediment of inland navigation	-	-	-	-	-	-	-	-	-	-	-	-
Water quality and temperature	43.water contamination and deterioration of water quality	-	-	o	o	-	-	-	-	-	-	-	-
	44.Water eutrophication	-	-	-	-	-	-	-	-	-	-	-	-
	45.Sea water intrusion	-	-	-	-	-	-	-	-	-	-	-	-
	46.Change in temperature of water	-	-	-	-	-	-	-	-	-	-	-	-
Atmosphere	47.Air pollution	-	-	-	-	-	-	-	-	-	-	-	-

M/P:Master Plan P/P: Pilot Project

Environmental impact Score

ooo: Important positive impact
oo: Some positive impact
o: Extent of positive impact and known
#: avoidable if the historical remains is excluded

xxx: Serious negative impact
xx: Some negative impact
x: Extent of negative impact not known
-: No Impact

E.8 Vegetation Examination Results in 3 TA

(a) Target area 1

Vegetation density per $1m^2$ was examined at Mengcineci Village. The location is E;31 ° 22'865", S;26 ° 21'18.

1) Close to gully
Euphorbia geniculata: 8
Panicum maximum: 11
Paspalum parpalodes: 21
Enneapogon scopeenus: 3
Vegetation cover rate: 40%

2) 50m up to gully
Aristida adscensionis: 18
Euphorbia geniculata: 1
Panicum aequinerve: 7
Paspalum parpalodes: 15
Vegetation cover rate: 50%

3) 100m up to gully
Eragrostis curvula: 53
Aristida adscensionis: 2
Euphorbia geniculata: 3
Panicumaequinerve: 18
Paspalum parpalodes: 7
Vegetation cover rate: 75%

The further distant from the gully, the denser grass cover and more species are found. On the pasture surveyed there grazed more than 60 cattle during the study. It is considered that declined density of vegetation by overgrazing contributes to the occurrence of gullies. There is large fence near gully for evacuating cattle, which was established by a community. The fence was placed for rotation grazing and the community people make decision on where to make fence.

(b) Target area 2

The same measurement was repeated in Target area 2, selecting a developed gully in Mantambe, located at E;31 ° 25'060, S;27 ° 16'607, and the result is given as follows:

1) Closest to a gully, total number of stamps: 23
Aristida juneiformis: 11
Eragrostis curvura: 2
Paspalum notatum: 8
Euphorbia hirta: 1
Panicum natalense: 23
Vegetation cover rate: 15%

2) 50 meter above the gully, total number of stumps; 47
Setaria sphaecelata: 6
Paspalum scrobiculatum: 5
Panicum natalense: 2
Eragrostis curvura: 1
Cynodon dactylon: 17
Syberanthus africanum: 47
Vegetation cover rate: 50%

(c) Target area 3

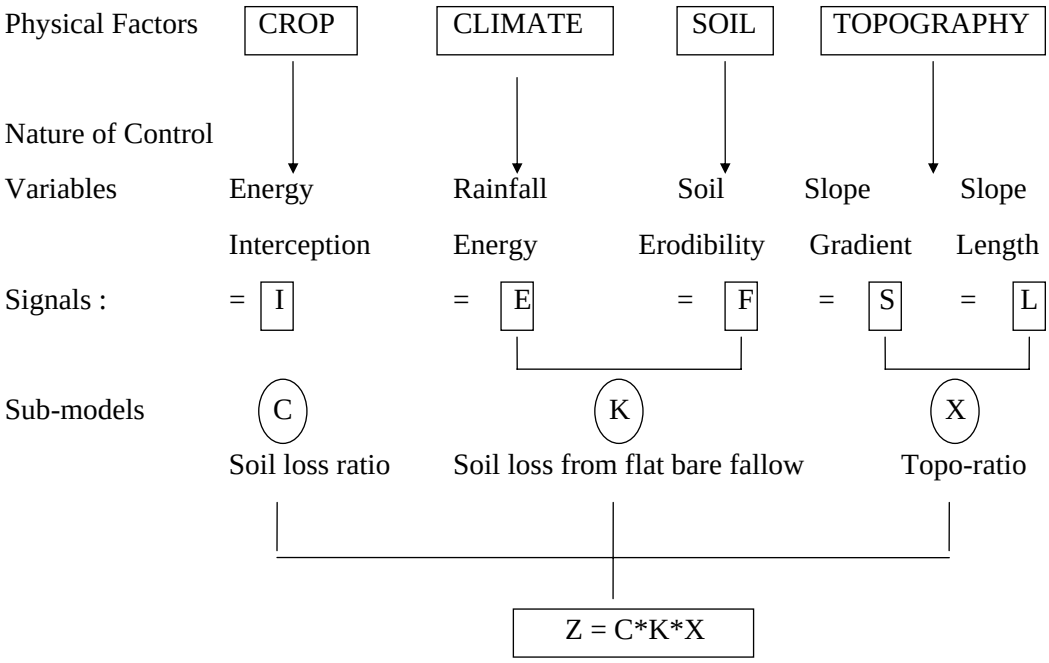
Vegetation density per $1m^2$ was examined at Bhadzeni Village. The location is E;30 ° 59'932", S;26 44'077.

1) Close to gully
   Euphorbia Geniculata: 14
   Eragrostis Plana: 13
   Paspalum Parpalodes: 19
   Chloris Virgata: 9
   Digitaria eriantha:3
   Jatoropha Gossypifolia: 5
   Ammeniaa Baccifera: 1
   Mimosa: 1
   Vegetation cover rate: 40%
2) 50m upstream of gully
   Paspalum Parpalodes: 1
   Diheteropogon Filifolius: 18
   Chloris Virgata: 7
   Euphorbia Geniculata: 12
   Jatoropha Gossypifolia: 4
   Ammeniaa Baccifera: 4
   lichen: 1
   Vegetation cover rate: 20%
   There are many stones. Soil is very hard and soil texture is sandy. So, soil of this point is not favorable for growth of grass, because sandy soil is not suitable to reach higher density of this point is lower than near gully.
3) 100m upstream of gully
   Paspalum Parpalodes: 3
   Digitaria eriantha:2
   Diheteropogon Filifolius: 11
   Chloris Virgata: 1
   Euphorbia Geniculata: 6
   Ammeniaa Baccifera: 9
   Eragrostis Plana: 16
   Puddhrea Africana: 1
   Vegetation cover rate: 30%
   Although less compared with point2), there scattered many stones on the ground. It may also be a causative factor to lower vegetation density.
4) Right angle of the point at 50m upstream of gully (as a reference)
   Most of vegetation is full with *Paspalum parpalodes* it is described single vegetation although some roots of *Eragrostis plana* were observed. Soil texture is heavy clay at the spot, so great water holding capacity may make flora possible to grow in high density.

The vegetation of the highveld is abundant in grasses and the peripheral areas of target area 3 have been planted with *Pinus patura, Pinus eliotti* and *Eucalyptus camaldulensis* for pulp material. But this area is also characterized by stony ground surface. This may give a negative effect against vegetation.

E.9 Soil Loss Estimation by SLEMSA

Soil Loss Estimation Model for Southern Africa (SLEMSA) is hereby adopted to estimate soil loss with project and without project. SLEMSA is a model developed in Zimbabwe, which has been used for soil loss estimation, in Malawi also. Therefore, it is thought to be adoptable in Swaziland. It consists of three sub models, namely C, K and X. Calibration procedures of hazard extent of a particular site are given below:



Equations: C = The ratio of soil loss from a cropped plot, to the bare fallow, refer in Table-1

E = 15,680 (in case of LGP = 90～135days) (J/m2)
116.1LGP(in case of LGP = 136～165 days) (J/m2)
58.7LGP(in case of LGP = 166～195 days) (J/m2)
107.6LGP(in case of LGP = 196～210 days) (J/m2)
22,600(in case of LGP<210 days) (J/m2)
(LGP = Length of growth period of major crops)
LGP value can be interpreted by the annual rainfall data (refer in Table-2)

F = F bare + 1 for contour ridge cultivation (F bare refer in Table-3)

$K = \exp\{(0.4681+0.7663F)\ln E+2.884-8.1209F\}$(ton/ha)

S = Slope Gradient (%)

L = Length of Slope (m)

$X = L^{0.8}(0.78+0.53S+0.078S^2) / 25.65$

Z = C*K*X

Z: Predicted mean annual soil loss (ton/ha/yr) is calculated by multiplication of K, X and C. Soil loss figures in land slope class 25~55% have been interpreted from known trends and from field knowledge and not calculated with SLEMSA, since SLEMSA is not valid for slopes steeper than 20%.

Table-1 Factors used with the universal soil loss equation

Vegetation type	C factor
Maize (subsistence) with contour grass strips	0.30
Woodland	0.09
Grass, fair condition	0.09
Grass, overgrazed	**0.32**
Scrub	0.07
Rock outcrops	1.0

Resource: R.P.C. Morgan et al./Soil Technology11 (1997) 263-289

Table-2 Relationship between annual mean Rainfall (P) and LGP in Zimbabwe

Rainfall (P)	corresp.LGP
832mm	135days
926mm	150days
1.020mm	165days
1,207mm	195days
1,301mm	210days

Correlation equation : LGP=0.16P+1.8587

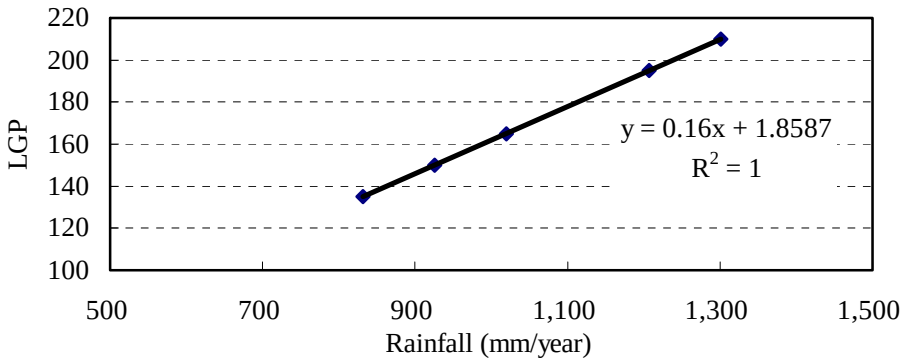


Figure-1 Relationship between LGP and Rainfall

Table-3 F- values used with SLEMSA

Nearest soil type in Zimbabwe	Soil texture	F-value
Lithosol	Light	2.0
Vertisol (PP candidate site in TA1)*	Heavy	**4.5**
Fersiallitic (PP candidate site in TA3)	Medium	**5.0**
Paraferrallitic	Medium	5.0
Vertisol	Heavy	4.5
Orthoferrallitic	Medium	5.0
Regosol (PP candidate site in TA2)	Light	**4.0**
Orthoferrallitic	Medium	6.0
Lithosol	Medium	2.5

Resource: R.P.C. Morgan et al./Soil Technology11 (1997) 263-289

* : Soil type of PP site candidate in TA1 is Acrisol, but it has similar feature to Vertisol and can be replaced by Vertisol.

** : Soil type of PP site in TAs is from Soil Map in Swaziland (1:125,000)

*** : PP: Pilot Project

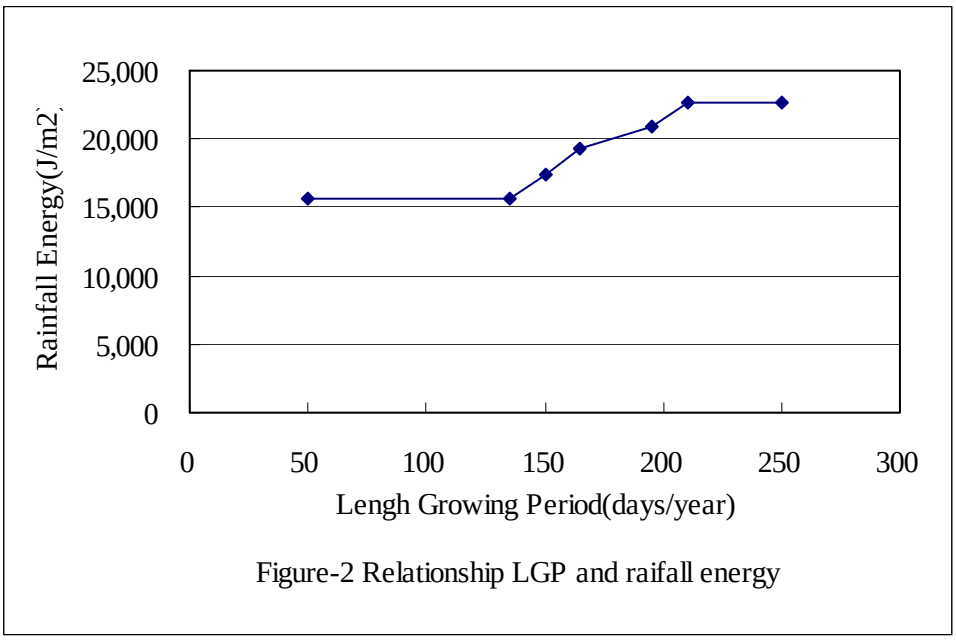


Figure-2 Relationship LGP and raifall energy

Annex F

F Rural Society / Gender Issue

F.1 Agenda for the Workshop at Chiefdoms

a. Agenda for small workshops at seven chiefdoms

1) Opening prayer
2) Introduction of participants
3) Background and objectives of the study
4) Objectives of the workshop (on the process of selecting pilot area)
5) Collecting information
   - Population of male and female and number of homestead (confirmation) and its trend
   - Number of the community (confirmation) and structure of the communities under chiefdom
   - Conditions of Chief (availability, leadership, etc.)
   - Conditions of other local leaders (Bucopho, Indvuna, Inner council, Village Headman, etc.)
   - Existing organizations/groups concerning about land use and land rehabilitation
   - Major income sources
   - Disputes among or with neighboring chiefdoms or communities
   - Targets and needs on land use plan and land rehabilitation (in discussion groups)
   - Willingness to participate in whole activities (planning, implementation, monitoring and evaluation), share works (not be paid), collected and contribute money or in-kind especially for maintenance of projects, and to share their experiences with communities of other chiefdoms.
   - Availability of labour in the community
6) Identification of the chiefdom boundary
7) Request for further data collection, if necessary
8) Announcement of the following workshop for the final selection
9) Close

b. Agenda for the Workshop <Final Selection>

1) Opening prayer
2) Introduction of participants
3) Objectives of the study
   - To formulate Master Plan for whole Inkhundla
   - To implement pilot project at one chiefdom
4) Meaning of the pilot project and selection of the area
   - Project will be monitored by whole Inkhundla.
   - Selected area will be the representative of whole Inkhundla.
   - Tested techniques and activities could be applied to whole Inkhundla based on the Master Plan.
   - Communities of the selected chiefdom have the responsibility to participate in each level of activities (planning, implementation, monitoring and evaluation), share works (not be paid), collect and contribute money or in-kind especially for maintenance of the project, and to share their experiences with communities of other chiefdoms.
5) Explanation of the selection procedure of pilot area (Preliminary selection and final selection)
6) Preliminary selection of seven chiefdoms as done by the team (present comparison table)
7) Final selection in a participatory manner
   - Criteria and evaluation of each chiefdom are presented with explanation from the team
   - Any other criteria are discussed with participants
   - Final evaluation and selection
8) Request for cooperation
9) Following schedule
10) Close

F.2 Interview/Workshop at Target Areas

F.2.1 Interview/Workshop at Target Area 1 <Kukhanyeni Inkhundla>

Date: January 30th, 2001

Name of the Chiefdom	1	2	3	4	5
	Esi	Moyeni	Ebutfongweni	Malyaduma	Ngwazini
Number of participants	11	4	9	10	4
Male	5	3	7	4	3
Female	6	1	2	6	1
Name of the Chief	Mandanda	Mshede Dlamini	Mntfane Nkosi Madalambane	Mandanda Mtsetfwa	Matatazela
Number of community under Chiefdom	1	1	1	3	7
Name of the communities	Esi	Mdayane Royal Kraal	Ebutfongweni	1. Etiko 2. Malyaduma 3. Masolora	1 Engweya 2 Ndzingandlaba 3 Emphelelaphi 4 Ngwazini 5 Emphisheni 6 Etsheni Lesambi 7 Emahlabatsini
Existing facilities in the Chiefdom					
Borehole (number, year, operating/out of order)	0	4 -working -3 -Not working - 1	3 -in 1993 - 1 -in 1994 -2	11 -working - 6(in 1997) -Not working - 5(in 1992)	5 -working - 3 -Not working - 2
Well / Spring (number, year, used/not used)	Well - 11	Well - 8 - used - 3 - not used - 5	Well - 3 - used - 3	Well - 17 - used - 17	Well - 12 - used - 12
Communal tap	0	Mdayane	Ebutfongweni (1998)	0	- Mgwenya (1996) - Ndzingandlaba - Etsheni Lesambi - Ngwazini - Emphosini - Mphelelaphi
Primary School	0	0	0	Malyaduma P. School	Ngwazini P. School
Secondary School	0	0	0	0	0
Clinic	0	0	0	0	0
Maize mill	0	0	0	- Malyaduma - 2 - Moses Sihlongonyane - 1 - Mfanawetfu Gwandza - 1	- Thandanani Farmers Association - Raphael Mdluli - Not working
Dip	0	0	1 (Em/bothoma 418)	1 (Mkhwakhweni)	1 (Embothoma)
Dam/reservoir	0	0	1	0	0
Income generating activities (list of the activities)	- Gardening - Sewing - Poultry	- Eggs - Poultry - Piggary - Sewing - Dairy Farming	- Poultry - Piggery - Gardening - Vegetable Stalls - Sewing - Handcraft (Hawkers)	- Fencing - Poultry - Gardening - Shopping Complex - Sewing	- Maize Mill - (2) - Poultry - Piggery - Fencing - Bees - Groceries - Gardening - Blocks Making - Dairy Farming - Meat Farming - Agricultural and supplies - Sewing - Environmental Protection
Major development activities in the Chiefdom					
1	Farming	Roads	Roads (50% OK)	Roads	Farmers shed
2		Electricity			Clean water
3		Forest			
4		Water			
5					
On-going supported project					
1) project name, 2) supporting organization, 3) year started, 4) condition	1 1)Poultry Mahlawue Association 2)Inkhundla 3)In1995 4)Still under Maintenance 2 1)Asebilekane Association 2)Inkhundla 3)In 1995	1 1)Water Project 2)Japan 3)in 1997 2 1)Market 2)Inkundla 3)in 2000 4)Not working 3 1)Youth's Garden 2)Y2K 3)in 2000 4)Not working	1 1)Japanese Water Scheme 2)Started in 1998 3)On working condition	1 1)Fence Machine 2)Council of Churches 2 1)Gardening 2)Ministry of Agriculture 3 1)Shopping complex 2)Inkundla	1 1)Clean water 2)Japanese Government 3)in 1996 4)On working condition but small portion was left without clean water 2 1)Maize Mill 2)British Council 3 1)Chicken Shed 2)Council of Churches
Existing organization in the Chiefdom					
1) name, 2) year started, 3) condition	1 1)Asebilekane Association 2)in 1995 2 1)Mahlawue Association 2)in 1995 3 1)Shakata Women Association 2)in 2001 4 1)Farmer Association 2)in 1999	1 1)Simanye Mdayane Market 2)in 1999 3)Not working 2 1)Mdayane Youth Association 2)in 2000 3)Not working 3 1)Akhona Emakhosikati (Mdayane) 2)in 2001 3)Not working	I) 1.Ebutfongweni Association 2.On working condition ii) 1. Ebutfongweni Water Project 2.Not functioning	1 1)Lusweti Association 2)in 1997 2 1)Phutsanani 2)in 1985 3 1)Vulamehlo 2)in 1996 4 1)Tinkhabweni Mult Purpose 2)in 2000 5 1)Vusasive Association 2)in 2000 6 1)Emadlelo Association 2)in 1980 7 1)Nkonkoza Dip Tank 2)in 2000	1. Thandanani Farmers Association 2. Lusito Poultry Association 3. Vukani Women Association 4. Black Mbuluzi Farmers Association 5. Ngwazini Beekeepers Association 6. Ngwazini Environmental Association 7. Ngwazini Piggery 8. Sesivukile Association

Name of the Chiefdom	6	7	8	9	10
	Mbeka	Nswaceni	Mkhulamini	Sankolweni	Engcayini
Number of participants	5	7	8	2	9
Male	3	6	1	2	5
Female	2	1	7	0	4
Name of the Chief	Lusendvo	Nkosini	Mabange 2	Mvukuzaku	Mandanda
Number of community under Chiefdom	1	1	3	1	1
Name of the communities	Mbeka	Ngwaceni Ekukhanyeni	1. Vusweni-Mkhawuleni Gwandza 2 Mlonyeni-Duze Mabuza 3 Mkhulamini-Jimson Mavuso	Sankolweni	Engcayini
Existing facilities in the Chiefdom					
Borehole (number, year, operating/out of order)	2 -working - 2	0	3 - working - 1 - not working - 2	5 - working - 1 - not working - 4	0
Well / Spring (number, year, used/not used)	Well - 4 - used - 4	Well - 7 - used - 7	Well - 15 - used - 15	Spring - 8	Spring - 8
Communal tap	0	0	- Evusweni (1988) - Mlonyeni (1988) - Mkhulamini (1988)	0	0
Primary School	0	Ekukhanyeni P. Shool	Mphembekati	Sankolweni P. School	0
Secondary School	0	Ekukhanyeni High school	0	0	0
Clinic	0	0	Mkhulamini Clinic	0	0
Maize mill	- Mbeka - 1 - Daliya Nkambule -1	0	- Albert Dlamini - Not operating - Father Dlamini - 1	Maize mill - (1) Jackson Musa Dlamini Not working	0
Dip	0	0	1 (Nkonkwane)	1 (Mbheso)	0
Dam/reservoir	Mbeka Dam	Ekukhanyeni Dam	0	0	0
Income generating activities (list of the activities)	- Poultry - Piggery - Blocks Making - Gardening - Dairy Farming	- Poultry - Farmers shed for Gardening and Building - Piggery - Gardening	- Farmers shed for farming inputs/sewing - Gardening - Sewing - Poultry - Piggery - Maize Mill	- Poultry - Gardening - Piggery - Sewing - Sisa Range -Cattle	- Gardening - Piggery - Sewing - Poultry - Buying and selling of goods
Major development activities in the Chiefdom					
1	Roads	Farmers shed	None	Road	None
2		Electricity			
3					
4					
5					
On-going supported project					
1) project name, 2) supporting organization, 3) year started, 4) condition	0	1 1)Farmers shed for fertilizer and Consumer Shop 2)E.E.C 3)in 1998	1 1)Vusweni Multipurpose (Zamokuhle) Co-operative 2)(a)Council of Churches (b) E.E.C 3)in 1994 4)working (selling of fertilizer and Grocery) 2 1)Logedzeni Farmers Shed 2)Community and German Embassy 3)in 1998 4)workingh (selling of fertilizer and Sewing)	1 1)Piggery 2)Inkhundla 3)in 2000 2 1)Poultry Project 2)Australia 3 1)Sisa Ranch 2) IFAD (Agricultural) 3)in 1997	1 1)Lozicheme Association 2 1)Fencing 2)Council of Churches 3)From 1999 - 2000 4)Not finished
Existing organization in the Chiefdom					
1) name, 2) year started, 3) condition	1 1)Intamalaphila Association 2)in 1992 2 1)Phaphamani Piggery 2)in 1998 3)All on working condition	1 1)Asibone Mult Purpose 2)in 1988 2 1)Piggery Section 2)in 2000 3 1)Women's Market 2)in 1983	1 1)Zamokuhle Farm shed (selling of fertilizer and grocery) 2)in 1994 2 1)Logedzeni Farm Shed (selling of fertilizer) 2)in 1998 3 1)Sukumani Women (sewing) 2)in 1999 4. Poultry 5 1)Imfundvukufundvela Farming 2)In 1999 6 1)Sibonelo Farming 2)In 1995 3)Operating 7 1)Siyakeni II -Farming 2)In 1995 3)Operating 8 1)Vukani Kudle Women Farming 2)In 1993 3)Operating 9	1 1)Phikisanani Poultry 2)From 1992 2 1)Phambili men Association - Gardening 2)From 1998 3 1)Vukani Women Association - Piggery 2)From 1999 4 1)Mshadweni Sisa Range 2)From 1997	1 1)Lozicheme Farmers Association 2)From 1996 3)Still on 2 1)Kuphila Women Dress Making Association 2)From 2000 3)Still on 3 1)Ngcayini Multipurpose 2)From 1999 4 1)Kuvelwana Farmers Association 2)From 2000 3)Still on

Name of the Chiefdom	11	12	13	14	15
	Kantunja	Nkilijo Royal Kraal	Nyakeni	Bhekinkosi	Nsenga
Number of participants	4	5	14	17	6
Male	4	5	8	8	3
Female	0	0	6	9	3
Name of the Chief	Ndlovuyagwane	Mkhumbi	Mabange	Mshede Dlamini	Mandanda Mtsetfwa
Number of community under Chiefdom	1	1	9	1	1
Name of the communities	Ntunja	Nkilijo	1 Nyakeni 2 Ncakini 3 Emlonyeni 4 Evusweni 5 Emanyovini 6 Emashona 7 Emaceleni 8 Nkonkoza 9 Mkhulamini	Bhekinkosi	Mbhodanga Vilakati
Existing facilities in the Chiefdom					
Borehole (number, year, operating/out of order)	0	5 - working - 3 - not working - 2	3 - working - 2 - not working - 1	4 - working - 3 - not working - 1	0
Well / Spring (number, year, used/not used)	Spring - 5	Spring - 17	Spring - 40	Spring - 4 - working - 2 - not working - 2	Spring - 14
Communal tap	0	- Emabovini (1996) - Emangcineni (1996) - Emateze (1996)	Mkhulamini	Bhekinkosi (1997)	0
Primary School	0	Nkilijo Primary	1. Salukazi 2. Seven Holy Founders Mdyaduma 3 Mphembekati 4. Malyaduma	Bhekinkosi Nazarene	New Mbuluzi
Secondary School	0	Nkilijo Secondary	1. Mabange High School 2. Ekukhanyeni High School	0	Mhlahlo High School
Clinic	0	0	Mkhulamini Clinic	Bhekinkosi Clinic	0
Maize mill	- Ntunja Association - 1 - Ntamukwechubeka Association - 1	- H.W Khoza - H. Dlamini - L. Dlamini	- Wilson Lukhele - Mahlaba Dlamini - Mr. Nyawo - Mr. U. Zubuko - Mr. Manyatsi	- Thomas Maseko - Monty Maseko	0
Dip	1 (Ntunja) 1(Mdlebeni)	1 (Mhlambanyoni) 1 (Imbothoma)	1 (Mkwakweni) 1 (Mbuluzane) 1 (Mndlebeni)	1 (Maphophoma)	1 (Ephoweni)
Dam/reservoir	0	0	- Salukazi - Mkhuweni	0	0
Income generating activities (list of the activities)	- Chicken for eggs - Vegetable Production	- Fruits and Forestry - Sewing - Gardening - Poultry - Making of Fence - Concrete Poles and Tiles	- Poultry - Gardening - Piggery - Sewing - For Hire - Carpenters - Block Yard - Groceries	- Poultry - Gardening - Sewing - Piggery - Milk cows - Handcraft - Selling of Vegetables and Fruits - Hiring Tractors	- Gardening - Piggery - Poultry - Mat making - Sewing
Major development activities in the Chiefdom					
1	None	None	None	Water Taps	Roads
2				Farmers shed Under construction	Farmers shed
3				Pasture Management still under construction	
4					
5					
On-going supported project					
1) project name, 2) supporting organization, 3) year started, 4) condition	1 1)Forest Project 2)Ministry of Agriculture 3)Year of planting - 1986 4)Year of harvest - 2001 2 1)Land for cattle feeding 2)MOAC 3)From 1988	1 1)Farmers shed 2)E.E.U 3)in 1996 2 1)Primary School , one classroom 2)Japan 3 1)Electricity to the bore holes 2)Japan 4 1)Secondary School 2)Holland	1 1)Syalukaza Imbali association 2)Council of Churches 2 1)Indudurweni 2)America 3 1)Sewing Group 2)Council of Churches 4 1)Sibusiso Se Imbulukazana 2)Leites Motor 5 1)Water Project (Nyakeni) 2)SMP (Donor)	1 1)Water Project 2)Japan 3)Since 1997 4)working 2 1)Clinic 2)Micro Project 3)in 1992 3 1)Primary School 2)Y2K Micro Project 4 1)Shibani Association 2)in 1998 5. Cattle Farming 6. Feed Lock 7. garden 8. Piggery 9. Poultry Farming 10. Farmers shed	1 1)Farmers shed 2)Germany and Kukhanyeni Inkundla 3)in 2001 4)Still under construction 2 1)Nsenga Co-operative 2)in 1973 3)Still operating 3 1)Phaphama Association 2)In 1999 3)Still operating 4 1)Thembaletfu Association 3)in 1999 4)Still operating 5 1)Nsenga Youth Association 2)in 1997 3)Still operating 6 1)Simanye Vegetables Association 2) in 1997 3)Not operating
Existing organization in the Chiefdom					
1) name, 2) year started, 3) condition	1. Range Management Association	1 1)Mangcineni Farmers association 2)Since 1997 2 1) Nkilijo Farmers Association 2) Since 1999 3 1)Fanamafa Association 2) Since 2000 4 1) Matete Farmers Association 2) Since 2000 5 1) Luzamo Vegetables Growers 2) Since 1992 6 1) Zamokwakhe 2) Since 1995 7 1) Tamani Women 2) Since 1993 8 1)Nkilijo Youth Farmers Association 2) Since 1995 9 1) Sports Association	1 1) Siyembili Women Association 2) Since 2000 2 1) Lobuko Association 2) Since 1999 3 1) Mutfo Women 2) Since 1990 4 1) Sita Umndeni 2) Since 1992 5 1) Mabange Market 2) Since 1990 6 1) Endudurweni Association 2) Since 1999 7 1) Iyachukaza Imbali 2) Since 1995 8 1) Sibusiso Semambuluza 2) Since 1990 9 1) Emaceleni Association 2) Since 1990	1. Cattle Farming 2 1) Emandla Bobabe Farmers Association 2) Y2K 3 1) Sogcomane Dairy Scheme 2) Since 1972 4. Maize Farming 5. Sewing 6. Vegetables 7. Block Making 8. Poultry	1 1)Nsenga Cooperative 2) Since 1973 3)operating 2 1)Phakama Association 2)Since 1999 3)operating 3 1)Thembaletfu Association 2)Since 1999 3)operating 4 1)Nsenga Youth Association 2)Since 1997 3)Operating 5 1)Simanye Vegetable Association 2)Since 1977 3)not functioning

Name of the Chiefdom	1 Eru	2 Moyeni	3 Eburfongwen	4 Malayahuna	5 Ngwanzu	6 Mbeka	7 Newacere	8 Mdhulamin	9 Sankohwen	10 Engcanvin	11 Kantanya	12 Nkilo Royal Kraal	13 Nyakeni	14 Bhekinkoni	15 Nsenga
SWOT Analysis of the Chiefdom															
Strength	1. We have Sewing Machines but we don't have sewing materials 2. We are active/no quarrels 3. Soil 4. Water 5. Educated children but no work 6. We have Plenty of sites for making business 7. We believe in God	1. Piggery Projects 2. Feed Lock 3. Poultry Farming 4. Fence Making 5. Dipping Tank 6. Fencing Grazing Land (our people respect our chief and can follow project 7. Roads 8. Water 9. Electricity	1. We have good chances of access to Electricity , Water and Telephones 2. Good educated labor which can be available at any time 3. We also have accessible roads	1. No quarrels among the people of Malayahuna , if they are being called for a meeting , they keep time 2. Association have been educated on activities they are doing 3. There is plenty of space for making business 4. We have educated people who can afford to work	1 Good working associations 2. Clean water in the community 3. Good command by the chief 4. Electricity along the main road 5 Road good one from Manzini	1. Association for water in development 2. General development committees places 3. People are educated 4. Association for electricity in place	1 Land development committees 2. We have road 3. Enough space for starting businesses 4. We have water 5. We have electricity	1. They like development 2. No quarrels 3. If they are being called to a meeting, they attend well	1. Workforce - good build -schools 2. Educated people - not working 3. Good roads 4. Attendants at Mphikatini is good 5. No united 6. Youth is good or healthy 7. Umphakatini is very supportive 8. Reserved land for youth	1. We are active people in development 2. We are united 3. No drugs abuse 4. We are educated about development 5. No theft 6. Plenty of land for ploughing	1 Our community wish to have water project, hence when chief calling his subject, they are willing to have water as successful project 2. It goes easily with water 3 Deeping Tank 4 Toilets 5. Prevention of soil erosion 6. Community arrangement	1. Electricity 2. Full of young people who are educated but unskilled 3. Business area cleared 4. Telephone Line 5. Community Police 6. Enough schools for education 7. Resource center 8.The chief support the whole projects	1. Good Chief 2. Enough Land 3. Enough Men Power 4. Have so many association	1. In our community we have water project 2. We have people who have skills from different training such as Business Management and Project management 3. We have a business area 4. They are fit for any business 5.The youth are more effective from business 6. They are disciplined 7. We have road but is not good	1. Good road 2. We plough maize and vegetable 3.We like working
Weakness	1. No roads to the homesteads 2.No electricity 3.Gardening but no market	1. We need to be educated in some of the projects 2. We have no hospitals so some of the people get sick and die before the project is through.	1. Our community is a bit small at the moment because of chiefhanery disputes but our leadership is taking care of that. Which things we believe will work positively 2.Bore hole for making big 3. We have a problem of going to town during rainy days due to state of main roads	1. No reliable roads especially in rainy days it is difficult to travel 2. No water 3. No electricity 4. No telephone 5. No farmers shed 6. No high school	1. Slippery road during raining seasons 2. Dispute in neighboring chiefdom 3. No market for agricultural products	1. Youth does not want to work 2. Most of the people do not join the associations 3. No enough space for making project 4. No electricity 5. No telephone 6. Shortage of land	1 No telephones	1. No financial for helping the youth to starts business 2. No roads to the place of businesses and we hope (Kunyuayera Nkandla will help us	1. No markets for our vegetables 2. No bridges 3. Gullies	1. No road 2. No grazing land 3. No clinics 4. No schools 5. No water 6. No electricity 7. No farmers shed 8. No telephone	1. No schools 2. No adult education 3. No roads /Foot bridge	1. Water 2. Road not in good condition 3. Grazing lands not fenced to arrest the people	1. No proper roads 2. No electricity 3. No water 4. No telephone 5. No clinics 6. Have youth but no jobs	1. Shortage of funds 2. Shortage of electricity 3. Shortage of telephone 4. Shortage of bridges 5. Shortage of farming equipment (Tractors) 6. Shortage of water dams 7. Shortage of chicken house or poultry house	1. No telephone site 2. No electricity site 3. No grazing site 4. There is soil erosion
Opportunity	1. Development fund for Inkhundla 2. We have active youth 3. Plenty of well	1. Water unused bore holes 2.Roads 3.Electricity 4. Land for projects	1. We need to be provided with stops , pre-schools , water dams and police station which will be within our reach 2. We need fence and gardening equipment for our gardening. 3. We need electricity and pump for our bore hole. All that will be very helpful to our piggery and poultry projects 4. Have boreholes, but currently not used. 5. On-going projects	1. There is plenty of space for making business 2. We have educated people who can afford to work	1 Grant by the King 2. Road to be graveled from Manzini to Luve	Plenty water with irrigation potential	1 We have road to be tared soon 2. We have C.C.U association to help us in financial wise 3. Financial assistant by King 4. Adequate water supply	1. Development fund (Inkhundla)	1. Good land to plough only crop and vegetables if we can have water 2. Little money we have from Inkhdla 3. We can have money for cattle at Ilita Ranch	1. Development fund from Inkhundla 2. Our association is very strong and determined	1. We have development fund in our Inkundla 2. We have upgraded roads and Government promise better roads	1. Road will be in good condition soon 2. The inspectors of Government will provide training course 3. N.G.O.S also prove training (Sedco) 4. Community Police shortens crime 5. The Chief support the people to get training	Mr. Guduza promise us that by March they will make some and there is 40 in that we promised by Inkundla	1. 40 million 2. Clean water 3. Matriculated youth	1. We have associations that help us with money such as 40 million ,70 thousand and 44 million 2. We have the opportunity to get Inkundla from our Chief
Threat	1. Soil eronon 2. Road condition 3. Schools far away 4. Poverty	Need money	1. Gully erosion	1. No water but we can get some from bore hole 2. No reliable roads but the Ministry of Transport is promising to help 3. Roads being washed away by the rainfall 4. Pasturelands also washed away by rainfall	1. If we loose the grant we won't get Financial Assistance 2. If the Government fail to at least gravel the road it won't be easier to reach our community during rainy season	Population growth vs available land	1. No irrigation water 2. No employment for our people 3. No educated people	1. Trees are being cut which affect the nature 2. Washing away of soil 3. Lack of financial where as there much work to be done 4. Lack of grazing land due to the fact that, there is lot of cattle	1. Failure to get water 2. Failure to have a Police Station 3. Increasing dongas in area 4. Failure to have bridges	1. Water is too far 2. No grazing land 3. Clinic is too far 4. Schools too far 5. No good road 6. No electricity 7. Formation of dongas 8. No farmers shed 9. No telephones	1. Shortage of water supply 2. No sheds for farmers 3. N o foot bridges 4. Pre-schools and adult education 5. Alarming of unemployment people	1. Shortage forest 2. Too many dongas 3. Too much cattle	Community is not united	1. No work shops 2. No Forest 3. There is soil eronion 4. So many thieves 5. No means of transport such as buses , taxies etc 6. No units between community members and association	1. No good road to transport our goods 2. Shortage of electricity 3. Shortage of farming equipment 4. Shortage of fire wood 5. Transport shortages to transport our goods 6. Shortage of hagh school 7. Shortage of capital 8. Shortage of irrigation 9. Shortage of pre- school 10. Shortage of roads and bridges 11. Shortage of fencing our land	1. If we try to borrowed money sometimes we do not get it 2. Vanishing of forestry 3. Soil eronion
Problems in the Chiefdom															
1	Bridges	Dip tank	Telephone	Clean water	Road	Lack of financial assistance	Poverty	No electricity	Clinic	Water	Water supply	Water	Community is not united	Water	Water
2	Roads	Schools	Electricity	Roads	Poverty	Lack of knowledge to start projects	Chief is not concerned about development	No telephone	Electricity	no fenced grazing areas	foot bridges	Clinics		Dams	Electricity
3	Schools	Hospitals	Pre-school	Electricity	Police station	Lack of peace in communities	Lack of educated people in the area	No water in some places	Telephone	Clinic	unemployment	Grazing Lands		Fruits Trees	Telephone
4	Police station		Roads	Telephone	Lack of financial assistance			No police station	dongas	Poor road condition	pre-shool	Dongas		Trees	Clinic
5	Telephone		Security	High school	Irrigation water			No good roads	No Police Station	Electricity	farmers shed	Unemployment		Fencing	Lack of jobs for the youth
6	Dip tank			Clinic	Unfenced grazing land			Lack of schools		Gully eronion		Dams for irrigation			Most of our people have the H I V disease
7	Electricity			Pre-school	Pre-school			Lack of pre-schools				Shortage of forest			
8	Poverty			No farmers shed	Electricity							Markets of our products			
9				Police station	Clean water										
10				Forest											
11				Grazing land											
12				Dip tank											
How to solve the above problems															
1	By getting money for the projects	We need money to make projects	Planting trees in gullies	We can build a farmers shed because we have the space for it	Financial assistance from who so ever can help in any project we may think of	Financial increase among the society	If only we can be united with our chief and people	1. Minimize cattle	Education	Thinking of making some development which will give a good reward	Resolution of conflicts	Financial Assistance	Solving the problem of people undermining each other	If we get working capital	1. We can have water if only we can get a sponsor
2		Money to build schools		We can have electricity because we have electricity station	Lack of education or skill of proposed project	To be united with our chief	To have educated people	United within out community	Formation of association and work together	We need support for development projects	Monetary support	Trees for covering the dongas and the grazing land		If we can have farming equipment	We can have clinic if only we can join Swaziland Red Cross (Esphalali)
3						Need educated people	Financial increase among the society		Enough support to improve projects			Arrangement of homesteads		If we can get road and bridge	We can have telephone and electricity if only individual homestead can afford to pay E35
4												To acknowledge the community about family life			
5												Fencing of gullies			
Needs			Telephone												
1	Roads	Dip tank	Electricity	Dip tank	Irrigation water	Electricity	Telephone	Water	Water	Clean water	Schools	Clean water	Market	High School	Water
2	Schools	Schools	Security	Pre-School	Electricity	Telephone	Water	Electricity	Electricity	Grazing land	Roads	Clinics	Electricity	Pre-School	Maize mill
3	Clean water	Hospitals	Pre-school	farmers shed	Telephone	Water	Roads	Telephone	Clinic	Clinic	Water supply	Protection of dongas	Police station	Training Center	Pre-School
4	Clinics	Money to make projects		Pasturelands	Recreational center		Clinics too far	No good road	Bridge	Road	Foot bridge / bridge for cars		Water	Electricity	Electricity
5	Bridges			Forest	Pre- Schools		Feeling Stations	Financial Assistance for our project	Police station	Electricity	Employment		Clinic	Farming Implements	Telephone
6	Telephone			Telephone	Financial Assistance		Industrial Sites			Schools	Clinics		Employment	Water	Clinic
7	Electricity			Electricity						Gooddshed				Fencing	
Do you have dongas in your area?	Yes we have	Yes we have	Yes we do	Yes we do	Plenty of dongas	Yes we do	Yes we do	Yes we do	Plenty of dongas	Plenty of dongas	Plenty of dongas	Yes we do	Yes we do	Yes we do	Yes we do
How do you feel about land degradation/soil erosion?	We thank of planting trees such as gum trees etc	We need to plant trees to stop the eroding land	To get rid of this dongas we need to plant trees and grass	We plant trees	It must be fenced and plant trees around and inside dongas	It will help if we plant trees and grader must help to cover the dongas	Planting trees	We have no solution to this dongas	Need to plant trees to stop them	We need something to cover them	To plant trees	By planting and fencing trees	By planting trees and reducing overgrazing	By planting trees and fencing the area	Yonge Nawe will help us

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F.2.2 Interview/Workshop at Target Area 2 <Shiselweni Inkhundla>

Date: February 15th, 2001

Name of the Chiefdom	1 Bhadzeni II Royal Kraal 2	2 Dladleni	3 Lushikishini	4 Macudvulwini	5 Makhashini	6 Bhadzeni I	7 Mgazini	8 Khaborina	9 Ngcoseni	10 Velenizweni
Number of participants	1	10	7	4	10	11	7	7	11	7
Male	1	2	1	1	5	3	1	3	7	4
Female	0	8	6	3	5	8	6	4	4	3
Name of the Chief	Mduze Dlamini	Lusendvo Faleudze	Mhlaba Motsa	Sithondo Dlamini	Mleshe Dlamini	Lusendvo Faleudze	F Hobohobo	Mhlaba	Mlobokazane Faleudze	Ndwandwa II
Number of community under Chiefdom	1	2	4	4	2		3	3	5	5
Name of the communities	Mlonyeni Ngwenya	1. Ntolomberi 2. Mdasoma	Majaheni Sunelane	1. Lunyaweni 2. Mhlangu 3. Lubovu 4. Timphisini	1. Mahhashini 2. Inkolkholho	Indvuna - Mhlaleli Dlamini Bagijimi - 2 1. Malangeni 2.Bhadzeni	1. Emalangeni 2. Emapulazini 3. Entsontshane	1. Langaliba 2. Lele 3. Dlamini	1. Emjikjelweni 2. Engweni 3. Edladleni 4. Ehdvondvolweni 5. Ensangwini (Indvuna - Mfanyana Msibi)	1. Khohlwa 2. Mabovura 3. Kadeda 4 Entsebovu 5. Embhidlbhidli
Existing facilities in the Chiefdom										
Borehole (number, year, operating/out of order)	2 in 1998 On working condition	0	8 -working - 6 -not working - 2	0	0	2 in 1991 Not working	3 in 1987 not working	0	9 Not working	4 in 1998 Still functioning
Well (number, year, used/not used)	10 On working condition	11	16 - not fenced - 5	30 -working - 20 -not working - 10	10	12 On working condition	10	0	36	10
Communal tap (name of the community, year, operating/out of order)	1. Makhebezele 2. Mphenyane On working condition	0	Maskaba - 2	Lubovu - 1 not working	0	Ngwempisana	Enkanyezini not working	0	4 1.Emaheni (Ludvondvolo) 2.Engcoseni 3. Ehjikjelweni 4. Ensangwini	3 1. Khohla - not functioning 2. Ethangeni - Not properly functioning 3. Emhlahlo - Functioning
Primary School	Mphonono A. M S	0	1. Maseni 2. St Stephen 3. Tentele	1. Macundvulwini 2. Lunyaweni 3. Ndlaleni	Gundwini	1. Ngwempisana 2. Mbesumandla	0	0	1. Dzayane 2. Engcoseni 3. Cana 4. Tsawela 5. Siyendle 6. Wesele	1. Ngwempisana 2. Mhlatane 3. Mount Hermon 4.Holy Rosary 5. Mtimane 6. Ekukhulumeni 7. Entsebovu 8. Velenizweni
Secondary School	0	0	Nokuthula	0	0	0	0	0	1. Cana 2. Ngcoseni	1. Mankayane 2. Ndwandwe 3. Encabaneni
Clinic	0	0	Nokuthula	0	0	0	0	0	Cana	1. Mankayane 2.Encabaneni
Maize mill	1. Makhebelele 2. Mponono 3. Edibhi (Ebhadzeni)	1. Sipho Faleudze	1. Mankela I 2. Logalakadla II 3. Sidzakeni I	1. Mhlangu 2. Lunyaweni	1. Izewu Mtsetfwa	1. Ngwempisana 2. Ngcavulane 3. Ngwempisi store	1. Nkanyezini	0	1.Mancuberi 2. Kanyeni 3. Tsawela 4. Ngcoseni	1. Deda 2. Emhlatane
Dip	1. Mponono 2. Bhadzeni II	0	1.Sidzakeni 2. Logalakadla 3. Somtsewu	1. Nkundla 2. Sunyaipel 3. Landwane	0	1. Malangeni 2. Ngwempisana	1. Thumbela 2. Thamala 3. Endatseni 4. Sidumala 5. Tsadama	1. Khaborina	1 Mancuberi 2. Madeni 3. Embolwane 4. Engwempisi 5. Ngovazane 6.Mjeke 7. Ensangwini	1. Mhlatane - 2 3. Velenizweni 4. Lukhetseni 5. Entsebovu 6. Ekukhulumeni 7. Encabaneni
Dam/reservoir (name of the community)	0	0	0	0	0	0	0	0	0	0
Income generating activities (list of the activities)	1. Farm shed 2. Carpentry 3. Stores	1. Farming 2. Making mats 3. Selling cattle	1. Gardening 2. Poultry 3. Sewing	1. Maize Farming 2. Gardening 3. Poultry 4. Sewing 5. Piggery 6. Mats making	1. Selling Maize 2. Making mats 3.Making basket	1. Raising chickens 2. Basket making 3. Sewing	1. Fields Farming 2. No development due to shortage of water	1. Mats making 2. Maize farming 3. Gardening	1. Maize farming 2. Gardening 3. Cattle Farming 4. Poultry 5. Piggery 6. Peanuts Farming	1. Poultry 2. Handcraft 3. Gardening 4. Sewing 5.Block making 6. Welding
Major development activities in the Chiefdom										
1		0	Building of Farm shed	Building of farm shed	0	Building of school	Road	0	Water	Road construction from Luyena to Siteunara
2			Building of dam			Water projects	Farm shed		Road from Dayango to Sincunara	
3			Building piggery shelter			Road construction				
4			Building poultry shelter							
On-going supported project										
1) project name, 2) supporting organization, 3) year started, 4) condition	1 1) Farm shed 2) Inkoundla 3) 1995 4) On working condition 2 1) Class 2) Inkoundla 3) 2000	0	1 1) Dam 2) E.U 2 1) Farm shed 2) British High Commissioner 3) Not completed	1 1) Poultry Farming 2)Still Share	1. Water Project 2. Micro Projects 3. Not yet started	1 1) Water project 2) E.U 3) 1999 2 1)Bambanani Poultry 2)Tetsaneni	0	0	1 1) Embilingulane 2) Canadian Fund and Inkundla 2 1) Ngcoseni Farms Schemes 2) Mancaberi Irrigation and Agriculture	1 1) Intamakuphila Garden Scheme 2) IFAD 2 1) Nhlanhleni Poultry 2) SD Agri.Foundation
Existing organization in the Chiefdom										
1) name, 2) year started, 3) condition	1. Sewing 2. Carpentry 3. Inkukisa 4. Farm shed 5. Stores 6. Soccer 7. Water camp	0	1. Piggery 2. Poultry 3. Gardening 4. Carpentry 5.Sewing 6. Funeral Assistance 7. Community Police 8. Maize Farming - S.M.C	1. Poultry 2. Piggery 3. Forestry 4. Community Police 5. Funeral assistance 6. Farming association 7. Water association	Chubekela Phambili Water project Since 2000	1. Bambanani Poultry 2. Vuka Utendele 3. Nkanyezini burial society	1. Gardening 2. Farm shed association 3. Sewing 4. Community Police	1. Farmers 2. Sewining 3. Poultry 4. Youth	1. Garden associations 2. Mancuberi Irrigation (Beans) 3. Embilingwane (Poultry) 4. Buhlubuhlangene (Cattle) 5. Asebemunye Women (Chickens) 6. Khutsatelani Women 7. Tamasi women (Garden)	1. Sukumani Poultry 2. Timisele Multi Purpose 3. Nhlanhleni Poultry 4 Tfuftukani Piggery 5. Intamakuphila Gardening 6. Vulamehlo 7.Mtimane Farmers Association 8. Ngululse Gardening 9. Nsalitje Sewing 10. Phaphamani Sewing 11. Phakamani Gardening

	1	2	3	4	5	6	7	8	9	10
Name of the Chiefdom	Bhadzeni II Royal Kraal 2	Dladleni	Lushikishini	Macudvulwini	Mahhashini	Bhadzeni I	Mgazini	Khabonina	Ngcoseni	Velenzweni
SWOT Analysis of the Chiefdom										
Strength	1. Sand for building houses 2. We are united 3. We are educated 4. Road 5. Multi-purposes farm shed 6. Building of chiefdom 7.Farmers 8. Carpentry	1. Road 2. People 3. Land for farming 4. Water	1.We are proud of our Chief because he encourages development 2.We have educated people who can be able to work 3. We have road and means of transport 4.We have projects and association	1. No thieves 2. Working educated people 3. Hot spring 4.United among the community	1. Soil 2. Wells 3. Road 4. Fenced grazing land 5. Active people	1. Security - Community Police 2. Well constructed roads 3. Many rivers 4. Educated people with no jobs 5. Schools 6. Stores 7. Projects	1. No development 2. Plenty of rivers but no water assistance	1. Education 2. Land for farming 3. Rivers 4. United young people 5. Sand for building 6. Desire for improvement	1. Water 2. Soil 3. Road 4. Good communication 5. Educated people 6. Grazing land 7. Electricity	1. Abattoir - Poultry 2.Very active farmers 3. Road 4. Gardening 5. Poultry Structures
Weakness	1. Telephone 2. Electricity 3. Financial Assistance	1. We are not united 2. No grazing land 3. No clean water	1. Unproperly water 2. No good road , it is not easy to travel especially in rainy session 3. Market too far 4. Financial assistance for starting jobs	1. No good roads 2. No bridges 3. No electricity 4. No telephones 5. No market 6. No water in taps 7. No clinics 8. No money for developing the area	1. No telephone 2. No electricity 3.No clinic 4. No clean water	1. Electricity 2. Money 3. Market 4. Poor Co-operation	1. Unable to work because our chief doesn't have development 2. Poverty 3. No bridges 4. No electricity	1. No clean water 2. Bad roads 3. No school 4. No electricity 5. No bridges 6. No clinic 7. Poor	1. Poverty 2. Shortage of money 3. Shortage of market 4. No bridges 5. Soil erosion 6. No transport 7. No knowledge 8.Jealous	1. No electricity 2. No portable water 3.No roads to homestead 4. Financial capital 5. Poverty
Opportunity	1. Water for irrigation 2. Making of blocks for selling 3. Growing of trees and sugar cane 4. Poultry Farming	1. We have place for building abattour 2. We have land for farming	1. Piggery 2. Poultry 3. Gardening 4. Block making 5. Fence making 6.Sewing school uniforms 7.Maize Farming 8. Plenty of rivers	1. Rivers for irrigation 2. Plenty of land for farming 3. Market for selling 4. Farm shed for storing tools	1. Farm shed 2. River for irrigating our vegetable 3. Financial assistance from Inkoundla	1. Rivers 2. Market for pigs 3. Land for projects 4. Abattoir for chickens 5. Farmers 6. Forest 7. Road	1. Rivers 2. Fields but we don't have water and fence	1. Irrigation 2. Block making 3. Fence making 4. Gardening 5. Suger cane 6. Schoold 7. Mills	1. Water 2. Soil 3. Chicken 4. Cattle 5. Mats 6. Piggery	1. Abattoir - Poultry 2. Poultry - structures 3. Market available 4. Land 5. Rivers
Threat	1. High fees in schools 2. Aid 3. Unmarried families 4. Drought 5. Burning of forest 6. Laziness 7.Unreligion 8.Taking away of culture	1. Theft 2. Cattle die 3. HIV/Aids	1. Soil erosion 2.No job opportunities 3. H I V and Aids 4. No clean water 5. No electricity 6. Drought 7. No means of transport 8. Road slippery 9. High cost of education 10. No bridges	1. No clean water 2. Soil erosion 3. No road 4. No electricity 5. Shortage of employment	1. HIV/Aids 2. Cholera 3. Police station	1. Rapid population increase 2. Soil erosion 3. Cutting of forest 4.Burning of trees 5. Drought 6. Theft 7.Ophans	1. Soil erosion 2. Water for irrigation 3. We are not united	1. Drought 2. No money 3. Transport 4. No bridges 5. HIV/AIDS 6. No electricity 7. Chief disupute 8. Training 9. No support 10. Death	1. Soil erosion 2. Drought 3. HIV/Aids 4. Not united 5. Cutting of trees 6. No knowledge 7. Die of cattle	1.Disputes 2. Finances 3. HIV/Aids 4. Drought 5. Old age 6. Poverty
Problems in the Chiefdom										
1	Means of communications	Not united	No money	No road	Poverty	Poverty	No job opportunities	Jealousy	No employment	Poverty
2	Water	They do not want to be developed	No job opportunities	Soil erosion	Unemployment	No clean water	Soil erosion	Dispute	No clinic	Desertification
3	Burning of forestry		High drugs rate	Burning of forest		Electricity		No support	Die of cattle	Forest fire
4	Electricity		No grazing lands and water	Poverty		Clinic		Laziness	shortage of money	Portion of area has no water scheme
5			High crime rate	No job opportunities		Low foot bridge			Soil erosion	Unemployment
6									No bridges	
How to solve the above problems										
1	Gardening	The chief must be strict	Constructing of roads	Financial assistance	Financial assistance	Electricity	Need water	Teach people pacience	Opening of jobs	Capitalization - Projects
2	Financial Assistance		Constructing of bridges	Road	Opening of organizations	Clean water	Water pipes	Love	construction of roads and bridges	Human development
3	Job opportunities		Electricity and markets	Electricity	Employment	Clinic	Fence	Lead by example	Security for livestock	Increasing land
4	Electricity		Financial assistance	Clean water		Money for associations		Work hard	Helping of capitals	Purchasing for further expectation
5	Telephones					High school			Handcraft	Electricity
6									Planting of trees	Water
Needs										
1	Electricity	Water	Gully reclamation	Road	Clean water	Education on projects	Employments	Electricity	Knowledge/Education	Electricity
2	education	fencing grazing land	fencing grazing land	Clean water	Electricity	Money for projects	Prevent soil erosion	Finance	Capital	Portable water
3	fencing of our grazing land	Education for farmers' association	Getting money for projects	Electricity	Telephone	Clean water	Telephone	Materials	Construction of roads and bridges	Poultry feeds
4	Telephones	Pre-schools	Clean water for irrigation and drinking	Building of clinic	Clinic	Electricity	Electricity	Clean water	Handcraft	Funds to buy farms - expansion of crop
5	Money to continue with our project	Electricity	Electricity	Market for vegetables	Police station	Telephone		Transport	Gully reclamation	Transportation for various produce to the market
6	Market	markets for our products			Financial assistance			Clinic		
7					Reduce livestock			Schools		
Do you have dongas in your area?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
How do you feel about land degradation/soil erosion?	1. Burning of trees should be done at the right time 2. Follow the procedure of farming	1. Planting of trees 2. Building of camps 3. Put stones inside the dongas	1. Planting of trees and grass 2. Separating and fencing of grazing lands	1. Planting of trees 2. Planting of grass 3. Putting of stones in the holes 4. Reducing livestock numbers	1. Planting trees 2. Putting stones inside the dongas	1. Tree planting 2. Grass planting 3.Putting of stones	1. Tree planting 2. Grass planting 3. Putting of stones inside the holes	1. Pland grass and trees 2. Reduce cattle 3. Use stones to close dongas	1. Planting of trees and grass 2. Minimizing of livestock 3. Putting of stones inside the dongas	1. Zero grazing 2. Avoid fire at wrong times

F.2.3 Interview/Workshop at Target Area 3 <Ngwempisi Inkhundla>

Date: February 1st, 2001

	1	2	3	4	5
Name of the Chiefdom	Ekwayiweni	Mahagane	Mabonebulawe	Mkhokhweni	Zikhotheni
Number of participants	16	6	20	3	22
Male	10	4	6	3	9
Female	6	2	14	0	13
Name of the Chief	Ngome	Velaphi Hlophe	Salebona Tshangase	Mlomokazulu	Mlokothwa
Number of community under Chiefdom	5	6	9	5	7
Name of the communities	1.Malayinini 2.Gudlintaba 3.Mantambe 4.Zinhlabeni 5.Mapulazi	1.Mahagane 2.Sivule 3.Mazinsangu 4.Lungange 5.Mhlosheni 6.Galile	1. Hhengela 2. Hhuhhuma 3. Mavundluthi 4. Manzimhlophe 5. Nomngwiji 6. Nsalintshe 7. Thandizwe 8. Mabona 9. Sivule		1. Kudeni 2. Ndlovini 3. Ngoleni 4. Nkalak'thaka 5. Zibondeni 6. Mlanjwaveni 7. Inhlangano
Existing facilities in the Chiefdom	1 = (1991)				
Borehole (number, year, operating/out of order)	1	0	0	0	1)Galile - 1 2)In 1992 3)working condition
Well (number, year, used/not used)	Broken = (1994) 9	8	26	4	20
Communal tap (name of the community, year, operating/out of order)	0	0	1. Mabona 2. Thandizwe 3. Mavundluthi 4. Manzimhlophe - 0 5. Sivule 6. Hhuhhuma - 0 7. Hlengela 8. Nomangwinji 9. Nsalintshe	0	0
Primary School (name of the community)	1. Manyandeni Primary 2. Mantambe Primary	Ndusume Primary	1. Beersheba Primary 2. Mngondeni Primary 3. Themba Primary 4. Miziper Primary 5. Oslo Primary	1. Welcome Primary 2. St. Juliana 3. Our Lady of Sorrows	1. Galile Primary 2. St. Anselm Primary
Secondary School (name of the community)	Mantambe Secondary Mantambe High	Mantambe Secondary	Masiphula High School	Our Lady of Sorrows High School	Franson High school
Clinic (name of the community)	0	0	0	Emaromeni	Mhlosheni
Maize mill (name of the community)	0	0	0	Jackson Sithole	Ngwenya
Dip (name of the community)	2 1. Lontwelwe 2. Mantambe	2 1. Sikhokhozela 2. Lotwele	4 1. Sivule 2.Thandizwe 3. Ncotjane 4. Nsalitshe	2 1. Sikwebesi 2. Henhood	2 1. Mlokothwa 2. Paradise
Dam/reservoir (name of the community)	0		0	0	0
Domestic water system (name of the community)	0	2	0	0	0
Major development activities in the Chiefdom					
1	Cattle Farming	Banana Fruits	Gardening	0	Maize Farming
2	Poultry Farming	Maize Farming	Poultry		Gardening
3	Piggery Farming	Gardening	Making mats		Poultry
4	Goats Farming	Poultry	Making brooms		Sewing
5	Sheep Farming	Sewing	Piggery		
6	New Road	Making mats	Cattle Farming		
7		Road	Road (feeder road)		
8			Water (Emizper)		
On-going supported project					
1) project name, 2) supporting organization, 3) year started, 4) condition	0	1 1)Inkundla Gardening 2)in 1998 3)Still operating	1 1)Hhuhhula Poultry Farming 2)E.E.C 3)in 1991 2 1)Chubekani Assciation 2)E.E.C 3)in 1991 3 1)Beersheba Primary School 2)Inkundla/Government 3)in 2000 4 1)Rural Water 2)Inkundla	1 1)Fencing of grazing area and we get money from Inkundla 2)in 2000	1 1)Vegetable garden 2)Inkhundla 3)in 2000 4)on-going 2 1)Sewing 2)Inkhundla 3)in 2000 4)on-going 3 1)Poultry 2)Inkhundla 3)in 1999 4)on-going 4 1)Support to elderly people 2)World Vision 4)on-going

	1	2	3	4	5
Name of the Chiefdom	Ekwayiweni	Mahagane	Mabonebulawe	Mkhokhweni	Zikhotheni
Existing organization in the Chiefdom					
1) name, 2) year started, 3) condition	1. Thamba Lantungwa 2. Khula Mntungwa 3. Khanyisani Manyanda -Not in working conditon , no money -No assistance	1 1)Mcinso Garden Community - vegetables 2)in 1998 3)Still operating 2 1)Phakamani - sewing 2)in 1998 3)Still operating	1 1)Tetameleni Women - sewing 2)in 1992 2 1) Hhuhhuma Chubekani Association 2)in 1991 3 1) Thula Sizwe Multi Purpose co-operation 2) in 1994 3) Having problems 4 1) Masibambisane - Gardening 2) in 1986 5 1) Inkosi Ingisize Co- operative Farmers 2) in 1992	1. Proposed Vegetable Scheme 2. Proposed market at Welcome	1. 1) Mabhundlweni Poultry Project 2) In 1999 3) On working condition 2. 1) Zamani Madoda 2) In 2000 3) On working condition 3. 1) Mbandzeni 2) In 2000 3) On working condition 4. 1) Siphiwo Sabomake 2) In 1996 3) On working condition 5. 1) Good Hope Association on farmers 2) In 1998 3)On working condition 6. 1) Phikelelani Bomake Sewing 2) In 2000 3) On working condition 7. 1) Chwisha Farmers Association 2) In 1993 3) on working condition 8. 1) Vunulani Bomake Market 2) In 1996 3) On working conditions 9. 1) Simunye Bomake Poultry 2) In 1996 3) On working condition 10. 1) Siyakhula Garden 2) Year 2000 3) On working condition 11. 1) Simunye Bomake Poultry 2) In 1996 12. 1) Vunulani Bomake Market
SWOT Analysis of the Chiefdom					
Strength	1. We are united 2. Main road 3. Plenty of rivers 4. Man Power 5. Grazing land 6. Schools	1. Good road 2. Hard working people 3. Associations 4. Unemployed educated youth 5.Unemployed women 6. Electricity 7. Schools	1. Farming land 2. Water 3. Road 4. Electricity 5. Associations 6. Unemployed educated youth	1. Availability of water for irrigation and domestic use	1. Educated People 2. Toilets at homesteads 3. Associations - 10
Weakness	1. No Money 2. No Water 3. No Market 4. No Road 5. No High School 6. No Clinics 7. No Post Office 8. No Cattle Camp	1. Clinics 2. Police Station 3. Telephone 4. No Market 5. No money	1. No money 2. No Clinics 3. No Telephones 4. No Electricity 5. Adult Education	1. No Roads 2. No Electricity 3. No Telephone 4. No market 5. Chief Disputes 6. No land because of many private farms 7. No Adult Education	1. No market 2. No roads 3. No water 4. No Primary Schools 5. Clinic - 1
Opportunity	1. Garden - no water 2. Bore hole - broken 3. Market - no money 4. Goodshed 5. Secondary	1. Water 2. Farmers 3. Associations 4.Money from Inkundla	1. Plenty of rivers 2.Poultry Market	1. Inkundla Fund 2. New Proposed Market 3. Man Power 4. Availability of water from Mantambe river	1. Plenty of water 2. Goodshed 3. Electricity Station but no electricity to the home steads due to money problems
Threat	1. Drought 2. Clinic 3.Pure water 4.Aids 5. Cattle Camp 6. Hailstorm	1. Soil erosion 2. HIV/Aids 3. Drought 4. Hailstorm	1. Dongas 2. Drought 3. Aids 4. No Clinics 5. No employment	1. Disputer 2. Drought 3. HIV/Aids/Cholera 4. Dongas 5. High birth rate 6.Exodus of students to South African Schools 7. High cost of education	1. HIV/Aids 2. Foot and Mouth Disease 3. Drought and Storm 4. Soil Erosion 5. Theives
Problems in the Chiefdom					
1	Poverty	Hospital	Unemployment for youth	Poverty	Clean water
2	Theft	Electricity	Shortage of school fees for children	Job opportunities	Dip tank
3	Soil erosion	Police Station	High Schools - not enough	Lands for homesteads, fields and grazing	No grazing lands
4	Jealous		Clinics	Roads	No schools
5	Security		No places for those who wants to be educated on business	Telephone	Roads
6	Clinic		Transportation	Electricity	Soil erosion
7	No employment			Clean water	
How to solve the above problems					
1	Jobs	Financial Assistance to start businesses	Job opportunities	If we can get finance	Financial Assistance
2	Police Station	Opportunity to work	Dams for irrigation	Job opportunities	Community councilors
3	Dam for irrigation		Financial Assistance to build schools and clinics	Get basics infrastructure	Police Station
4	Purified water		Better ways of borrowing money	Irrigation	
5	Planting trees prevent soil erosion			Fill dongas by growing trees	
6				Create income generating projects	
7				Provide more land by purchasing farms	
Needs					
1	Clean water	Employment	Factories	Irrigation water	Clean water
2	Clinic	Hospital	Water pipes	Piped water	Income generating projects
3	Electricity	Police Station	Clinics	Finance	Roads to the homesteads
4	High School	High School	Basary for learners	Land for farming , grazing and homesteads	Clinics
5	Police Station		Salary for the elders	Clinics	Enough schools
6	Market			Road	
7	Telephone			Electricity	
8	Industries			Primary Schools	
Do you have dongas in your area?	Yes	Yes	Yes	Yes	Yes
How do you feel about land degradation/soil erosion?	Planting of trees	Planting trees	Putting stones and planting trees	Need to fill them by stones , growing trees and grass	Need to fill them by planting trees
Willing to participate in projects	Yes	Yes	Yes	Yes	Yes

F.3 Seasonal Calendar

F.3.1 Seasonal Calendar (1)

TA1 Eni and Engcayini Chiefdom

<Men>

Month	January	February	March	April	May	June	July	August	September	October	November	December
Activity	Weeding	Gardening	Looking after cattle	Harvesting	Harvesting	Harvesting	Harvesting	We do minor jobs	Putting manure in our fields	Start Farming	Plough the fields	Start weeding
	Paying school fees	Ploughing	Make harvesting trail	Enspan oxen		Livestock no more go to the grazing land	Water the garden	Put manure in the fields	Farming			Traditional Dance
	Organization meetings					Fence the garden						Boys cut thorn trees
	School meetings											Getting ready for Christmas
Rate*	5	2	2	3	3	3	1	1	2	3	5	5

<Women>

Month	January	February	March	April	May	June	July	August	September	October	November	December
Activity	Weeding	Plough beans	Enjoying fresh food from the fields	Harvesting	Cutting grass for roofing houses	Harvesting maize	Harvesting	Rest	Getting ready for farming	Start farming	Plough the fields	Weeding
	Prepare children for school opening	Harvesting groundnuts			Plastering houses	Cutting reed	Cutting grass for roofing our houses	Girls get ready for reed dance		Putting manue in the fields		Traditional dance
	Organization meetings				Harvesting	Cattle out for grazing						Getting ready for Christmas
	School meetings											
Rate*	5	2	1	3	5	3	3	1	2	3	5	5

TA2 Zikhotheni Chiefdom

<Men>

Month	January	February	March	April	May	June	July	August	September	October	November	December
Activity	Farming	Looking after cattle	Less work to do	Harvesting	Harvesting	Finished harvesting	Harvesting Maize	Rest	Rest	Getting ready for farming	Farming	Farming
	Weeding	Eating maize	Preparing to harvest	Making harvesting trail		Harvest King's sorghum	Stop looking after cattle			Looking after cattle	Look after cattle	Looking after cattle
	Look after cattle						Harvesting King`s sorghum					We do traditional Dance
	Pay School fees											Young man cuts thorn trees
	Weed King's fields											
Rate*	1	1	1	2	4	2	1	1	1	4	5	3

<Women>

Month	January	February	March	April	May	June	July	August	September	October	November	December
Activity	Spraying cotton and maize	Weeding	Cutting of trees	Harvesting	Harvesting	Harvest cotton	Harvest maize	Harvesting	Putting manure in the fields	Putting manure in the fields	We do farming	Weeding
	Weeding	Spraying the maize crop	Making harvesting trail	Spraying the maize crop	Taking the maize from the fields	Cutting of grass	Plastering of houses	Cut cotton trees	We rest	We do farming	We plough	Spraying the crops
	Paying school fees	Putting manure in the fields	Cutting of grass in the fields	Packing maize into the harvesting trail	Packing the maize into the harvesting trail	Doing nothing		Putting manure in the fields			We plough sweet potatoes	Putting manure in the fields
	Weeding cotton				Harvest cotton							Getting ready for Christmus
Rate*	2	3	2	3	1	1	1	1	1	3	5	5

Note: *The numbers indicate how busy the month is. 5 is the busiest month.

Seasonal Calendar (2)

TA3 Macudvulwini Chiefdom

<Men>

Month	January	February	March	April	May	June	July	August	September	October	November	December
Activity	Weeding	Weeding maize crop	Looking after cattle	Harvesting at Mfabantfu	Harvesting	Rest	Harvesting	Putting manue in the fields	Putting manue in the fields	Start farming	Start farming	Farming
	Beans farming	Looking after cattle	Making harvesting trail									Traditional Dance
	Looking after cattle											
Rate*	4	1	2	3	3	1	1	2	1	1	4	5

<Women>

Month	January	February	March	April	May	June	July	August	September	October	November	December
Activity	Weeding	Looking after cattle	Looking after cattle	Harvesting	Harvesting	Cutting grass	Harvesting	Rest	Cutting reed	Start farming	Start farming and plough	Farming
	Looking after cattle								Rest			Weeding
	Paying school fees											Getting ready for Christmas
	5	2	1	3	2	1	3	1	1	2	5	5

Note: *The numbers indicate how busy the month is. 5 is the busiest month.

F.3.2 Day Schedule (1)

TA1 Eni and Engcayini Chiefdom

Time	Men	Women
3:00	Sleep	Sleep
4:00	Sleep	Wakeup
5:00	Sleep	Prepare breakfast and school children
6:00	Sleep	Clean our houses
7:00	Make handcraft and gardening	Clean the yard
8:00	Looking after cattle	Eat breakfast
9:00	Looking after cattle	Make handcraft
10:00	Eat breakfast	Others take cattle to the grazing land
11:00	Gardening	Looking after cattle
12:00	Gardening	Prepare lunch
1:00	Eat lunch, others milking cow	Wash our cloth
2:00	Take cattle to the grazing yard	Fetch fire wood
3:00	School children returned home	Prepare lunch for school children
4:00	Men fetch fire wood	Fetch water from the river
5:00	After gardening , one member of the family makes fire	Cook supper
6:00	Cattle returned from grazing land	Bath
7:00	Rest	Fetch cattle from the grazing land
8:00	Eat food	Eat supper/school children study
9:00	Bath	Discussing about things we have to do the following day
10:00	Sleep	Sleep
11:00	Fast asleep	Fast asleep
12:00	Fast asleep	Fast asleep

TA2 Zikhotheni Chiefdom

Time	Men	Women
3:00	Fast asleep	Fast asleep
4:00	Wakeup and enspan oxen	Wake up
5:00	Working in the fields, Children go to school	Prepare meal for the children
6:00	Working in the fields, Working in the garden	Prepare lunch for the children, Fetch water from the river
7:00	Still working	Cleaning the yard
8:00	Building cattle kraals, Roofing houses	Gardening, Others cut grass
9:00	Take cattle to the grazing land, Working in the fields	Working in the fields
10:00	Return home after weeding the fields	Working in the fields
11:00	Milking the cow	Return home
12:00	Lunch time	Prepare food
1:00	Lunch time	Prepare food
2:00	Return to the fields and also do different kinds of work	Prepare food
3:00	Continued working in the fields	Take a rest
4:00	About to finished our work	Fetch water
5:00	Finished working	Prepare food
6:00	Return home	Clean the house
7:00	Prepare for bed	Dish and eat
8:00	Sleep	Washing kitchin utensils
9:00	Fast asleep	Bath
10:00	Fast asleep	Sleep
11:00	Fast asleep	Fast asleep
12:00	Fast asleep	Fast asleep

Day Schedule (2)

TA3 Macudvulwini Chiefdom

Time	Men	Women
3:00	Sleep	Sleep
4:00	Sleep	Sleep
5:00	Wakeup (busy season)	Wakeup
6:00	Wakeup (normal season)	Working in our home
7:00	Working in our home	Working in our home
8:00	Working in our home	Working in our home
9:00	Working in our home	Working in our home
10:00	Rest	Rest
11:00	Rest	Rest
12:00	Rest	We do minor job
1:00	Rest	We do minor job
2:00	Rest	We do minor job
3:00	Working in our home	Working in our home
4:00	Working in our home	Working in our home
5:00	Working in our home	Working in our home
6:00	Working in our home	Rest
7:00	Working in our home	Rest
8:00	Sleep	Sleep
9:00	Fast asleep	Fast asleep
10:00	Fast asleep	Fast asleep
11:00	Fast asleep	Fast asleep
12:00	Fast asleep	Fast asleep

F.4 Summary of Problems (from Workshop)

Item	TA1	TA2	TA3	Total
1. Infrastructure	**65.0**	**38.9**	**21.2**	**125.3**
Water for domestic use	16.0	7.2	7.9	31.1
Hospital/Clinic	8.3	10.1	4.7	23.1
Road/ Bridge	13.1	4.3	4.7	22.2
Electricity	10.2	5.8	3.9	19.9
Telephone	8.7	1.4	-	10.2
Dip tank	2.4	5.8	-	8.2
School	3.4	2.9	-	6.3
Pre-school	2.4	-	-	2.4
Adult education	0.0	1.4	-	1.4
High school	0.5	-	-	0.5
2. Income	**14.6**	**42.0**	**38.6**	**95.2**
Poverty	4.4	20.3	13.4	38.0
Job opportunity	2.4	13.0	15.7	31.2
No farming land	-	8.7	1.6	10.3
Financial assistance	3.4	-	6.3	9.7
Irrigation water	2.4	-	-	2.4
No money	-	-	1.6	1.6
Fruit trees	1.5	-	-	1.5
Farmers shed	0.5	-	-	0.5
3. Social problem	**13.6**	**14.5**	**22.7**	**51.0**
Security/Police station	4.4	11.6	0.8	16.8
Jealous	-	2.9	3.9	6.8
Community is not united	2.4	-	3.9	6.4
No intension for development	1.9	-	3.1	5.1
Dispute	1.5	-	3.1	4.6
Communication	-	-	3.9	3.9
Lack of knowledge	3.4	-	-	3.4
High use of drug	-	-	2.4	2.4
Laziness	-	-	1.6	1.6
4. Environment condition	**6.8**	**4.3**	**17.3**	**28.4**
Soil erosion	-	4.3	7.1	11.4
Forestry	1.0	-	7.1	8.1
Desertification	-	-	3.1	3.1
No fence in grazing area	2.4	-	-	2.4
Gully erosion	1.9	-	-	1.9
Grazing land	1.5	-	-	1.5

Note : Five problems were listed by each chiefdom in order of priority. The first prioritized problem was scored as 5 and the fifth problem as 1. The sum of scores for each problem was converted into ratio to the total point.

F.4.1 Summary of Needs (from Workshop)

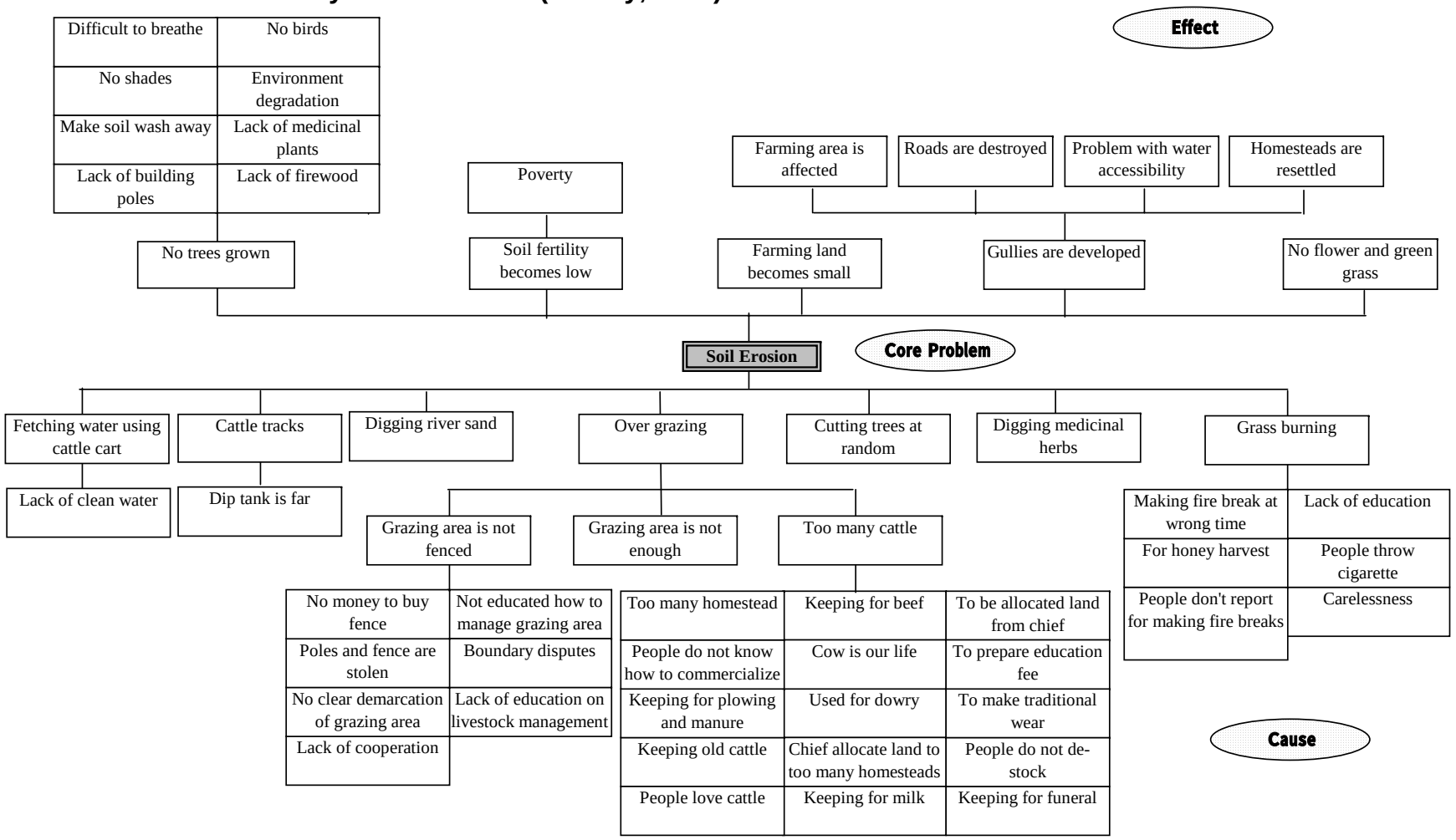
Item	TA1	TA2	TA3	Total
1. Infrastructure	**86.0**	**55.9**	**50.6**	**192.3**
Domestic water	19.4	23.4	16.2	59.0
Electricity	14.6	3.9	18.2	36.6
Clinic/Hospital	8.3	18.2	2.6	29.0
Road/Bridge	10.2	3.9	5.2	19.3
Telephone	7.3	-	5.8	13.1
Pre-school	7.3	-	1.3	8.6
School	6.3	1.3	-	7.6
High school	2.4	5.2	-	7.6
Dip tank	4.9	-	-	4.9
Grazing land	2.9	-	-	2.9
Maize mill	1.9	-	-	1.9
Transport	-	-	1.3	1.3
Filling station	0.5	-	-	0.5
2. Income	**6.3**	**36.4**	**20.6**	**63.3**
Financial assistance	1.5	3.9	11.7	17.0
Employment	-	13.0	3.2	16.2
Irrigation water	2.4	6.5	-	8.9
Income generating project	-	5.2	-	5.2
Farm shed	-	3.9	-	3.9
Market	2.4	-	0.6	3.1
Land for farming and grazing	-	2.6	-	2.6
Materials	-	-	1.9	1.9
Poultry feeds	-	-	1.9	1.9
Handicraft project	-	-	1.3	1.3
Support for elders	-	1.3	-	1.3
3. Social needs	**5.9**	**7.8**	**14.9**	**28.6**
Knowledge/Adult education	-	2.6	14.3	16.9
Security/Police station	3.4	5.2	0.6	9.2
Training center	1.5	-	-	1.5
Recreation center	1.0	-	-	1.0
4. Environment conservation	**2.0**	**-**	**13.6**	**15.6**
Fencing of grazing land	-	-	7.1	7.1
Protection of gully erosion	1.5	-	3.9	5.4
Trees to protect gully erosion	-	-	2.6	2.6
Forest	0.5	-	-	0.5

Note : Each chiefdom was asked to list five needs in order of priority. The first prioritized problem was scored as 5 and the fifth problem as 1. The sum of scores for each problem was converted into ratio to the total point.

F.5 Problem Tree

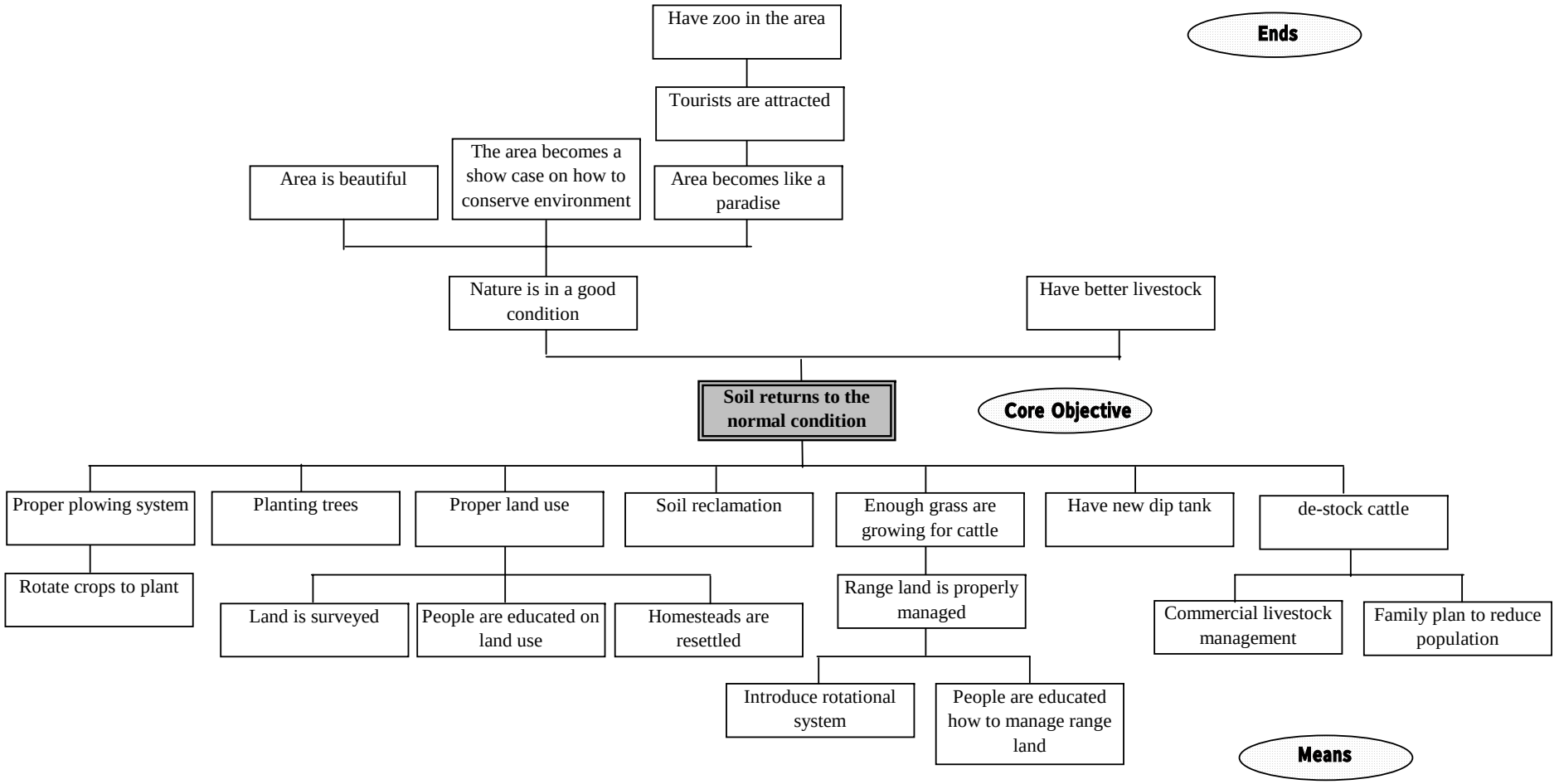
For Master Plan

F.5.1 Problem Tree <TA1 Kukhanyeni Inkhundla> (25 July, 2001)



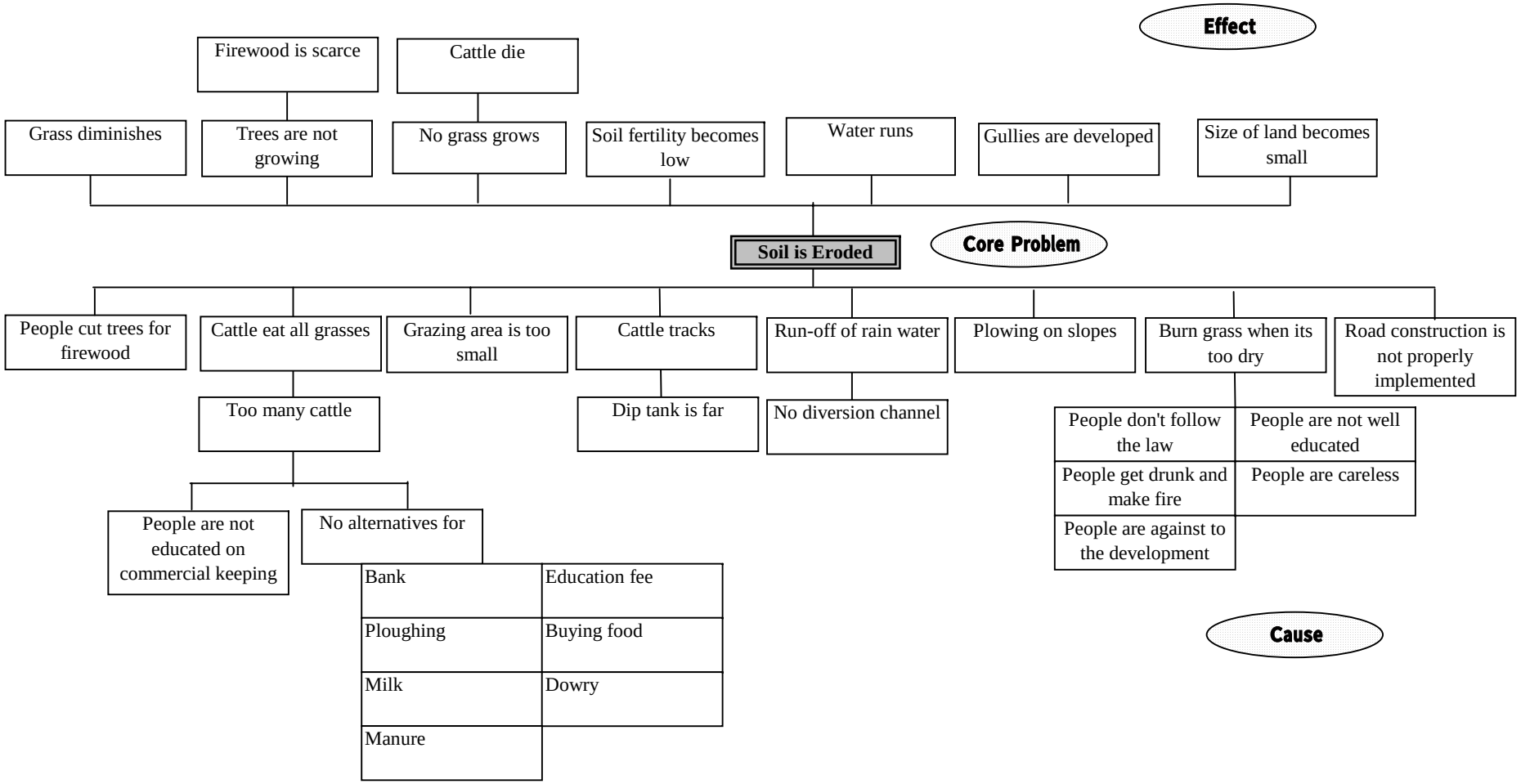
F.5.2 Objective Tree <TA1 Kukhanyeni Inkhundla> (25 July, 2001)

For Master Plan



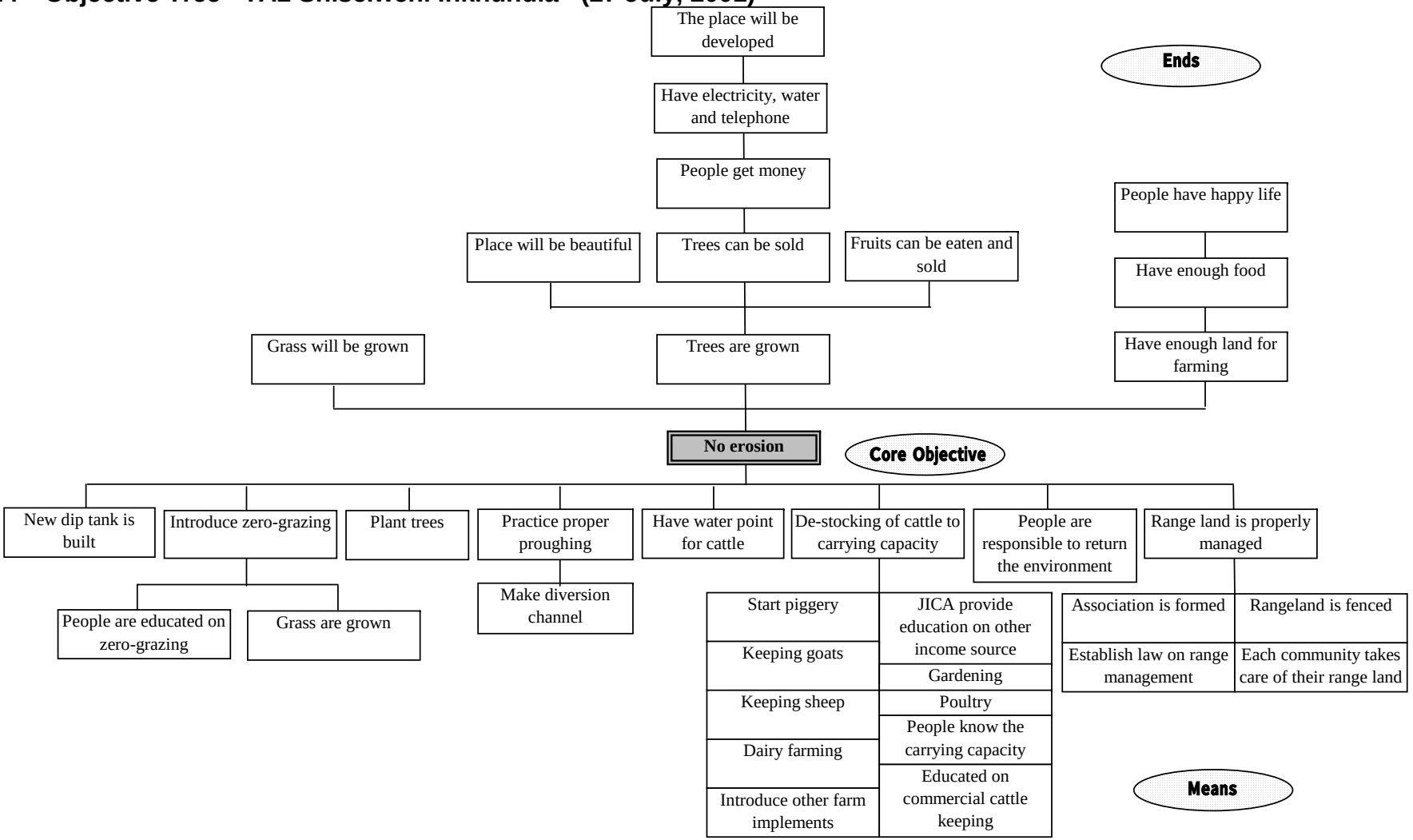
For Master Plan

F.5.3 Problem Tree <TA2 Shiselweni Inkhundla> (27 July, 2001)



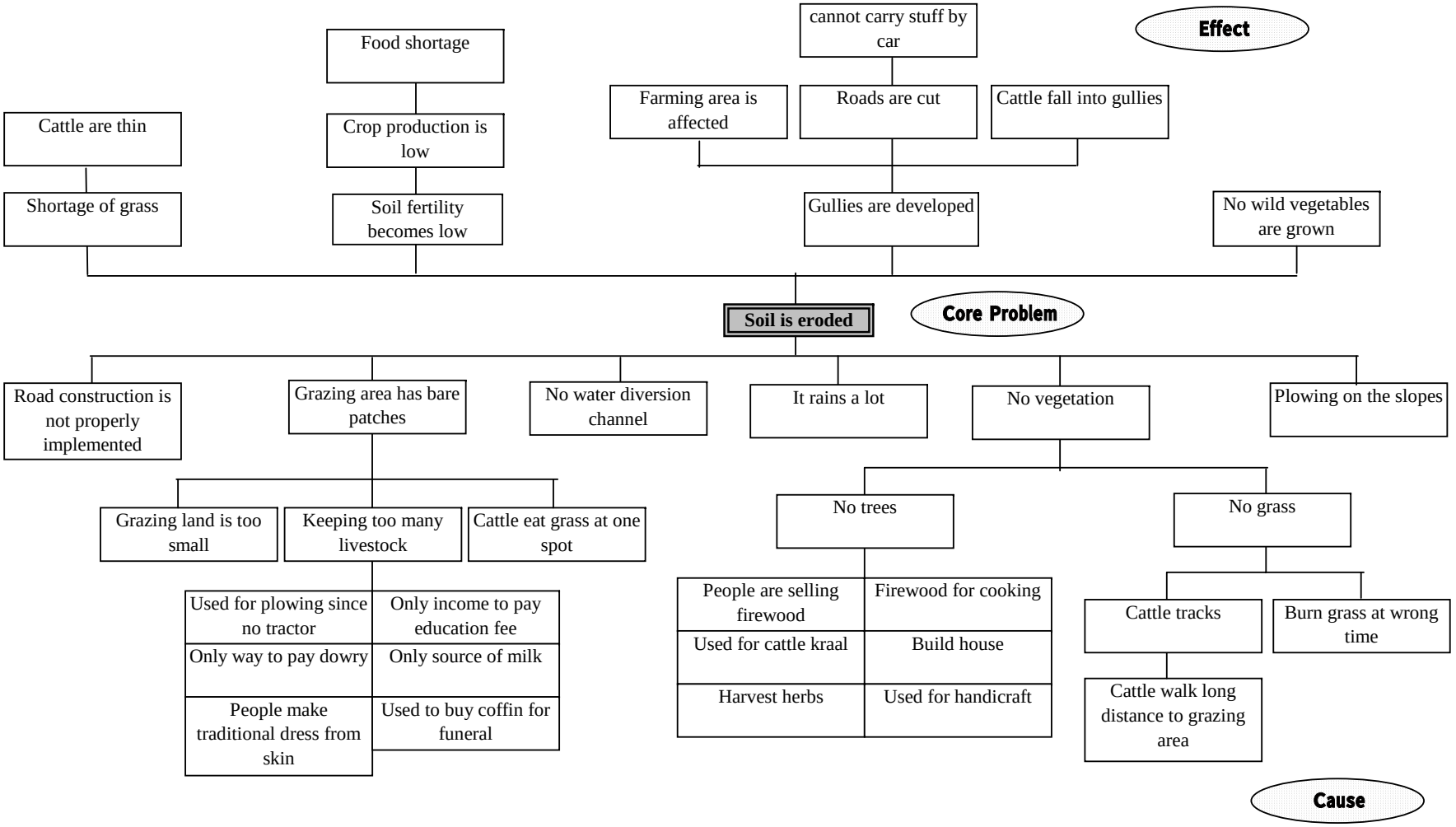
F.5.4 Objective Tree <TA2 Shiselweni Inkhundla> (27 July, 2001)

For Master Plan



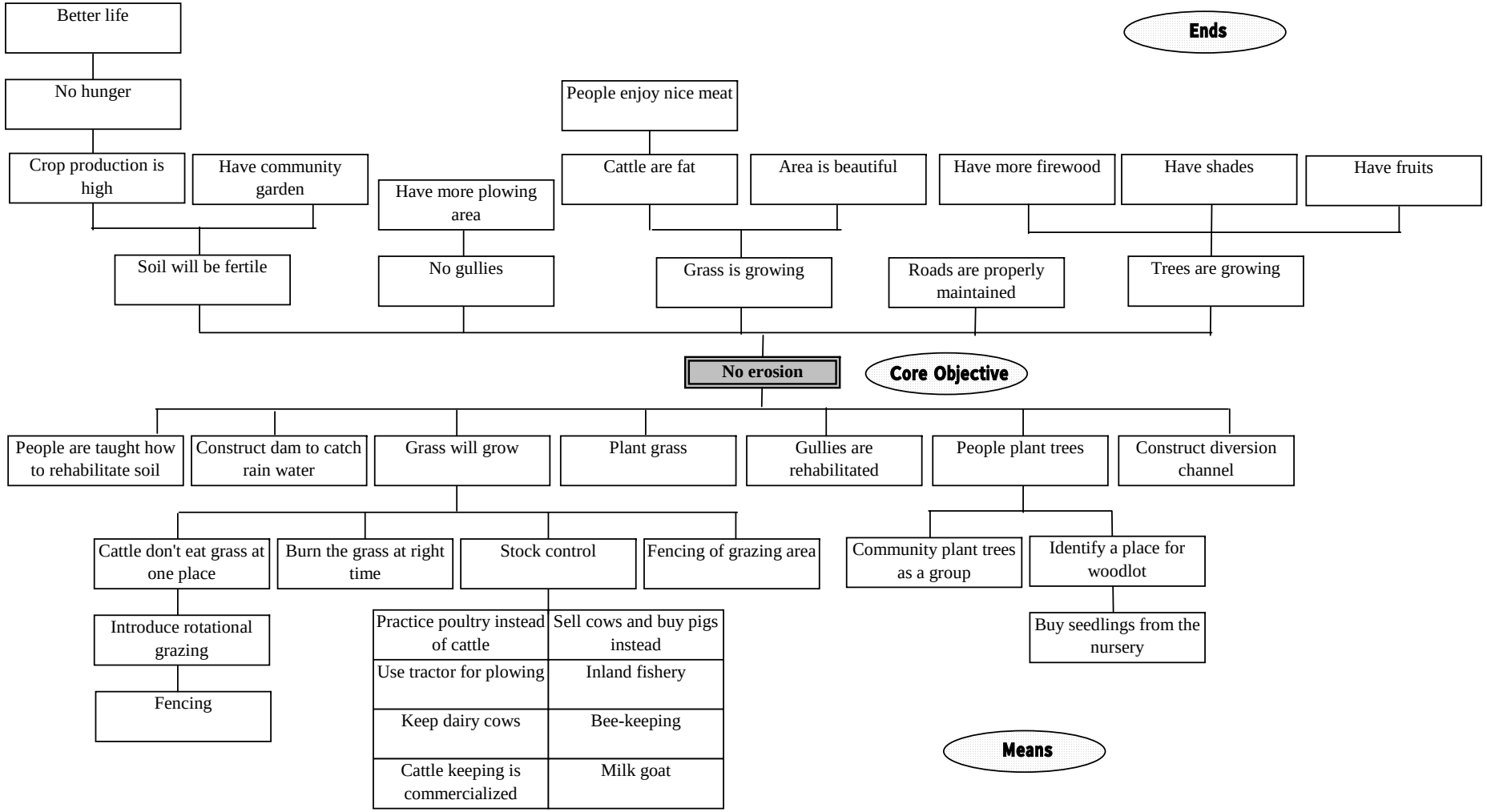
F.5.5 Problem Tree <TA3 Ngwempisi Inkhundla> (31 July, 2001)

For Master Plan



For Master Plan

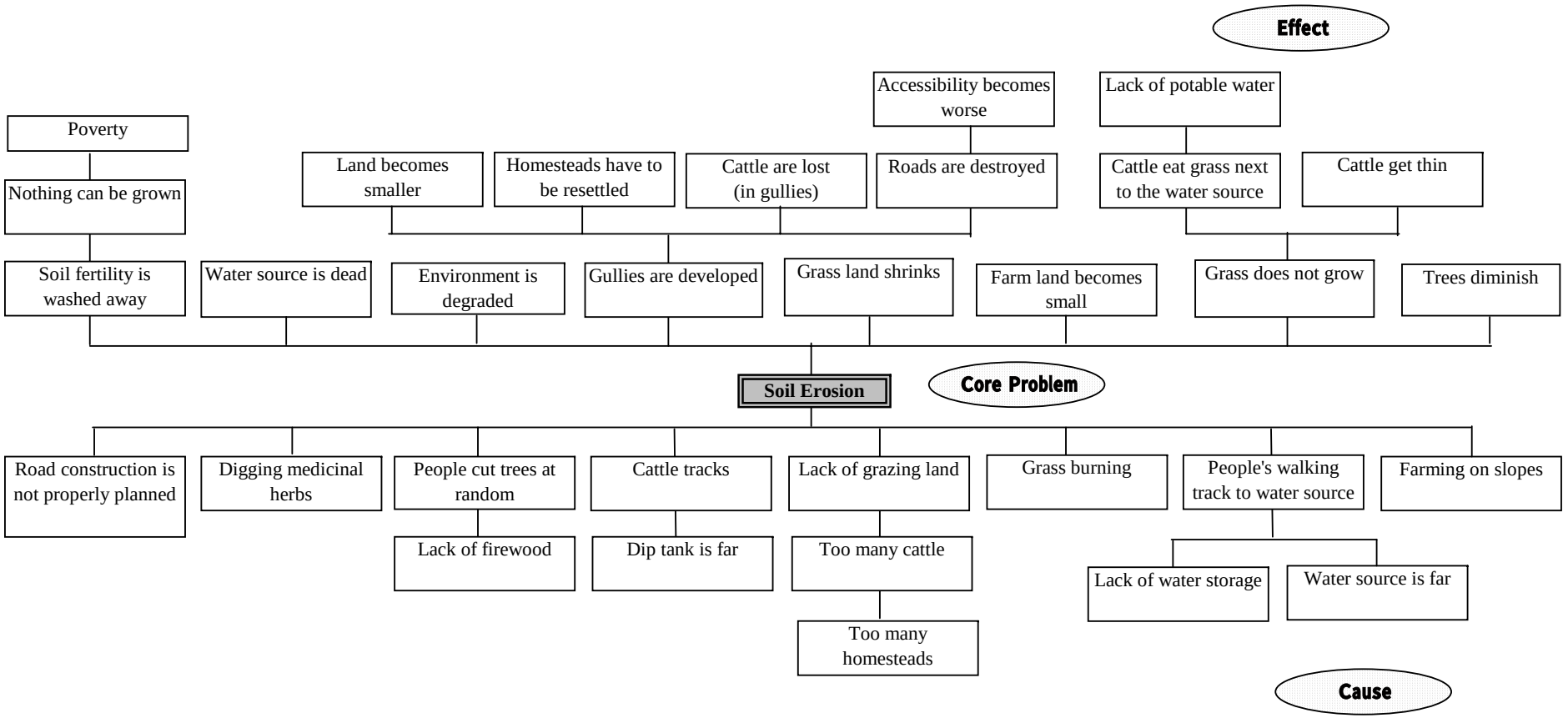
F.5.6 Objective Tree <TA3 Ngwempisi Inkhundla> (31 July, 2001)



F.6 Problem Tree and Objective Tree in Each Target Area

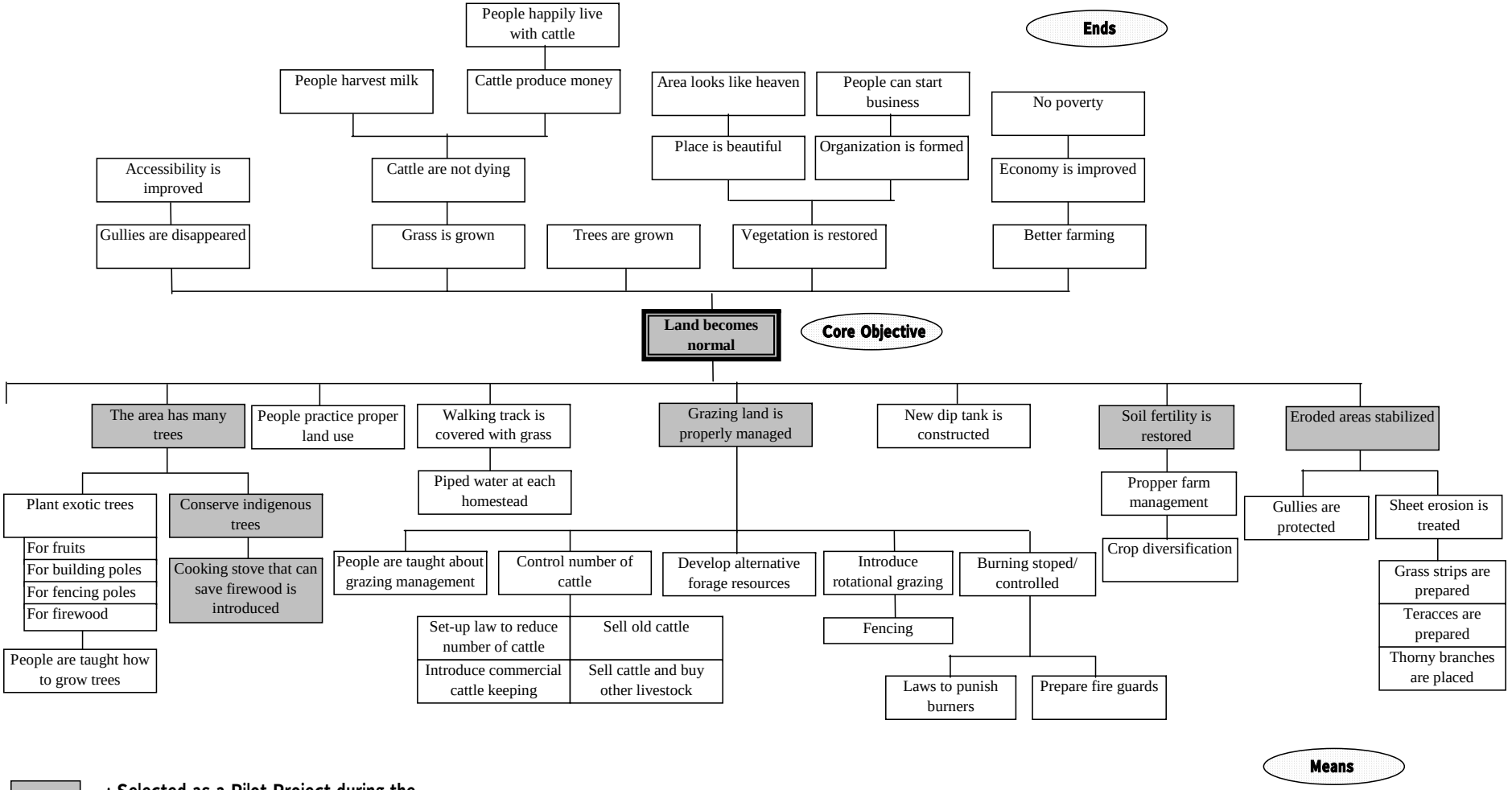
F.6.1 Problem Tree <TA1 Eni and Engcayini Chiefdom> (26 July, 2001)

For Pilot Project

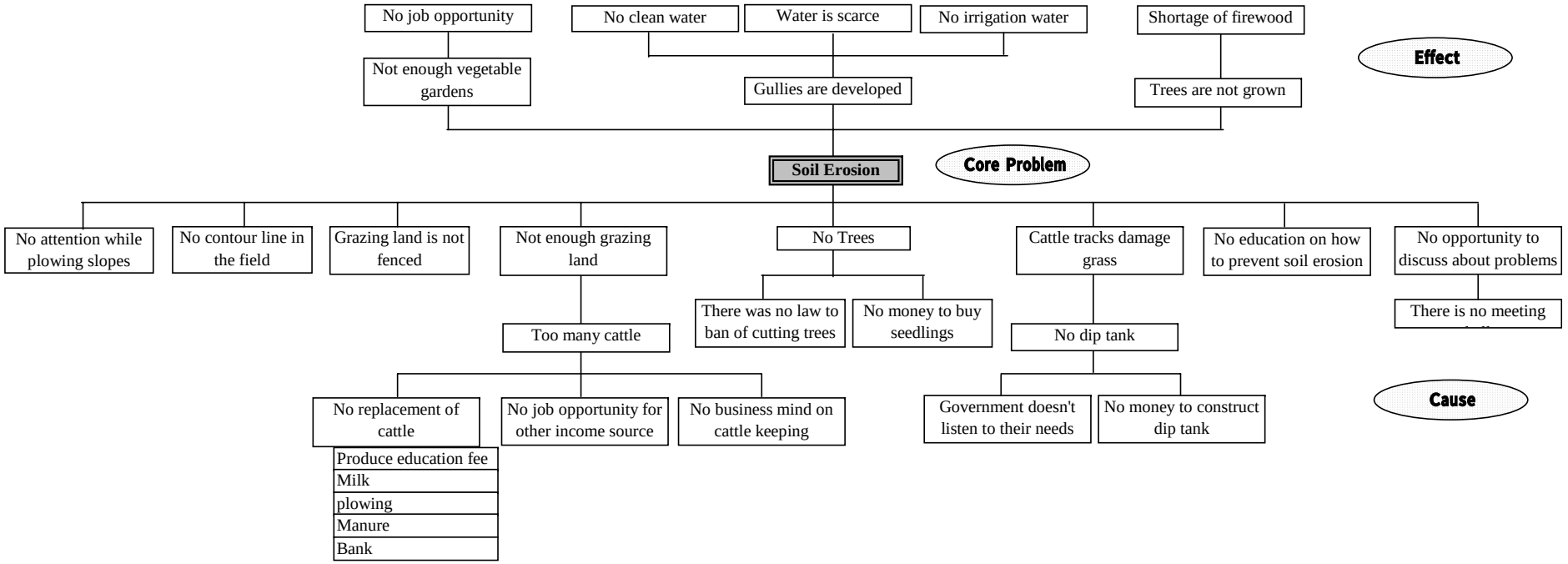


F.6.2 Objective Tree <TA1 Eni and Engcayini Chiefdom>

For Pilot Project

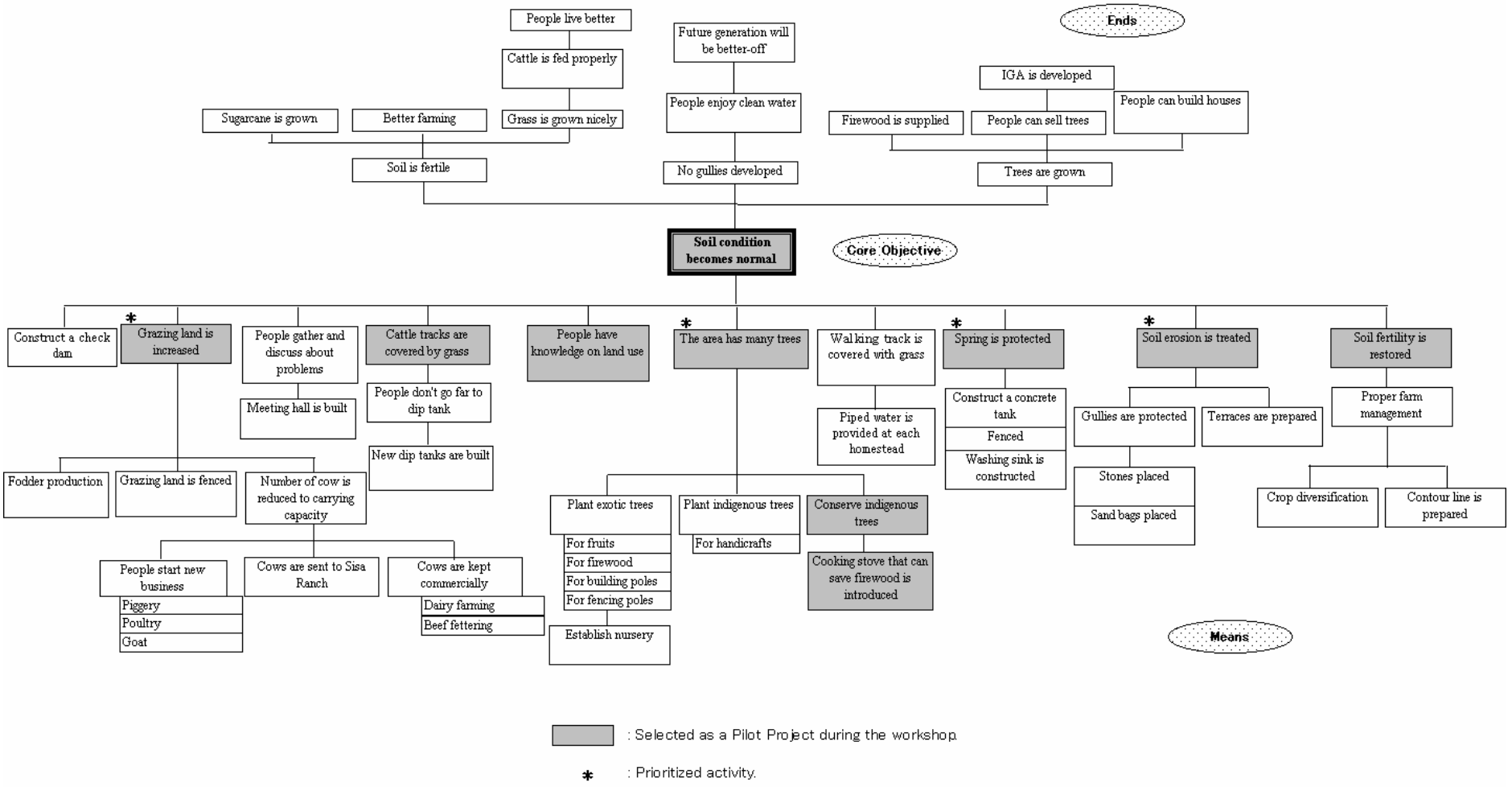


F.6.3 Problem Tree <TA2 Zikhotheni Chiefdom> (19 July, 2001)

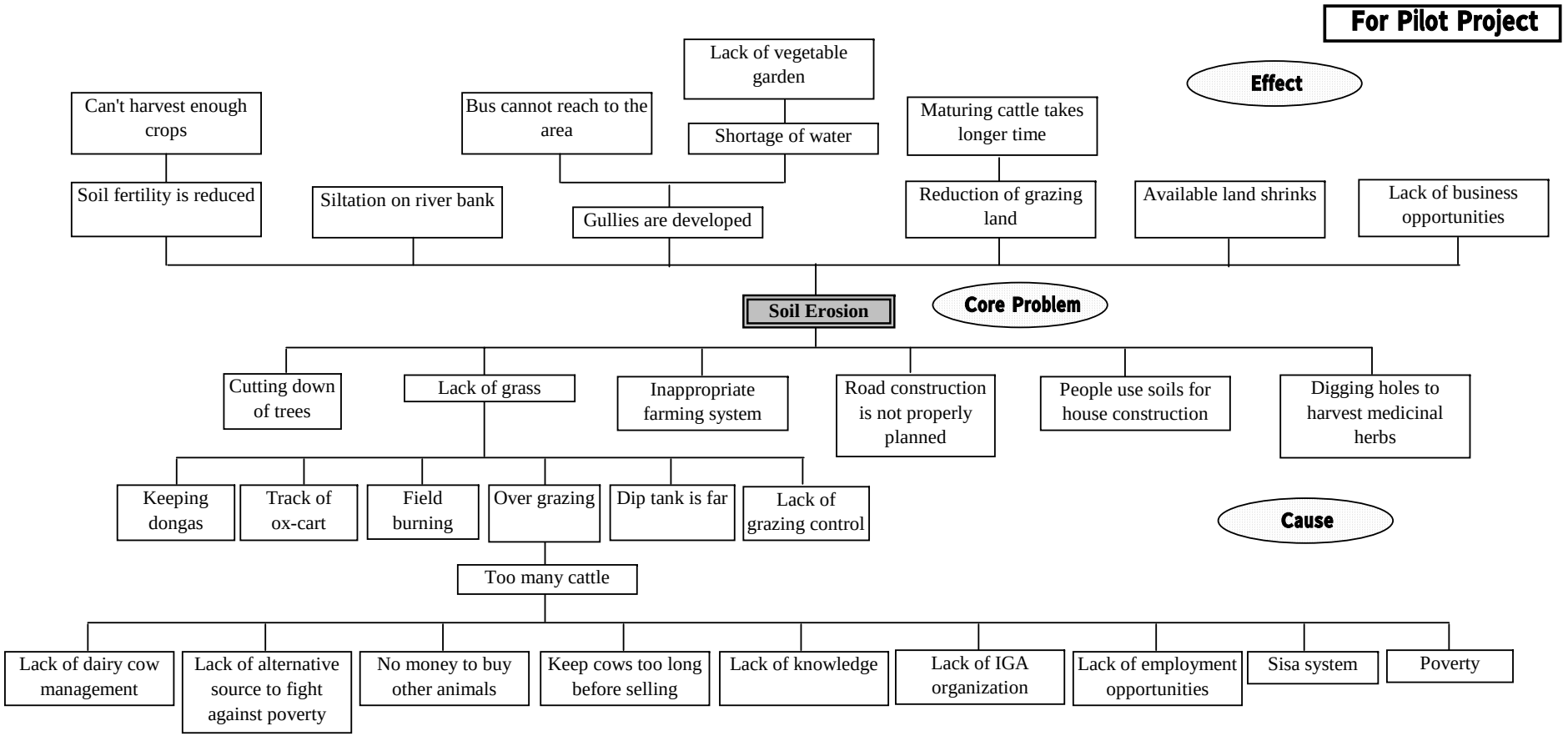


For Pilot Project

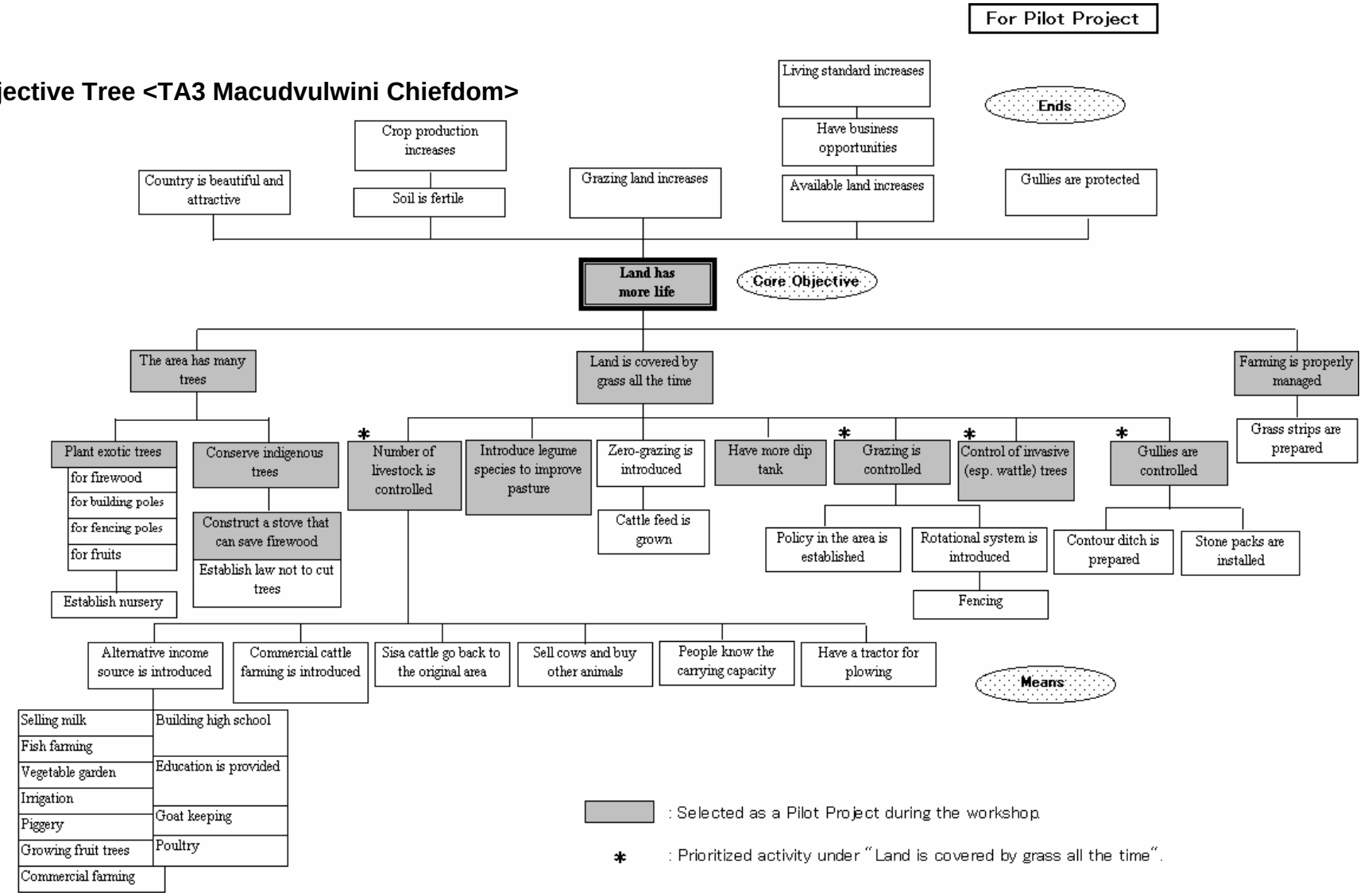
F.6.4 Objective Tree <TA2 Zikhotheni Chiefdom>



F.6.5 Problem Tree <TA3 Macudvulwini Chiefdom> (21 July, 2001)



F.6.6 Objective Tree <TA3 Macudvulwini Chiefdom>



F.7 Questionnaire for Baseline Survey: Household Survey

Ref. No. _____ — _____

Survey Date: _____ / _____ / 2001
Survey Time: start _____ end _____ (_____ minutes)
Enumerator: 1_____ 1. Chester 2. Muriel 3. Mlamuli 4. John 5. Makhosonkhe
Community Name: 2_____
Name of Chiefdom: 3_____
Inkhundla (No.): 4_____ 1. Kukhanyeni 2. Shiselweni 3. Ngwempisi

Section A General Information

1 Name of the respondent A1 _____

2 Sex 1. male 2. female A2 [ ]

3 Age A3 [ ] yrs

4 Religion 1. Christian 2. Muslim 3. Indigenous
4. Others (specify) A4 [ ]

5 How many households are there in your homestead? A5 [ ]
.

6 Is your "family" formed by household or homestead? A6 [ ]
.
1. household 2. homestead

(Following questions are based on the answer of A6)

7 Number of household/homestead members (including the respondent) A7 [ ]

8 List of homestead/household members (refer to code sheet)

	a)Relation-ship to HH Head (code)	b)Sex M/F	c)Age	d)Main Occu-pation (code)	e)Side-job (code)	f)Working place (code)	g)Frequency to come back home	h)Edu-cation (code)
1	A8a1 (head)	A8b1	A8c1	A8d1	A8e1	A8f1	A8g1	A8h1
2	A8a2	A8b2	A8c2	A8d2	A8e2	A8f2	A8g2	A8h2
3	A8a3	A8b3	A8c3	A8d3	A8e3	A8f3	A8g3	A8h3
4	A8a4	A8b4	A8c4	A8d4	A8e4	A8f4	A8g4	A8h4
5	A8a5	A8b5	A8c5	A8d5	A8e5	A8f5	A8g5	A8h5
6	A8a6	A8b6	A8c6	A8d6	A8e6	A8f6	A8g6	A8h6
7	A8a7	A8b7	A8c7	A8d7	A8e7	A8f7	A8g7	A8h7
8	A8a8	A8b8	A8c8	A8d8	A8e8	A8f8	A8g8	A8h8
9	A8a9	A8b9	A8c9	A8d9	A8e9	A8f9	A8g9	A8h9
10	A8a10	A8b10	A8c10	A8d10	A8e10	A8f10	A8g10	A8h10
11	A8a11	A8b11	A8c11	A8d11	A8e11	A8f11	A8g11	A8h11
12	A8a12	A8b12	A8c12	A8d12	A8e12	A8f12	A8g12	A8h12
13	A8a13	A8b13	A8c13	A8d13	A8e13	A8f13	A8g13	A8h13
14	A8a14	A8b14	A8c14	A8d14	A8e14	A8f14	A8g14	A8h14
15	A8a15	A8b15	A8c15	A8d15	A8e15	A8f15	A8g15	A8h15
16	A8a16	A8b16	A8c16	A8d16	A8e16	A8f16	A8g16	A8h16
17	A8a17	A8b17	A8c17	A8d17	A8e17	A8f17	A8g17	A8h17
18	A8a18	A8b18	A8c18	A8d18	A8e18	A8f18	A8g18	A8h18
19	A8a19	A8b19	A8c19	A8d19	A8e19	A8f19	A8g19	A8h19

Section B Livelihood

1 What are the main sources of cash income for your household? Please indicate the order of importance, and amount per year.

		order		E/Year
a. selling farm products	B1a1		B1a2	
b. selling cow	B1b1		B1b2	
c. selling other livestock	B1c1		B1c2	
d. selling other products (specify) _____	B1d1		B1d2	
e. salary from permanent job	B1e1		B1e2	
f. wage from seasonal job	B1f1		B1f2	
g. wage from temporary job	B1g1		B1g2	
h. private business (specify) _____	B1h1		B1h2	
i. remittance from family members	B1i1		B1i2	
j. lending money	B1j1		B1j2	
k. others (specify) _____	B1k1		B1k2	

2 What is the total cash income of your household per year? B2 ____

3 What are the main items of cash expenditure of your household? Please indicate the order of importance and the amount per year.

		order		E/Year
a. food	B3a1		B3a2	
b. clothes	B3b1		B3b2	
c. children's education	B3c1		B3c2	
d. medical expenses	B3d1		B3d2	
e. repayment of debt	B3e1		B3e2	
f. agricultural input (fertilizer, seeds, etc.)	B3f1		B3f2	
g. transport	B3g1		B3g2	
h. others (specify) _____	B3h1		B3h2	

4 What is the total cash expenditure of your household per year? B4 ____ E/year

5 a. What is the main source of drinking water in the rainy season? B5a ____

b. What is the main source of drinking water in the dry season? B5b ____

1. shallow well 2. borehole 3. pond/reservoir 4. river
5. spring 6. Community tap
7. others (specify) _____

6 How far is the water source in the rainy season? (go and back)B6a ____ minutes
(half way)B6b ____ km

7 How far is the water source in the dry season? (go and back)B7a ____ minutes
(half way)B7b ____ km

8 Who usually fetches water?
1. man 2. woman 3. boy 4. girl 5. not fixed B8 ____

9 Do you boil water before drinking?
1. yes 2. no B9 ____

10. Do you have some problem with the water quality?
1. yes 2. no B10 ____

11 What fuel do you usually use for cooking? (fuel code) B11 [ ]

12 What fuel do you usually use for heating? (fuel code) B12 [ ]

13 What fuel do you usually use for lighting? (fuel code) B13 [ ]

Fuel Code

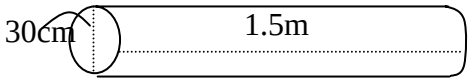
1. wood 2. charcoal 3. grass 4. gas 5. electricity 6. candle
7. kerosene 8. maize stokes/ pigeon pea stems 9. generator
10. animal dung 11. animal/plant oil
12. others (specify) _____

14 If you use wood for cooking, heating or lighting, how do you obtain wood?

1. own harvest 2. purchase 3. combination of both
4. others (specify) _____ B14 [ ]

15 If you use wood for cooking, heating or lighting, how many bundles (head load) of wood do you use per week?

Size of 1 bundle



B15 [ ]

16 In case of own harvest in B14, how far is the fetching place? B16a [ ] minutes (go and back)
B16b [ ] km (half way)

17 In case of own harvest in B14, how much time per week do you spend collecting wood?
B17 [ ] hours/week

18 In case of own harvest in B14, who collects fuel wood?
1. man 2. woman 3. boy 4. girl 5. not fixed B18 [ ]

19 In case of purchase in B14, what is the price? B19 [ ] E/bundle

20 Is fuel wood easily available?
1. easily available 2. not so easy, but available
3. not sufficient 4. not available at all B20 [ ]

Section C Decision Making

Who decide the following matters in your household?

1. General management/control of the household money. C1_____
2. Children's education C2_____
3. Purchasing daily needs (food, cloths, etc.) C3_____
4. Purchasing other items (furniture, etc) C4_____
5. Selling cow C5_____
6. Selling goat C6_____
7. Selling sheep C7_____
8. Selling chicken C8_____
9. Selling pig C9_____
10. Selling rabbit C10_____
11. Selling other animals C11_____
12. husband join the community development activities C12_____
13. wife join the community development activities C13_____

Code

1. husband 2. wife 3. discuss together 4. men 5. women 6. others (specify)

Section D Community Activity

1 Which organizations are important in your village?

1. village committee 2. farmers' club 3. religious group
4. women's group 5. youth club
6. others (specify) _____ D1 [ ]

2 Do you belong to any organization?

1. yes 2. no D2 [ ]

3 If YES for D2, of which organization are you a member?

1. village committee 2. farmers' club 3. religious group
4. women's group 5. youth club
6. others (specify) _____ D3 [ ]

4 If NO for D2, what is the reason?

D4 _____

_____

_____

5 What is your major problems? (Choose 5 in order of importance).

1. drinking water
2. clinic
3. educational facilities
4. electricity
5. roads
6. transportation
7. food shortage
8. access to credit
9. security
10. rangeland management
11. Soil erosion
12. Gully erosion D5a [ ]
13. Livestock management D5b [ ]
14. Agricultural technology D5c [ ]
15. Irrigation water D5d [ ]
16. others (specify) _____ D5e [ ]

6 What items need to be improved in your community? (Choose 5 in order of importance).

1. drinking water supply
2. rangeland management
3. protection of gully erosion
4. livestock improvement
5. agricultural technology
6. roads improvement
7. transportation
8. electricity supply
9. irrigation water supply
10. education facilities
11. health/medical facilities D6a [ ]
12. food shortage D6b [ ]
13. credit systems D6c [ ]
14. security D6d [ ]
15. others (specify) _____ D6e [ ]

7. Do you intend to join and attend community development activities?
   1. yes 2. no D7. _____

8. If NO for D7, what is the reason?
   D8_____

9. Do you intend to join and attend the activities to stop land degradation/dongas?
   1. yes 2. no D9._____

10. Do you feel that communal grazing land in your area is degraded?
    1. yes, seriously 2. yes, but not so serious 3. no problem D10._____

Section E Landholding and Land Tenure

1 What is the total landholding area of your household including homestead?
E1 | ha

2 Do you have enough land to feed your family?
1. yes 2. no E2

3. When were you allocated your land? (which year) E3

4. Have you ever asked to resettle to another place?
1. yes 2. no E4

5 If yes for E4, what was the reason?
E5_____

Section F Agriculture

1. How big is your farm land? F1_____ha

2. What kinds of crop do you grow in the wet season? Is it a irrigated land? How much do you consume at home and how much do you sell? (refer to Code Sheet)

	Crop (Code)		Irrigation (Code)		Home consumption (%)		Selling (%)
F2a1		F2a2		F2a3		F2a4	
F2b1		F2b2		F2b3		F2b4	
F2c1		F2c2		F2c3		F2c4	
F2d1		F2d2		F2d3		F2d4	
F2e1		F2e2		F2e3		F2e4	
F2f1		F2f2		F2f3		F2f4	
F2g1		F2g2		F2g3		F2g4	
F2h1		F2h2		F2h3		F2h4	
F2i1		F2i2		F2i3		F2i4	
F2j1		F2j2		F2j3		F2j4	

3. What kinds of crop do you grow in the dry season? Is it a irrigated land? How much do you consume at home and how much do you sell?

	Crop (Code)		Irrigation (Code)		Home consumption (%)		Selling (%)
F3a1		F3a2		F3a3		F3a4	
F3b1		F3b2		F3b3		F3b4	
F3c1		F3c2		F3c3		F3c4	
F3d1		F3d2		F3d3		F3d4	
F3e1		F3e2		F3e3		F3e4	
F3f1		F3f2		F3f3		F3f4	
F3g1		F3g2		F3g3		F3g4	
F3h1		F3h2		F3h3		F3h4	
F3i1		F3i2		F3i3		F3i4	
F3j1		F3j2		F3j3		F3j4	

4. Livestock

	Number of animals owned at present	During one year (2000)				
		Number of animals bred	Number of animals bought	Number of animals sold	Number of animas eaten/dead	Taken care by (code)
a. cattle	F4a1	F4a2	F4a3	F4a4	F4a5	F4a6
b. goat	F4b1	F4b2	F4b3	F4b4	F4b5	F4b6
c. sheep	F4c1	F4c2	F4c3	F4c4	F4c5	F4c6
d. pigs	F4d1	F4d2	F4d3	F4d4	F4d5	F4d6
e. chicken	F4e1	F4e2	F4e3	F4e4	F4e5	F4e6
f. ostrich	F4f1	F4f2	F4f3	F4f4	F4f5	F4f6
g. duck	F4g1	F4g2	F4g3	F4g4	F4g5	F4g6
h. turkey	F4h1	F4h2	F4h3	F4h4	F4h5	F4h6
i. donkey	F4i1	F4i2	F4i3	F4i4	F4i5	F4i6
j.	F4j1	F4j2	F4j3	F4j4	F4j5	F4j6
k.	F4k1	F4k2	F4k3	F4k4	F4k5	F4k6

Take-care code

1. man 2. woman 3. boy 4. girl 5. not fixed

5 Have you ever seen soil of your field washed away by rain?

1. yes, often in the rainy season
2. yes, but seldom
3. no, because my field is flat
4. no, because of high ridging
5. no, because of grass cover
6. no, because of box ridges
7. no, because of other reason (specify) _____ F5 [ ]

6 What is your most important source of agricultural technology? (choose one)

1. parents 2. neighbor farmers 3. extension worker
4. farm input supplier 5. own experience
6. others (specify) _____ F6 [ ]

7 If you use transport, what is the main type of transport?

1. tractor 2. pick-up 3. truck 4. bus 5. tiller
6. bicycle 7. ox-cart 8. hand-cart 9. donkey
10. Hand/ head carry 11. others (specify) _____ F7 [ ]

Section G Agroforestry/Community Forest

Agroforestry

Definition: *agroforestry is practice of tree planting in cultivated areas for firewood, fodder, construction wood such as poles, improvement of soil fertility in order to get higher yields of various crops such as maize or stopping land degradation as the one seen in rangelands.*

1 Have you ever heard about agroforestry?
1. yes 2. no G1 [ ]
(If your answer is NO, proceed to F4)

2 If yes for G1, from whom did you know about agroforestry?
1. Government officer 2. NGO 3. other farmers 4. neighbour 5. donor agencies 6. private companies 7. radio 8. others (specify) _____
G2 [ ]

3 If yes for G1, do you practice it?
1. yes 2. no G3 [ ]

4 If no for G1, (after explaining about agroforestry) would you like to practice agroforestry?
1. yes 2. no G4 [ ]

5 If no for G4, what are the reasons?
1. lack of tree seedlings 2. lack of money 3. not enough land 4. the system is too complicated 5. not allowed to plant trees in cultivated areas 6. trees will not survive in rangelands and farms 7. need some technical back-up
8. others (specify) _____ G5 [ ]

6 If yes for G4, what would be your most important reasons in the order of priority.(top three)?
1. firewood 2. cash income 3. fodder
4. building material 5. soil improvement
6. others (specify) _____ G6 [ ]

Community Forest

Definition: *community forest is the one owned communally by the people sharing common grazing land. It is established on the grazing land or any other land held communally. Community forestry may be simply promotion of vegetation regeneration or active planting of exotic or indigenous tree species.*

7 Have you participated in establishment of community forestry?.
1. yes 2. no G7 [ ]
(If NO, proceed to G10)

8 If yes in G7, what was your contribution?
1. labour 2. material 3. contribution 4. advice
5. Others (specify) _____ G8 [ ]

9 What motivated you to participate in community forestry?
1. material for building 2. material for fuelwood 3. prevention of degradation
4. leadership 5. Others (specify) _____ G9 [ ]

10 If NO in G7, (after explain about community forestry) why did you not participate in community forestry?
1. did not know about it 2. does not exist 3. not interested
4. others (specify) _____ G10 [ ]

11 Would you like to join a committee on community forestry?
1. yes 2. no G11 [ ]

F.8 Results of the Household Baseline Survey

Section A General

Sex of the Respondents (%)

	TA1	TA2	TA3	Average
Male	48.4	66.7	61.7	58.9
Female	51.6	33.3	38.3	41.1

Information of the Household

	TA1	TA2	TA3	Average
Religion (%)				
Christian	97.8	100.0	100.0	99.3
Indigenous	1.1	0.0	0.0	0.4
Others	1.1	0.0	0.0	0.4
Number of household/homestead	4.2	4.6	4.6	4.5
Family size	8.8	9.6	8.8	9.1
Family unit to share resources (%)				
Household	80.6	83.3	86.7	83.5
Homestead	19.4	16.7	13.3	16.5
Head of family (%)				
Male	64.8	70.0	60.0	64.9
Female	35.2	30.0	40.0	35.1
Immigrant workers *1 (%)				
Working outside of Inkhundla	58.5	76.9	64.5	66.6
Living Outside of Inkhundla *2	76.7	42.9	50.0	56.5

Note: 1* Rate is among the male-headed household.
2* Migrant workers who come back home less than once a week.

Section B Livelihood

Average Household Income and Expenditure (E)

	TA1	TA2	TA3	Average
Income	16,758	10,642	13,880	13,760
Expenditure	9,101	6,555	8,054	7,903

Water Source (%)

	Shallow well	Borehole	Pond/ Reservoir	River	Spring	Community Tap	Others
Rainy Season							
TA1	12.9	9.7	1.1	15.1	24.7	34.4	2.2
TA2	13.3	6.7	6.7	50.0	20.0	0.0	3.3
TA3	16.7	5.0	0.0	21.7	21.7	26.7	6.7
Average	14.3	7.1	2.6	28.9	22.1	20.4	4.1
Dry Season							
TA1	12.9	9.7	1.1	16.1	24.7	34.4	0.0
TA2	13.3	6.7	3.3	60.0	13.3	0.0	3.3
TA3	11.7	5.0	0.0	28.3	21.7	26.7	1.7
Average	12.6	7.1	1.5	34.8	19.9	20.4	1.7

Water

	TA1	TA2	TA3	Average
Average distance				
Wet Season Minutes	23.7	24.5	22.8	23.7
Km	3.6	0.5	0.4	1.5
Dry Season Minutes	24.2	28.7	25.2	26.0
Km	3.7	0.6	0.5	1.6
Responsibility to fetch (%)				
Man	1.1	0.0	0.0	0.4
Woman	44.1	50.0	56.7	50.3
Boy	30.1	40.0	35.0	35.0
Girl	48.4	66.7	50.0	55.0
Not fixed	21.5	6.7	18.3	15.5
Boil before drink (%)				
Yes	22.6	10.0	16.7	16.4
No	77.4	90.0	83.3	83.6
Quality				
Have problem	33.3	33.3	30.0	32.2
Have no problem	65.6	66.7	70.0	67.4

Fuel (%)

	TA1	TA2	TA3	Average
For Cooking				
Wood	86.0	100.0	100.0	95.3
Charcoal	0.0	0.0	0.0	0.0
Grass	1.1	0.0	0.0	0.4
Gas	23.7	3.3	10.0	12.3
Electricity	5.4	6.7	1.7	4.6
Candle	0.0	0.0	0.0	0.0
Kerosene	19.4	13.3	5.0	12.6
Generator	0.0	0.0	0.0	0.0
Animal dung	0.0	0.0	1.7	0.6
Animal/Plant oil	0.0	0.0	0.0	0.0
Others	0.0	0.0	0.0	0.0
For Heating				
Wood	87.1	96.7	100.0	94.6
Charcoal	2.2	0.0	0.0	0.7
Grass	0.0	0.0	0.0	0.0
Gas	10.8	3.3	10.0	8.0
Electricity	4.3	10.0	1.7	5.3
Candle	0.0	0.0	0.0	0.0
Kerosene	12.9	13.3	5.0	10.4
Generator	0.0	0.0	0.0	0.0
Animal dung	1.1	0.0	1.7	0.9
Animal/Plant oil	0.0	0.0	0.0	0.0
Others	0.0	0.0	0.0	0.0
For Lighting				
Wood	2.2	3.3	0.0	1.8
Charcoal	0.0	0.0	1.7	0.6
Grass	0.0	0.0	0.0	0.0
Gas	2.2	0.0	1.7	1.3
Electricity	10.8	10.0	8.3	9.7
Candle	83.9	93.3	88.3	88.5
Kerosene	20.4	3.3	38.3	20.7

	TA1	TA2	TA3	Average
Generator	0.0	3.3	1.7	1.7
Animal dung	0.0	0.0	0.0	0.0
Animal/Plant oil	0.0	0.0	0.0	0.0

Fetching Firewood

	TA1	TA2	TA3	Average
Way of collection (%)				
Own harvest	74.2	66.7	85.0	75.3
Purchase	11.8	26.7	11.7	16.7
Combination of both	5.4	6.7	3.3	5.1
Others	0.0	0.0	0.0	0.0
Consumption (bundle/week)	2.5	2.3	2.2	2.3
Distance to fetching place				
Minutes	102.3	160.8	99.0	120.7
Km	2.1	2.4	2.4	2.3
Spending time (hours/week)	4.1	6.4	5.1	5.2
Responsibility to fetch (%)				
Man	5.4	3.3	3.3	4.0
Woman	46.2	56.7	48.3	50.4
Boy	15.1	30.0	20.0	21.7
Girl	40.9	50.0	35.0	42.0
Not fixed	14.0	3.3	20.0	12.4
Average price/bundle (E)	21.2	27.8	72.3	40.4
Availability (%)				
Easily available	23.7	10.0	18.3	17.3
Not so, but available	43.0	50.0	56.7	49.9
Not sufficient	11.8	20.0	18.3	16.7
Not available	11.8	16.7	6.7	11.7

Section C Decision Making

Decision Making (%)

	TA1	TA2	TA3	Average
Control of money				
Husband	51.7	57.1	61.1	56.6
Wife	6.9	14.3	2.8	8.0
Discuss	37.9	28.6	33.3	33.3
Men	1.7	0.0	2.8	1.5
Women	0.0	0.0	0.0	0.0
Others	1.7	0.0	0.0	0.6
Children's education				
Husband	49.1	57.9	57.1	54.7
Wife	5.5	10.5	5.7	7.2
Discuss	43.6	26.3	34.3	34.7
Men	1.8	0.0	2.9	1.6
Women	0.0	0.0	0.0	0.0
Others	0.0	5.3	0.0	1.8
Purchasing daily needs				
Husband	22.4	35.0	30.6	29.3
Wife	44.8	40.0	52.8	45.9
Discuss	31.0	25.0	11.1	22.4
Men	0.0	0.0	2.8	0.9
Women	0.0	0.0	2.8	0.9
Others	1.7	0.0	0.0	0.6

	TA1	TA2	TA3	Average
Purchasing other items				
Husband	30.4	47.4	54.3	44.0
Wife	26.8	26.3	17.1	23.4
Discuss	41.1	26.3	22.9	30.1
Men	0.0	0.0	5.7	1.9
Women	0.0	0.0	0.0	0.0
Others	1.8	0.0	0.0	0.6
Selling cow				
Husband	51.2	81.8	70.8	67.9
Wife	2.4	9.1	0.0	3.8
Discuss	43.9	9.1	25.0	26.0
Men	0.0	0.0	4.2	1.4
Women	0.0	0.0	0.0	0.0
Others	2.4	0.0	0.0	0.8
Selling goat				
Husband	66.7	100.0	66.7	77.8
Wife	4.2	0.0	0.0	1.4
Discuss	29.2	0.0	28.6	19.3
Men	0.0	0.0	4.8	1.6
Women	0.0	0.0	0.0	0.0
Others	0.0	0.0	0.0	0.0
Selling sheep				
Husband	44.4	100.0	71.4	71.9
Wife	33.3	0.0	0.0	11.1
Discuss	22.2	0.0	14.3	12.2
Men	0.0	0.0	14.3	4.8
Women	0.0	0.0	0.0	0.0
Others	0.0	0.0	0.0	0.0
Selling chicken				
Husband	12.8	18.8	3.4	11.7
Wife	70.2	62.5	82.8	71.8
Discuss	10.6	12.5	10.3	11.1
Men	0.0	0.0	3.4	1.1
Women	2.1	0.0	0.0	0.7
Others	4.3	6.3	0.0	3.5
Husband join the activity				
Husband	45.1	38.9	53.1	45.7
Wife	2.0	5.6	0.0	2.5
Discuss	52.9	55.6	43.8	50.8
Men	0.0	0.0	3.1	1.0
Women	0.0	0.0	0.0	0.0
Others	0.0	0.0	0.0	0.0
Wife join the activity				
Husband	3.7	0.0	8.8	4.2
Wife	37.0	52.9	41.2	43.7
Discuss	59.3	47.1	47.1	51.2
Men	0.0	0.0	0.0	0.0
Women	0.0	0.0	2.9	1.0
Others	0.0	0.0	0.0	0.0

Section D Community Activity

Community Activity (%)

	TA1	TA2	TA3	Average
Important organization				
Village committee	11.8	13.3	13.3	12.8
Farmers club	34.4	36.7	46.7	39.3
Religious group	5.4	3.3	0.0	2.9
Women's group	51.6	53.3	48.3	51.1
Youth club	2.2	3.3	0.0	1.8
Others	5.4	3.3	0.0	2.9
Do you belong to any group?				
Yes	45.2	33.3	45.0	41.2
No	54.8	60.0	55.0	56.6
Which group do you belong?				
Village committee	7.5	10.0	5.0	7.5
Farmers club	11.8	6.7	13.3	10.6
Religious group	4.3	0.0	0.0	1.4
Women's group	23.7	20.0	23.3	22.3
Youth group	1.1	0.0	0.0	0.4
Others	1.1	0.0	0.0	0.4

Problems

	TA1		TA2		TA3	
Priority	1/2	3-5	1/2	3-5	1/2	3-5
1. Infrastructure	**123.6**	**93.7**	**153.4**	**143.3**	**126.5**	**120.1**
Drinking water	33.3	6.5	73.3	13.3	45.0	10.0
Clinic	30.1	19.4	40.0	16.7	23.3	16.7
Electricity	20.4	14.0	16.7	36.7	18.3	26.7
Roads	17.2	26.9	6.7	30.0	23.3	30.0
Educational facilities	19.4	12.9	6.7	13.3	8.3	11.7
Transportation	3.2	14.0	10.0	33.3	8.3	25.0
2. Income	**45.2**	**64.5**	**40.0**	**76.6**	**43.4**	**76.6**
Food shortage	19.4	20.4	20.0	13.3	21.7	8.3
Access to credit	11.8	8.6	16.7	3.3	10.0	8.3
Irrigation water	5.4	24.7	3.3	40.0	10.0	35.0
Agricultural technology	8.6	8.6	0.0	20.0	0.0	23.3
Livestock management	0.0	2.2	0.0	0.0	1.7	1.7
3. Social problem	**17.2**	**23.7**	**0.0**	**16.7**	**10.0**	**25.0**
Security	17.2	23.7	0.0	16.7	10.0	25.0
4. Environment condition	**3.3**	**35.6**	**3.3**	**36.7**	**14.9**	**35.0**
Soil erosion	2.2	19.4	3.3	13.3	8.3	15.0
Rangeland management	1.1	9.7	0.0	6.7	3.3	13.3
Gully erosion	0.0	6.5	0.0	16.7	3.3	6.7

Note : Five problems were listed by each respondent in order of priority. The ratios of respondents who answered an item as the top or second priority are shown in the columns of "1/2", and ratios for third, fourth and fifth are indicated in the columns of "3-5".

Needs to be improved in the Community (%)

	TA1		TA2		TA3	
Priority	1/2	3-5	1/2	3-5	1/2	3-5
1. Infrastructure	**119.4**	**124.7**	**150.0**	**156.7**	**146.7**	**141.7**
Drinking water supply	43.0	7.5	83.3	10.0	66.7	1.7
Road improvement	31.2	28.0	16.7	23.3	30.0	35.0
Health/medical facilities	17.2	34.4	30.0	40.0	11.7	36.7
Electricity supply	17.2	20.4	16.7	30.0	15.0	30.0
Transportation	6.5	21.5	3.3	36.7	20.0	25.0
Education facilities	4.3	12.9	0.0	16.7	3.3	13.3
2. Income	**28.0**	**62.4**	**26.6**	**69.9**	**23.3**	**61.6**
Irrigation water supply	10.8	19.4	13.3	20.0	10.0	18.3
Agricultural technology	8.6	20.4	0.0	23.3	8.3	25.0
Food shortage	3.2	14.0	10.0	13.3	3.3	13.3
Credit system	2.2	5.4	3.3	10.0	1.7	1.7
Livestock improvement	3.2	3.2	0.0	3.3	0.0	3.3
3. Social problem	**17.2**	**24.7**	**0.0**	**23.3**	**10.0**	**28.3**
Security	17.2	24.7	0.0	23.3	10.0	28.3
4. Environment condition	**23.6**	**23.7**	**16.7**	**30.0**	**18.3**	**25.0**
Rangeland management	11.8	8.6	10.0	13.3	8.3	13.3
Protection of gully erosion	11.8	15.1	6.7	16.7	10.0	11.7

Note : Five needs were listed by each respondent in order of priority. The ratios of respondents who answered an item as the top or second priority are shown in the columns of "1/2", and ratios for third, fourth and fifth are in the columns of "3-5".

Intension to Join the Community Development Activities (%)

	TA1	TA2	TA3	Average
To join the community development activity (%)				
Yes	80.4	90.0	91.7	87.4
No	19.6	10.0	8.3	12.6
To join the activities to stop land degradation (%)				
Yes	83.7	90.0	88.3	87.3
No	16.3	10.0	11.7	12.7

Degree of Land Degradation (%)

	TA1	TA2	TA3	Average
Seriously degraded	43.0	40.0	51.7	44.9
Degraded, but not so serious	44.1	43.3	46.7	44.7
No problem	12.9	16.7	1.7	10.4

Section E Land Holding and Land Tenure

Land Area

	TA1	TA2	TA3	Average
Average land area (ha)	3.75	3.23	3.66	3.5
Land size (%)				
Have enough land	66.7	43.3	73.3	61.1
Have not enough land	33.3	56.7	26.7	38.9
Land allocated year (%)				
1920-1939	5.4	10.0	5.0	6.8
1940-1959	9.7	3.3	10.0	7.7
1960-1979	24.7	30.0	28.4	27.7
1980-1999	60.2	53.3	56.7	56.7

	TA1	TA2	TA3	Average
2000-2001	0.0	3.3	0.0	1.1
Asked to resettle (%)				
Yes	4.3	0.0	6.7	3.7
No	95.7	100.0	93.3	96.3

Section F Agriculture and Livestock

Average Farm Land Size (ha)

TA1	TA2	TA3	Average
2.82	2.47	2.83	2.71

Cultivating Crop (%)

	TA1		TA2		TA3	
	Wet	Dry	Wet	Dry	Wet	Dry
Maize (hybrid)	75.3	0.0	76.7	0.0	81.7	0.0
Maize (local)	31.2	0.0	6.7	0.0	35.0	0.0
Sorghum	1.1	0.0	3.3	0.0	1.7	0.0
Millet	0.0	0.0	0.0	0.0	0.0	0.0
Groundnuts	23.7	0.0	16.7	0.0	15.0	0.0
Rice	0.0	0.0	0.0	0.0	0.0	0.0
Pumpkin	52.7	0.0	73.3	0.0	58.3	0.0
Pigeon pea	3.2	1.1	3.3	0.0	1.7	0.0
Sugar cane	1.1	2.2	0.0	0.0	0.0	1.7
Cassava	10.8	1.1	0.0	0.0	0.0	0.0
Sunflower	0.0	0.0	0.0	0.0	0.0	0.0
Jugo beans	29.0	0.0	30.0	0.0	16.7	0.0
Cotton	0.0	0.0	0.0	0.0	0.0	0.0
Tabacco	0.0	0.0	0.0	0.0	0.0	0.0
Sweet potatoes	39.8	1.1	26.7	0.0	30.0	1.7
Tomato	6.5	14.0	3.3	0.0	1.7	20.0
Cabbage	2.2	17.2	3.3	0.0	0.0	30.0
Chilli	2.2	5.4	0.0	0.0	0.0	0.0
Onion	1.1	6.5	0.0	0.0	1.7	21.7
Garlic	0.0	0.0	0.0	0.0	0.0	0.0
String beans	11.8	1.1	13.3	0.0	30.0	0.0
Orange	1.1	0.0	3.3	0.0	1.7	0.0
Banana	5.4	5.4	3.3	3.3	6.7	0.0
Mango	4.3	2.2	0.0	0.0	0.0	0.0
Papaw	2.2	1.1	6.7	0.0	0.0	0.0
Wheat	0.0	0.0	0.0	0.0	0.0	0.0
Spinach	0.0	1.1	0.0	0.0	0.0	11.7
Beetroot	0.0	0.0	0.0	0.0	0.0	5.0

Maize Consumed at Home (wet season) (%)

	TA1	TA2	TA3	Average
Hybrid maize	85.9	85.2	79.3	83.5
Local maize	93.0	100.0	87.6	93.5

Livestock

	Cattle	Goat	Sheep	Pigs	Chicken	Duck	Turkey	Donkey
Owned								
TA1 Percentage	52.7	29.0	5.4	21.5	87.1	12.9	1.1	0.0
Average number	11.2	11.7	8.0	3.25	16.2	4.1	2.0	-
TA2 Percentage	50.0	36.7	6.7	33.3	90.0	16.7	6.7	0.0
Average number	9.5	7.5	6.5	3.1	15.0	5.2	5.0	-
TA3 Percentage	75.0	53.3	6.7	16.7	93.3	25.0	6.7	3.3
Average number	8.5	11.5	14.5	3.0	17.9	5.3	4.3	2.0
Bred								
TA1 Percentage	37.6	18.3	2.2	7.5	67.7	4.3	0.0	0.0
Average number	2.2	3.9	1.5	7.0	29.3	7.3	-	-
TA2 Percentage	36.7	26.7	6.7	10.0	73.3	10.0	3.3	0.0
Average number	2.7	2.8	1.5	2.7	10.8	4.0	2.0	-
TA3 Percentage	51.7	38.3	3.3	6.7	68.3	13.3	1.7	0.0
Average number	2.2	3.8	7.0	5.8	8.7	4.5	1.0	-
Bought								
TA1 Percentage	8.6	4.3	0.0	3.2	14.0	1.1	0.0	0.0
Average number	3.9	3.0	-	2.3	51.3	2.0	-	-
TA2 Percentage	6.7	6.7	0.0	10.0	10.0	0.0	0.0	0.0
Average number	1.5	2.5	-	1.7	2.0	-	-	-
TA3 Percentage	8.3	6.7	1.7	3.3	10.0	1.7	1.7	1.7
Average number	2.2	2.3	6.0	1.5	2.2	2.0	2.0	2.0
Sold								
TA1 Percentage	26.9	5.4	1.1	5.4	12.9	2.2	0.0	0.0
Average number	1.8	1.6	2.0	4.4	5.3	1.5	-	-
TA2 Percentage	6.7	0.0	0.0	6.7	10.0	3.3	0.0	0.0
Average number	6.0	-	-	2.0	3.0	2.0	-	-
TA3 Percentage	11.7	10.0	0.0	3.3	6.7	0.0	0.0	0.0
Average number	1.6	2.5	-	1.5	4.8	-	-	-
Eaten/Dead								
TA1 Percentage	24.7	17.2	2.2	14.0	75.3	7.5	0.0	0.0
Average number	2.0	3.88	1.0	1.77	9.84	4.0	-	-
TA2 Percentage	30.0	23.3	3.3	6.7	76.7	3.3	3.3	3.3
Average number	2.9	2.4	1.0	1.0	17.8	4.0	2.0	2.0
TA3 Percentage	48.3	36.7	3.3	5.0	76.7	15.0	0.0	3.3
Average number	3.0	3.0	3.5	1.0	12.6	3.9	-	1.5

Family Member to Take Care Livestock (%)

	Man	Woman	Boy	Girl	Not Fixed
Cattle					
TA1	23.9	8.7	52.2	2.2	13.0
TA2	40.0	13.3	46.7	0.0	0.0
TA3	24.4	15.6	37.8	4.4	17.8
Goat					
TA1	16.7	16.7	41.7	4.2	20.8
TA2	36.4	18.2	45.5	0.0	0.0
TA3	30.0	23.3	33.3	6.7	6.7
Sheep					
TA1	25.0	25.0	50.0	0.0	0.0
TA2	100.0	0.0	0.0	0.0	0.0
TA3	50.0	0.0	25.0	25.0	0.0
Pigs					

	Man	Woman	Boy	Girl	Not Fixed
TA1	21.1	31.6	5.3	15.8	26.3
TA2	30.0	40.0	10.0	0.0	20.0
TA3	20.0	60.0	0.0	0.0	20.0
Chicken					
TA1	6.6	59.2	3.9	2.6	27.6
TA2	3.7	55.6	0.0	3.7	37.0
TA3	3.6	76.8	1.8	0.0	17.9
Duck					
TA1	0.0	66.7	0.0	0.0	33.3
TA2	20.0	60.0	0.0	20.0	0.0
TA3	6.7	66.7	0.0	0.0	26.7
Turkey					
TA1	0.0	100.0	0.0	0.0	0.0
TA2	0.0	100.0	0.0	0.0	0.0
TA3	0.0	50.0	0.0	0.0	50.0
Donkey					
TA1	-	-	-	-	-
TA2	0.0	0.0	0.0	0.0	0.0
TA3	0.0	0.0	50.0	50.0	0.0

Soil Erosion found in the Farm Land (%)

	TA1	TA2	TA3	Average
Often in the rainy season	71.0	76.7	81.7	76.5
Yes, but seldom	15.1	13.3	11.7	13.4
No because of flat land	10.8	3.3	3.3	5.8
No because of high ridging	2.2	0.0	0.0	0.7
No because of grass cover	1.1	3.3	1.7	2.0
No because of box ridges	0.0	0.0	0.0	0.0
No because of other reason	0.0	0.0	0.0	0.0

Source of Agricultural Technology (%)

	TA1	TA2	TA3	Average
Parents	50.5	73.3	48.3	57.4
Neighbor farmers	5.4	0.0	6.7	4.0
Extension workers	20.4	13.3	25.0	19.6
Farm input supplier	1.1	0.0	0.0	0.4
Own experiences	18.3	6.7	16.7	13.9
School	0.0	3.3	3.3	2.2

Section G Agroforestry and Community Forest

Agroforestry (%)

	TA1	TA2	TA3	
Heard of agroforestry				
Yes	53.8	63.3	46.7	54.6
No	46.2	36.7	53.3	45.4
Heard from				
Government officer	24.7	33.3	8.0	22.0
NGO	3.2	6.7	0.0	3.3
Other farmers	12.9	20.0	36.0	23.0
Neighbor	5.4	26.7	40.0	24.0
Donor agencies	0.0	0.0	0.0	0.0
Private companies	2.2	0.0	8.0	3.4

	TA1	TA2	TA3	
Radio	6.5	13.3	8.0	9.3
Others	2.2	11.8	0.0	4.7
Practice				
Yes	70.2	11.1	38.5	39.9
No	29.8	88.9	61.5	60.1
Intension to practice				
Yes	89.8	95.0	80.0	88.3
No	10.2	5.0	20.0	11.7
Reason not to try				
Lack of seedling	18.2	22.2	19.0	19.8
Lack of money	9.1	0.0	4.8	4.6
Not enough land	27.3	22.2	42.9	30.8
Complicated	18.2	11.1	4.8	11.4
Not allowed	0.0	0.0	0.0	0.0
Not survive	0.0	0.0	9.5	3.2
Need back up	27.3	44.4	19.0	30.2
Reason of having intension				
Firewood	62.4	39.0	93.0	64.8
Cash income	30.1	23.7	65.1	39.6
Fodder	1.1	0.0	2.3	1.1
Building material	63.4	33.9	69.8	55.7
Soil improvement	12.9	3.4	2.3	6.2

Community Forestry (%)

	TA1	TA2	TA3	Average
Heard of community forestry				
Yes	31.2	23.3	5.0	19.8
No	68.8	73.3	95.0	79.0
Contribution for the CF				
Labor	85.2	100.0	50.0	78.4
Material	0.0	0.0	50.0	16.7
Cash contribution	14.8	0.0	0.0	4.9
Advice	0.0	0.0	0.0	0.0
Motivation for the CF				
Building material	17.6	22.2	33.3	24.4
Fuelwood	23.5	22.2	33.3	26.3
Prevention of degradation	47.1	55.6	0.0	34.2
Leadership	11.8	0.0	33.3	15.0
Why not to participate				
Did not know	67.3	45.0	51.0	54.4
Does not exist	21.2	30.0	26.5	25.9
Not interested	9.6	5.0	2.0	5.5
Other reason	1.9	20.0	20.4	14.1
Intension to join the committee of CF				
Yes	83.9	80.0	80.0	81.3
No	16.1	16.7	20.0	17.6

F.9 Improved Cooking Stove Manual

Advantages

1. Materials are locally available
2. It can save a considerable amount of firewood (about two thirds are saved)
3. Water can be boiled since there are extra fireplaces
4. It can save cooking time as there are three fireplaces and create extra time
5. Food can be kept clean since cooking place is high
6. It can keep children away from fire
7. It can ease back pain since one can stand while preparing food.

Disadvantages

1. It cannot be moved to other place
2. It requires more space
3. It requires maintenance
4. It cannot warm house since fireplace is not open
5. And others?

Construction of Stove

The following are the guide to construct an Improved Cooking Stove.

1) Materials

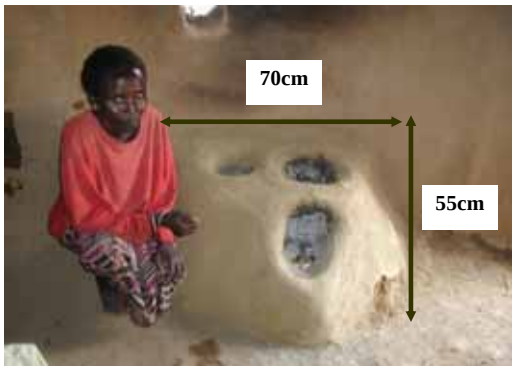
1. Mud (sticky soil such as anthill soil and clayey soil is appropriate)
2. Water
3. Stones/Bricks
4. Other materials could be used as owners like

2) Construction Procedure

1. Make the base with mud and stones. Prepare mud base first and stone/brick layer next. Build the base with these layers up to appropriate heights.
2. Prepare top fireplace with stones and cover with mud.
3. Smoothen the surface with mud.
4. Wait for a week or so. Cracks should be smeared with mud mixed with cow dung.
5. If it dries completely, one can start using it.

3) Notes

1. Keep a distance of at least 90cm from the ceiling to avoid a fire
2. If the owner does not have enough space to install full size of Stove, or has difficulties to prepare water to maintain, she can construct a small sized one as seen in the picture.



Small Size of Stove (2 cooking places)

4) Maintenance

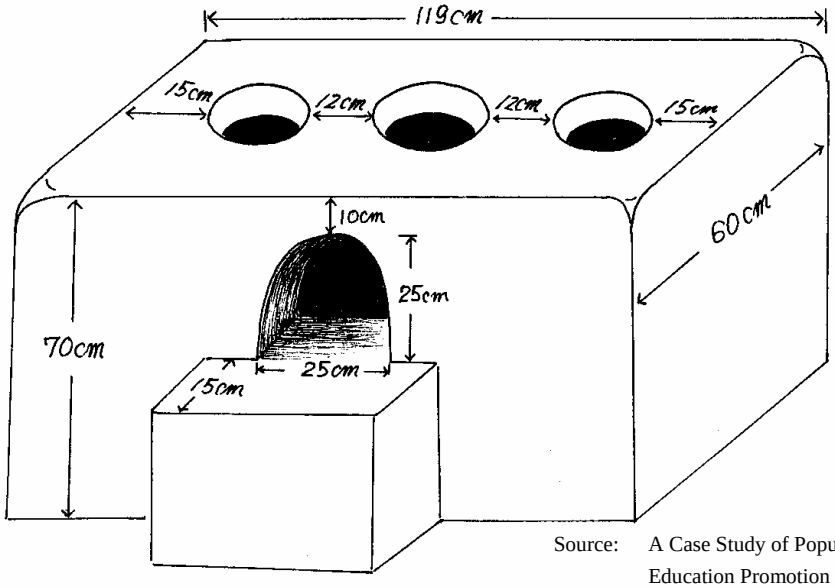
Improved Cooking Stove requires regular maintenance, especially rim of the fireplaces, otherwise it starts cracking and falling down. Maintenance is done by smearing the Stove with soil mixed with cow dung. Once-a-week maintenance is good enough for keeping the Stove in sound condition. The regular maintenance requires, besides soil and cow dung, about five litters of water. This could be a critical impediment to carry out the regular maintenance in dry areas. In very dry area, small sized Stove should be explored.

Setting Base with Soil

Prepare Stone Layer

Arrange Stones

Smearing and Completion



Source: A Case Study of Population Education Promotion Project

Standard Size of Stove

F.10 Programme of Inter Location Monitoring Tour (2)

1. Purpose
   1) Exchange of experiences through the pilot project among three communities,
   2) Observe achievements each other, compare and analyze the differences, and
   3) Preparation for objective self-evaluation

2. Site to visit & Date

9 June (Mon)		10 June (Tue)
TA1(Eni&Engcayini)	TA3(Macudvulwini)	TA2(Zikhoteni)
- Range management site (Eni) - Fodder plot & feed lot - Cooking stove - Soil conservation	- Spring protection (Mlathane) - Community garden (Mlathane) - Soil Conservation site - Range management site (Mlathane)	- Reforestation site - Nursery - Cooking stove - Community garden - Soil Conservation

3. Participants
- Development committee members (7 members)
- Community members (4 to 6 members)
- Bucopho, Extension worker, etc. (2 to 4 members)

4. Exchange of opinions
- In the end of the second day, have a meeting in 30 min, and present their opinions,
- Write opinions about each activity visited during the tour on each post-it and put them on paper of each TA.
- Each paper will be kept by each TA and utilized for the preparation of WS. The team should take photos of them.

5. What to be prepared
- Transportation
- Lunch

6. Person to contact
- Counterpart personnel
- Coordinator, member of PPMU
- RDA extension officer,
- Bucopho

7. Programme of the Tour

Day 1: <TA 1 and 3> June 9, 2003 (Monday)

Eni & Engcayini	Zikhotheni	Macudvulwini
9:30 New Mbuluzi School	7:00 Leave from Jericho school 9:30 TA1	7:00 Ngwepisana Dip 7:15 Mbeka 8:00 Macudvulwini school 9:30 TA1
1. Eni & Engcayini (9:30 – 12:00) 1. Range management site（Eni）(9:30 – 10:00) → Feed lot (Eni) (10:00 – 10:30) → 2. Soil conservation (10:30 – 11:00) → 3. Cooking Stove (11:15- 11:45) → Lunch (12:00-12:45) → Move to Macudvulwini (arrive at 14:30) 2. Macudvulwini (14:30 – 16:00) → 1. Community garden (14:30 – 15:00) → 2.Spring Protection (15:00-15:30) → Soil Conservation → Range management site (15:30 – 16:00)		
16:00 Leave Macudvulwini 17:30 Arrive at TA1 and break up	16:00 Leave Macudvulwini 18:30 Arrive at Zikhotheni and break up	16:00 break up at Macudvulwini school

Day 2: <TA2> June 10, 2003 (Tuesday)

TA1	TA2	TA3
7:30 Start from New Mbuluzi School 10:00 Nursery in Zikhoteni	10:00 Nursery in Zikhoteni	6:30 Ngwepisana Dip 6:45 Mbeka 7:30 Macudvulwini school 10:00 Nursery in Zikhoteni
1. Zikhoteni 1.Nursery (10:00 – 10:30) → 2. Reforestation Site (10:45- 11:15) → 3. Cooking Stove (11:15- 11:45) → Community Garden (12:00 – 12:30)→ 4. Lunch (12:30- 13:15) → 5. Exchange of opinions (13:15 – 14:00)		
14:00 Leave 16:30 Arrive at New Mbuluzi School and break up	14:00 break up at Big Tree	14:00 Leave 16:30 Arrive at Macudvulwini school and break up

F.11 Summary of Comments during Monitoring Tour

1. Eni & Engyaini

- Feedlot has to be displayed to the community level.
- Grass in the feedlot has been grown. It has to be used to feed the cattle before it dries.
- The grasses are grown in the feedlot already! Ours have not grown yet! We have to grow more! ☹
- In the grazing area there are sheep are seen dominant in the site disturbing the grass to grow. Something should be done to remove those sheep.
- It might be better to remove weeds, which cows do not eat.
- About donga rehabilitation, there is a need of adding trees on the counters to stabilize the soil.
- It seems that there is no collaboration between Umphakatsi and the development committee. It also disturbed the progress of the project activities. Umphakatsi representatives should be involved in the committee meetings.
- About Donga rehabilitation, there are stones which are seen being scattered next to the Donga. If more stones can be added and put inside the Donga, it can be reclaimed or covered.
- It is good that the trees are growing on the counters. We do not have trees on it! ☹
- Improved stoves with original design is very nice since it has been improved more than before and could be constructed cheaper.

2. Macdvulwini

- On the contour terrace site, the fencing is not enough to protect trees by animals.
- There is a need of toilet next to the shower in the spring protection site to keep the site clean.
- Vegetable garden is larger than the one of Zikhoteni and vegetables are beautiful and grown more than us! ☹ But they should sell more cheaper price!
- For the vegetable garden, it is recommended to use cow dung for manure.
- Need for shelter next to the vegetable garden.
- As for the method of planting vegetable, it is better to have more interval between each vegetable since there planted too close each other.
- There is enough water supply to extend vegetable garden and plant more vegetables.
- The facilities constructed for spring protection is so good.
- Macdvulwini people seem knowing what they are doing. They focus on future. They should continue work with the spirit of work and work together as a community.
- It is still not clear what is going to be done in the grazing area. Some questions were not answered well, such as how the cattle are fed in the grazing site.

3. Zikhoteni

- It is good that trees are planted on the counter terrace.
- It is good that the chemical used for planted trees destroy termites which disturb trees. But as it is not health-wise to use it, at least the empty bottles of the chemicals used should be destroyed, burned or buried in order to avoid danger of

poison for animals and people. (….seeing the empty bottle just left in the field) Development committee should control this matter.

- The umbrella committee should not try to control and supervise everything (too much dominant). They should delegate other members to show the work is for everyone.
- The pilot project in Zikhoteni seems as a project for one family as there is almost only one surname (Nxumalo). It was concerned that the participants to the series of activities should be mixed with other surname.
- Counter terraces for Zikhoteni are deeper than other study areas. It might be recommended to have the counter deeper like this for avoiding damage by heavy rain.
- Grass planted on the counters is very light and it cannot stabilize the soil. There is a need of deep rooted grasses. I wonder which grass will be suitable for our community (Macdvulwini).
- About the nursery, the activity seems very slow.
- It is better to plant trees to make shelter around the vegetable garden.
- Vegetables in this garden seems to be grown better with more fertilizers or chemicals.

In general, active discussion was held on the point of management of each scheme, especially the management of garden. At the same time, from observing the discussion point, it seems that people have more interest of keeping transparency and equality. For example, when people point out the delay of the activity, they start to discuss on the ownership of the work (community or the committee?), etc.

F.12 QUESTIONNAIRE for Monitoring Survey

Date: June, 2003

Section A Information on interviewee

A-1 Name of Interviewee _____

A-2 Sex: ☐ M / ☐ F

A-3 Age: ☐ 1. Teens ☐ 2. 20's , ☐ 3. 30's , ☐ 4. 40's , ☐ 5. more than 50's

A-4 Chiefdom Name ☐ 1. Eni ☐ 2. Engcayini ☐ 3. Zikhotheni ☐ 4. Macudvulwini

A-5 Name of the Community _____

A-6 Name of homestead head _____

Section B Pilot Project General

B-1	Do you find any changes in your life after participating in the activities of the Pilot Projects?	☐ 1. Nothing ☐ 2. Obtained physical output (such as trees, soil conservation objects, fencing, garden, stove, etc.) ☐ 3. Learnt new techniques and obtained knowledge ☐ 4. Motivated to work for community development ☐ 5. Negatively affected because of too much work ☐ 6. Others ( )
B-2	What were the difficulties for you to proceed with the series of activities?	☐ 1. Too much work ☐ 2. The work is too tough ☐ 3. Insufficient time ☐ 4. Difficult technology to use ☐ 5. Communication a problem ☐ 6. Others ( )
B-3	How do you see the leadership and performance of the development committee?	☐ 1.Very good ☐ 2.Good ☐ 3.Moderate ☐ 4.Weak ☐ 5.Very weak
B-4	How do you feel that you were involved in the decision making process for the series of activities?	☐ 1.Very much involved ☐ 2.Involved ☐ 3.Moderately involved ☐ 4.Slightly involved ☐ 5.Not involved
B-5	How do you think you were cooperating in the work during the Pilot Projects?	☐ 1.Yes, very much ☐ 2.Yes, in general ☐ 3.Moderate ☐ 4. Not so much ☐ 5. Very little / No
B-6	If the answer of B-5 is "Not so much" or "Very little", why not?	☐ 1. Don't have an interest ☐ 2. Don't feel it's necessary for my life ☐ 3. Too much work & insufficient labor force ☐ 4. Don't like to work as a group ☐ 5. Others ( )

B-7	How do you think the community members as a whole were cooperating in the work during the pilot projects?	☐ 1.Very good ☐ 2.Good ☐ 3.Moderate ☐ 4.Weak ☐ 5.Very weak
B-8	How do you evaluate the training courses, if you received them?	☐ 1.Very useful ☐ 2.Useful ☐ 3.Moderately useful ☐ 4. Not applicable in practice ☐ 5. I don't know

Please answer only the parts corresponding to the activities in which you participated;

Section C Gully training & Contour terracing: Yes / No

C-1	Do you think the constructed terraces and trained gullies will prevent the extension of the gully?	☐ 1. Yes ☐ 2. No ☐ 3. I don't know
C-2	How did you benefit through the activity on gully training and contour terracing? (Tick each item mentioned in the list)	☐ 1. Nothing ☐ 2. I don't know ☐ 3. The speed of gully expansion has been slowed ☐ 4. Learnt the technique and obtained knowledge ☐ 5. Feel less danger since it's protected ☐ 6. Motivated to work for community development ☐ 7. Others ( )
C-3	Do you have any intention to continue these kinds of activities?	☐ 1. Yes ☐ 2. No
C-4	If the answer of C-3 is "No", why not? (Tick each item mentioned in the list)	☐ 1. Don't have an interest ☐ 2. Don't think it's necessary for my life ☐ 3. Too much work & insufficient labor force ☐ 4. Not sure about the technique to use ☐ 5. Problem of inputs ☐ 6. Difficult to work as a group ☐ 7. Others ( )

Section D Grazing, feedlot, and fodder plot : Yes / No

D-1	How did you benefit through participating in the grazing scheme activities? (Tick each item mentioned in the list)	☐ 1. Nothing / No benefit ☐ 2. I don't know ☐ 3. Learnt about grazing management ☐ 4. Expected to sell cows for a good price ☐ 5. Help to prevent soil conservation ☐ 6. Work for community development ☐ 7. Others ( )
D-2	Do you have any intention to continue with range management activities?	☐ 1.Yes ☐ 2.No

D-3	If the answer of D-2 is "Yes", why will you continue?	☐ 1. Easier herding / less labour ☐ 2. Can keep more cattle ☐ 3. Fields protected ☐ 4. Cattle grow well ☐ 5. Soil is conserved ☐ 6. More grass ☐ 7. Others ( )
D-4	If the answer of D-2 is "No", what is the problem?	☐ 1. Don't have an interest ☐ 2. Don't feel it's necessary for my life ☐ 3. Too much work & insufficient labour force ☐ 4. Problem in use of technique ☐ 5. I'm not sure what to do / lack of knowledge ☐ 6. Problem of inputs ☐ 7. Difficult to work as a group ☐ 8. Others ( )

Section E Vegetable Garden Activities: Yes / No

E-1	Have you obtained the necessary skills to grow vegetables?	☐ 1. Yes, I can do it by myself ☐ 2. Yes, but I still need assistance ☐ 3. Not yet understood
E-2	What was the most important change for you through participating in the vegetable garden activity? (Tick each item mentioned in the list)	☐ 1. Learnt how to produce vegetables ☐ 2. Improvement of diet ☐ 3. Improvement of income ☐ 4. Work under community collaboration ☐ 5. Almost no changes, None ☐ 6. Others ( )
E-3	If the answer of E-2 is "Improvement of diet" or "Improvement of income", what changes have been brought about?	☐ 1. Assists in cutting down expenses for buying vegetables ☐ 2. Able to sell the surplus ☐ 3. both 1&2 ☐ 4. Others ( )
E-4	Are you confident enough to continue the vegetable garden on your own?	☐ 1.Yes ☐ 2.No
E-5	If the answer of E-4 is "No", why not?	☐ 1. Insufficient labour force ☐ 2. Problem of inputs ☐ 3. Lack of finance ☐ 4. Lack of knowledge ☐ 5. Distance to the farm ☐ 6. Others ( )

Section F Afforestation & Improved fallow: Yes / No

F-1	What do you expect to gain from joining in the nursery and plantation activities?	☐ 1. Expecting fuel wood /fruits etc. ☐ 2. Soil conservation/ enriched soil ☐ 3. Want to try agroforestry ☐ 4. Expecting to sell nursery plants ☐ 5. I don't know ☐ 6. Others ( )

F-2	What was the most important experience for you through participating in the plantation / nursery activities?	☐ 1.Obtained knowledge & techniques ☐ 2. Work for community development ☐ 3. Others ( )
F-3	Do you have any intention to continue these kinds of activities?	☐ 1. Yes ☐ 2. No
F-4	If the answer of F-3 is "No", why not? (Tick each item mentioned in the list)	☐ 1. Don't have an interest ☐ 2. Don't feel it's necessary for my life ☐ 3. Too much work & insufficient labour force ☐ 4. Not sure about technology used ☐ 5. Problem in inputs ☐ 6. Difficult to work as a group ☐ 7. Others ( )

Section G Improved Cooking Stove: Yes / No

G-1	How did you benefit from participating in construction of the stoves? (Tick each item mentioned in the list)	☐1. Kitchen has been tidy and clean ☐2. Can cook various foods at the same time ☐3. Cooking fast ☐4. Conserve a fuel wood ☐5. Community development has been activated ☐6. Others ( )
G-2	If you purchase fuel wood, how much money do you spend per year for the fuel?	E _____
G-3	What is the average number of bundles you consume for cooking lunch normally?	Without Improved Stove: _____ bundles With Improved Stove: _____ bundles
G-4	How much time do you spend for the preparation of lunch when using the improved cooking stove?	With Improved Stove: _____ hours

Thank you very much for your cooperation!

F.13 QUESTIONNAIRE for Development Committee members

Date: June, 2003

Section A Information on interviewee

A-1 Name of Interviewee _____ A-2 Sex: M / F

A-3 Chiefdom Name ☐ 1. Eni ☐ 2. Engcayini ☐ 3. Zikhotheni ☐ 4. Macudvulwini

A-4 Position in the Committee;

☐1.Chairperson, ☐2.Vice Chairperson, ☐3.Secretary, ☐4.Vice Secretary, ☐5.Treasury, ☐6.Member, ☐7.Representative from Chief's homestead

Section B Opinions on Pilot Project in general

B-1	How do you evaluate your leadership as a committee member?	☐1.Very strong; ☐2.Strong; ☐3.Moderate; ☐4.Weak; ☐5.No leadership
B-2	How often have you had committee meetings?	☐1. Every week; ☐2. 2 times/week; ☐3. once/month; ☐4. less than that; ☐5. Almost no meetings
B-3	Do you think could you involve whole community to the decision-making procedure and all activities?	☐1. Very much; ☐2. Yes in general; ☐3. Moderate involved ☐4. Slightly involved ☐5. Almost none
B-4	Do you think the community people were supportive for all activities?	☐1. Yes Very much; ☐2. Yes in general; ☐3. Moderate; ☐4. Less than expected; ☐5. Not at all supportive
B-5	What were difficulties to proceed and manage the activities? (Check all corresponded)	☐1. Information distribution to villagers ☐2. Too much things to do ☐3. Limitation of time ☐4. How to motivate people ☐5. Others ( )
B-6	Did the leadership training assist you for managing the pilot project?	☐1. Yes very much; ☐2. Yes in general; ☐3. Moderate; ☐4. Slightly; ☐5. Almost none
B-7	Do you think you are able to support your community as a development committee from now on?	☐1. Yes, I'm confident about it ☐2. Yes, I think we can ☐3. More or less we can ☐4. I'm not sure if we can or not ☐5. Still very much challenging

Section C : Please write whatever your opinion about the pilot project, or intention for the future, request to JICA / MOAC / community people etc.

Thank you very much for your cooperation!

F.14 QUESTIONNAIRE (Intra-Inkhundla Tour)

Date: _____, 2003

Section A Information on interviewee

A-1 Name of Interviewee _____ A-2 Sex: M / F

A-3 Chiefdom Name

Kukhanyeni Inkhundla: ☐ 1. Bhekinksi ☐ 2.Butfongweni ☐ 3. Eni ☐ 4. Maliyaduma ☐ 5. Mbeka ☐ 6.Mdayane ☐ 7. Mkhulamini ☐ 8. Ngcayini ☐ 9. Ngwazini ☐ 10.Nkiliji ☐ 11. Nsenga ☐ 12. Ntunja ☐ 13. Nyakeni ☐ 14.Sankolweni ☐ 15. Swaceni

Shiselweni 1: ☐ 1. Emasiphula ☐ 2. Mlomokazulu ☐ 3. Mchinsweni ☐ 4. Manyandzeni ☐ 5. Zikhoteni

Ngwempisi: ☐ 1. Bhadzeni 1 ☐ 2.Bhadzeni 2 ☐ 3. Dlandleni ☐ 4. Khabonina ☐ 5. Lushikishini ☐ 6. Macudvulwini ☐ 7. Mahhashini ☐ 8. Mgazini ☐ 9. Ngcoseni ☐ 10. Velezizweni

A-4 Position;

☐1.Indduna Yenkhundla, ☐2.Chief, ☐3.Indvuna, ☐4.Bucopho, ☐5.Others ( )

Section B Impressions of the Monitoring Tour

B-1	Please choose three impressive components, which you have seen today, and put priority numbers in the box.	☐1.Contour terracing, ☐2.Gully training, ☐3.Community garden, ☐4.Grazing scheme, ☐5.Feedlot & Fodder plot, ☐6.Spring protection, ☐7. Cooking stove, ☐8. Nursery, ☐9. Afforestation ☐10. Others ( )
B-2	Which components do you think will be "necessary" for improvement of your chiefdom? (Tick each item mentioned in the list)	☐1.Contour terracing, ☐2.Gully training, ☐3.Community garden, ☐4.Grazing scheme, ☐5.Feedlot & Fodder plot, ☐6.Spring protection, ☐7. Cooking stove, ☐8. Nursery, ☐9. Afforestation ☐10. Others ( )
B-3	Which component do you want to apply in your chiefdom? Please assume the three cases of financial resources listed, write the name of the components in the brackets. ** It's just asking your degree of interest and not the question asking for your demand of financial assistance.*	1. If the donor support everything, we want to do; ( ) 2. If the donor support the part of it, we also cost share to do; ( ) 3. We want to apply in our community even with our own expenses; ( )
B-4	Assuming to implement these kinds of projects in your community, what will be difficulty or constraints for implementation? (Tick each item mentioned in the list)	☐1.Nothing, ☐2. Motivate community people, ☐3. People are too busy, ☐4. Many people are away from the chiefdom, ☐5. Seems difficult in technique, ☐6.Communication in the community, ☐7. Limitation in financial resources and materials, ☐8. Disadvantageous location of chiefdom, ☐9.Limitation in land, use for communal activities ☐10. Others ( )

Thank you very much for your cooperation!

F.15 Result of Monitoring Survey (June, 2003)

Section A Information on interviewee

Items	TA1	TA2	TA3
1. Sex: Male	18	14	13
Female	15	24	14
2. Age: Teenager	0	1	0
20's	1	3	4
30's	9	5	3
40's	9	20	5
More than 50's	12	9	14

Section B Pilot Project General

B-1: Do you find any changes in your life after participating in the activities of the Pilot Projects?

Changes	%
1. Nothing	4.1
2. Obtained physical output	27.0
3. Learnt new techniques and obtained knowledge	74.0
4. Motivated to work for community development	54.0
5. Negatively affected because of too much work	4.1
6. Others	4.1

B-2: What were the difficulties for you to proceed with the series of activities?

Changes	%
1. Too much work	15.0
2. The work is too tough	14.0
3. Insufficient time	29.0
4. Difficult technology to use	3.1
5. Communication a problem	36.0
6. Others	33.0

* Most of the answer as "others" is "nothing".

B-3: Leadership and performance of the D.C

Category	Point	%
1. Very good	27	27.6
2. Good	54	55.1
3. Moderate	13	13.3
4. Weak	2	2.0
5. Very weak	2	2.0
Total	98	100.0

B-4 Involvement in decision making

Category	Point	%
1. Very much involved	34	34.7
2. Involved	45	45.9
3. Moderately involved	12	12.2
4. Slightly involved	3	3.1
5. Not involved	4	4.1
Total	98	100.0

B-5 Cooperation to the activities in the Pilot Project (by each participants)

Category	Point	%
1. Very much	36	36.7
2. Yes, in genera	46	46.9
3. Moderate	10	10.2
4. Not so much	2	2.0
5. Very little / No	2	2.0
Total	96	98.0

B-7 Cooperation by the community as a whole

Category	Point	%
1. Very good	29	29.6
2. Good	44	44.9
3. Moderate	20	20.4
4. Weak	2	2.0
5. Very weak	2	2.0
Total	97	99.0

B-8 Evaluation on the series of training course

Category	Point	%
1. Very useful	34	34.7
2. Useful	36	36.7
3. Moderately	5	5.1
4. Not applicable	7	7.1
5. Don't know	15	15.3
Total	97	99.0

Section C Gully training & Contour terracing:

C-1: Do you think the constructed terraces and trained gullies will prevent the extension of the gully?

Category	Point	%
1. Yes	24	96.0
2. No	0	0.0
3. I don't know	1	4.0
Total	25	100.0

C-2: How did you benefit through the activity on gully training and contour terracing?

Changes	%
1. Nothing	0.0
2. I don't know	0.0
3. The speed of gully expansion has been slowed	65.6
4. Learnt the technique and obtained knowledge	50.0
5. Feel less danger since it's protected	21.9
6. Motivated to work for community development	25.0
7. Others	3.1

C-3: Do you have any intention to continue these kinds of activities? 100%

Section D Grazing, feedlot, and fodder plot

D-1: How did you benefit through participating in the grazing scheme activities?

Changes	%
1. Nothing / No benefit	2.1
2. I don't know	6.4
3. Learnt about grazing management	55.3
4. Expected to sell cows for a good price	55.3
5. Help to prevent soil conservation	51.1
6. Work for community development	38.3
7. Others	2.1

D-2: Do you have any intention to continue with range management activities? 100%

D-3: Reason of having intention to continue the activity

Changes	%
1. Easier herding / less labour	57.8
2. Can keep more cattle	37.8
3. Fields protected	51.1
4. Cattle grow well	48.9
5. Soil is conserved	51.1
6. More grass	40.0
7. Others	0.0

Section E Vegetable Garden Activities:

E-1 Acquisition of skills of vegetable cultivation

Category	Point	%
1. Yes I can do by myself	16	76.2
2. Yes, but need assistance	4	19.0
3. Not yet	1	4.8
Total	21	100.0

E-2: What was the most important change for you through participating in the vegetable garden activity?

Changes	%
1. Learnt how to produce vegetables	95.2
2. Improvement of diet	85.7
3. Improvement of income	90.5
4. Work under community collaboration	76.2
5. Almost no changes, None	0.0
6. Others	9.5

E-3 Major Changes

Category	Point	%
1. Cut down expenses	2	9.5
2. Sell surplus	1	4.8
3. Both	16	76.2
4. Others	0	
Total	19	100.0

E-4: Are you confident enough to continue the vegetable garden on your own? 100%

Section F Afforestation & Improved fallow:

F-1: What do you expect to gain from joining in the nursery and plantation activities?

Changes	%
1. Expecting fuel wood /fruits etc.	41.4
2. Soil conservation/ enriched soil	82.8
3. Want to try agroforestry	20.7
4. Expecting to sell nursery plants	37.9
5. I don't know	0.0
6. Others	3.4

F-2: What was the most important experience for you through participating in the plantation / nursery activities?

Changes	%
1.Obtained knowledge & techniques	96.6
2. Work for community development	24.1
3. Others	0.0

F-3: Do you have any intention to continue these kinds of activities? 80% (20%=N.A.)

Section G Improved Cooking Stove:

G-1: How did you benefit from participating in construction of the stoves?

Changes	%
1. Kitchen has been tidy and clean	50.0
2. Can cook various foods at the same time	68.8
3. Cooking fast	56.3
4. Conserve a fuel wood	75.0
5. Community development has been activated	37.5
6. Others	0.0

G-2: If you purchase fuel wood, how much money do you spend per year for the fuel?

Average: E 363.0

G-3: What is the average number of bundles you consume for cooking lunch normally?

- Without Improved Cooking Stove: 2.86 bundle
- With Improved Cooking Stove: 1.61 bundle

G-4: How much time do you spend for the preparation of lunch when using the improved cooking stove?

Average: 0.93h

F.16 SELF EVALUATION WORKSHOP

– GENERAL NOTES TO ASSIST IN COMPLETION OF THE EXERCISE

◆ There are TWO OBJECTIVES to doing an evaluation:

- to assist farmers in recognising and identifying their own achievements AND what still needs to be done to ensure long term implementation of activities and benefit
- to assist planners in applying lessons learnt be farmers in the pilot project to other farmers who want to do the same sorts of activities

Self evaluation occurs when a community or even an individual farmer sit down:

- to think hard about what they have done and when they did different activities,
- to ask themselves what were the main overall outcomes and achievements of their activities compared to what they had planned to do,
- to determine who was involved in the activities (i.e. who were the stakeholders) and what were their relative contributions,

and ask themselves:

- whether or not the outcomes achieved their purpose and what were the strong points and/or weak points and problems and what if any are the potential solutions to ensure successful achievement of outcomes and purposes
- whether or not the planned activities and outcomes were the most appropriate and what if any there were problems that needed solving and how this was done

so that finally, the farmers can:

- plan the implementation of any current unachieved and unfinished activities and
- plan the implementation of new future activities and outcomes.

The best way to proceed is for a committee or sub-committee of farmers (and any other useful stakeholders) to get together and produce a series of preliminary reports. These reports are presented on sheets of paper in a series of rows and columns that we call Forms. These reports are then presented to a gathering of the whole community who decide whether the report is correct in every detail during a workshop meeting – any changes are recorded on the sheets and once finished these then become the community's final report of the project.

◆ The procedure and the tip of the discussion and completion of the forms are as follows;

Each Form is completed after much discussion and if necessary changed as the discussion progresses, both at the committee stage and at the community meeting. It is important in the initial stage not to rush too quickly into completing the report but to think about it for a while before completing the preliminary report.

FORM-1 IMPLEMENTATION SCHEDULE

First, Identify what broad activities were done to achieve your project – write this in the column for "Activity".

N.B. What we want to know is basically the process you went through to achieve your pilot project

Tip: Start by listing all the important activities and then arrange them in order of when they occurred

Next, Write down when it was done, that is when you started and when you completed the activities. Write this by putting a single line ( ) from the date you started to when you finished, or use a broken line to show when you started and stopped more than once ( ).

N.B. What we want to see is how long it took to do each activity

Tip: Only use a broken line where there was a real break in the activity which then later had to be restarted.

Think of the following questions:

- What did we actually do?
- What activities did we become involved in from the beginning until now?
- What activities will we have to do in future from now, either to complete some existing tasks or to start new tasks?

FORM-2 ACHIEVEMENTS

First, Identify what were the major achievements you had expected and hoped to finish when you prepared your Plan Of Operations – write this in the "**Expected Outputs**" column

N.B. Identify all expected achievements whether or not you accomplished them or not

Tip: Only consider the major accomplishments that had to be achieved for the pilot project to be potentially successful – not the details of specific activities. Some major ones have been indicated in advance by the Study Team.

Next, Write down what was actually achieved in the "**Actual Achievement**" column.

N.B. We want to compare what was planned and what was achieved.

Tip: We are mainly concerned with major and important achievements which in their own indicate a significant achievement in progress progress and the lack of achievement of these and why we failed

Think of the following questions:

- what were the actual results of all our efforts and activities?

FORM-3 PARTICIPATION BY THE STAKEHOLDERS

First, Identify all stakeholders involved directly in the implementation of your project

N.B. We want to learn who needs to be involved in future projects
Tip: Consider all stakeholders even if they only had a small part to play
Tip: Remember a stakeholder is anyone who may benefit or suffer from or who can influence the outcome of the project in any way whether positively or negatively, and so may include (internal) community members themselves, the committees and sub-committees, community leaders and elders, the Chief, etc, and (externally) government workers and officers, NGOs, project staff and any others such as traders who may buy produce or sell inputs, marketing agents, transport operators, etc.

Next, Describe, for each stakeholder in each activity, what was their contribution and participation (leading, planning, working, advising, etc), and was this contribution satisfactory or not and why. Write this down in the next column

N.B. Think of the following questions:

Community:
- What proportion of the community attended each activity and the series of meetings?
- In the meetings, could all participants express their opinion or was it dominated by a particular group of people?
- Did women join in all the activities and meetings?
- What support did the community give the Development Committee sufficiently? And in all the Committee's efforts at organisation?

Development Committee:
- Were all members of the Development Committee responsible for the activities?
- How good was the leadership by the Development Committee?

Traditional Leaders And Elders:
- Were the Traditional Leaders and Elders kept sufficiently informed about the project?
- Was there enough participation in the project by Traditional Leaders and Elders?

Government Staff:
- Was there enough involvement by Government Staff?
- Did Government Staff visit and give advise often enough?

NGO Staff:
- Was the assistance of the NGOs useful?
- Were the NGO Staff eager to assist the community?

Project Staff/Study Team Staff:
- Did the JICA Project Staff participate with the project enough?

FORM-4 EVALUATION OF THE ACHIEVEMENT – SUCCESS OR FAILURE OF ACHIEVEMENT AND PROCESS LEADING TO ACHIEVEMENT

First, Write down from Form 2 the expected outputs from the project in the expected output column

Next, Identify all the strong and positive aspects leading to the achievement of the output in the next column and all the weak and negative aspects and problems which hindered the achievement of the expected outputs.

Finally, Write down any solutions and changes that should be made to make it easier next time to achieve the expected outputs – this should include the actions to be taken internally by the stakeholder community and its members and externally by other stakeholders.

N.B. We need to consider all stakeholders so, first, identify who these all are before completing the task

N.B. Consider not only the attainment of the achievement but also the processes and procedures leading to the achievement.

Tip: Consider in the case of the attainment of the achievement, whether the results were appropriate or not – think why?

Tip: Consider in the case of the processes leading to the attainment of the achievement, which of the processes were very useful and which were a problem and need changing – think: why?

Think of the following questions:・・・・・・・ *Do not need to reply all questions but keep in mind when you think of the reason why you could attain the achievement or why you cannot!!*

Efficiency: *efficient use of resources materials, finances, labour, advice given, etc.*

- Was the time period of activities enough and appropriate?
- Were the series of training effective for obtaining the knowledge to use?
- Did the materials provided assist to attain the achievement?
- Could you utilize the resources you have in the community?

Effectiveness: *An Effective completion of the project?*

- Could you get the results what you have been expected through the activities?
- If not, what discouraged you for attainment of the achievement?
- Have the community motivated to participate and continue the activities?
- What were the difficulties / limitation for implementation of the activities?
- Do you find any changes in the natural resources in the community after starting the activities?

Relevance/Validity:

- Was the technology applied appropriate for achieving the objectives in your community?
- Was the technology possible to manage?
- Were the contents of the activities affordable for the capacity of the community people, in terms of knowledge, possibility in economically, labour force, and so

on?
- Should we have done anything in a different or any different activities?

Impact: *any desirable/undesirable impacts?, any direct/indirect impacts for the community?*
- Were there any changes in the community in terms of chain of command / power-relations?
- Do you find any indirect positive/negative impact such as; expansion of development works in different field or to outside of the project area, non-participated community members have started to show their interest, etc.?
- Are there any negative effects on the environment within the area?

Sustainability :

Process of the activity:
- How do you see the participation rate? If the participation rate was quite low, what was the problem?
- Did the development committee and sub-committees support the activity responsibly?
- Did the community cooperate to the committee members?
- Were the Traditional Leaders and Elders kept sufficiently informed about the project? and were they cooperative for the activities? If not, what the community / outsiders can do for overcome?
- Were the project implementation sites appropriate and agreed by all the community members?
- Was information on each activity provided to participants properly?
- Was the allocation of tasks equally?
- Will everyone have the chance to benefit?
- Were every community members involved in the meeting to decide every activity such as site selection, making constitution, managing rules, deciding the membership fees, etc., and were agreed by them?

For further activities:
- Are people willing to continue the activities? If not, why and what should you do then? – why? When?, how?, who will do it?
- To what extent will the community be able to continue to benefit from the project after the team leaves?
- Do we have funds to continue – have savings schemes been set up to collect contributions?- If not, what are the problems, how can you overcome the problem and what kind of supports do you need? – Any other necessary resources?
- What kind of support for the further activities necessary if you need?

Others:
- Comparing to the activities and its results implemented in other TAs, what were the differences?
- Ecologically and environmentally sustainable?

FORM-5 PLAN OF CONTINUING AND FUTURE ACTIVITIES

By now we know what is good and bad about the project and so we need to plan for the future.

First, Identify all the activities that should have been carried out for successful completion of the project but which have not yet been carried out.

Next Decide when these activities should be carried out (i.e. over what time period) and who should be responsible for them being carried out to completion – this includes all stakeholders whether or not they are from the community (internal) or not (external).

N.B. There are always two "people" responsible, firstly, a specific person who does the activity and, secondly, the community as a whole who assists that person!

Next, Identify what changes to activities need to be made to the current "Plan Of Operations" activities for the ongoing project and to future project activities.

REMEMBER TO ASK YOUR GOVERNMNT AGRICULTURAL EXTENSION OFFICER TO HELP YOU IN COMPLETING THE FORMS WHENEVER YOU WANT TO DO A SELF EVALUATION OF YOUR PROJECTS

F.17 Self-evaluation Workshop

F.17.1 Proceeding of the Self-evaluation Workshop (Eni & Ncgyaini)

Date: 12 June, 2003, 11:00- 14:30
Participants: Community(M;23, F;26), MOAC (Khoza, Tsenjiwe, Luyanda, Philisile), JICA (Tanabe, Shibata, Masumura, Kono, Maclaurin, Okata), Surveyor (3)
Facilitator: Khoza

Starting with prayer, Mr. Nhlabatsi made speech for welcoming community people on behalf of two chiefdoms and Mr. Masuku, a chairperson of the development committee stated the purpose of the meeting. Followed by the words by Mr. Tanabe, each sub-committee presented the result of the activities and evaluation.

1. <u>Soil Conservation</u>

1) Major activities done

Major Activities	Implemented schedule
1. The site was chosen by JICA regarding on heavy degraded area, and the site in Ncgyaini was selected.	
2. The work was planned	Jan- Feb, 2003
3. Fencing was done.	Feb, 2003
4. Construction of terrace and rehabilitation of Donga was done.	Feb-Mar, 2003
5. Grass was planted on the contour.	Jan- Mar, 2003
6. The committee was made after construction work done by NGO	March, 2003
7. Monitoring arrangements is done after a month to see the condition of the structure constructed.	
8. Constitution has not yet made, though it was planned.	
9. The committee has not received any training yet.	

2) Participation

Community:	Community member have worked with providing labour force or efforts made was so big that many activities were to be done.
Development Committee:	Development committee was looking on absent and latecomers. Also, assigned work to people and monitored whether they still do the right work.
Traditional leaders:	They assisted by providing land for the activity, and allow JICA to continue the work with community.
Govt. Staff	By providing with bulldozers for making contours and digging, providing trees and assisting or educating for the working.
NGOs	Providing knowledge and arrangement of work, labour force.
JICA	Investigate degraded area, looked for the appropriate site for the pilot project and funded the projects.

3) Evaluation

The activity was started with an expectation that the soil erosion will be reduced. There are some advantages obtained by the activity, and at the same time they encountered some problems shown as below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities
◆ Development Committee as well as sub-committee has been formed and the work is being continued. Especially, development committee was working hard though the work needed effort and time also tools were needed!
◆ Since the some of the sub- committee members were monitoring the site in order not be disturbed by animal's invasion, the trees are not damaged!
◆ Planted trees are growing lively, although the land was compacted because of cattle overgrazing.
◆ Reduction of washing away of soil or soil erosion, as there is a lot of growing.

◆ Though the constitution is not written down, the word of month has been used. ◆ As Dongas and soil erosion is everywhere in the country, members have an idea to conserve and rehabilitate them as they have gained knowledge and skills from NGO's who worked together with the community.	
Problems	Solutions
◆ The bared wire was not enough to prevent animals going into the soil conservation area.	◆ Ask for the assistance to the government agency or Inkhundla center.
◆ Lack of communication and cooperation of sub-committee members. It seems that the people who does not have interest are selected as members.	◆ Keep on time. Get penalty for those who are absent and latecoming. ◆ Ask for training about elections to NGOs in order to learn how to choose right members who have interest to work.
◆ Lack of leadership of sub-committee.	◆ Ask for training on leadership to government.
◆ Members are not sure what and how to continue the work.	◆ Ask for training to government or NGOs.
◆ There is no benefit as income generation.	

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Weeding for trees and slashing	By July, 2003	Development Committee and sub-committee
◆ Write down the constitution	By August, 2003	
◆ Plant fruit trees	By September, 2003	
◆ Plant ornamental trees and flowers on contours	By October, 2003	
◆ Ask assistance of training about Donga rehabilitation	By August, 2003	Development Committee
◆ Train and educate other community members on soil conservation	By November, 2003	Development Committee
◆ In order to cover the degraded area next to your homestead, add rubbish and scraps in the donga.	Continuously	Individually
◆ Observe community including degraded area in order to make a park to attract visitors and tourists.		Development Committee

2. <u>Improved Cooking Stove</u>

1) Major activities done

Major Activities	Implemented schedule
1.A training on construction of stoves was held under JICA people with demonstration.	Mar, 2002
2. Development committee was left with assignment of training. They helped the community on construction, use of the stove, and its advantages.	
3. Sub committee for cooking stoves was formed with four members.	
4. The development committee trained the sub-committee for improved cooking stoves and started to diffuse the stove.	Mar, 2002 - now
5. JICA experts came to monitor the activity.	May, 2003

2) Participation

Community:	Community members have helped on the construction of stoves by collecting stones and mud giving to those who have skills of construction.
D.C:	Development committee monitors the activity.
Traditional leaders:	They gave permission to JICA to train us on the construction of stoves. One homestead was used for demonstration purpose.
JICA	Introduced the techniques and gave training to the community.

3) Evaluation

The activity was started with an expectation that the reduction of firewood as well as reduction of time for cooking. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ The sub committee has developed knowledge about construction of stoves and they share the knowledge with other people by constructing stoves in the community. ◆ 15 stoves were constructed and the users like them. ◆ The amount of firewood used for cooking reduced by half. ◆ The improved stove has helped a lot and its useful to the community as it saves time. Women can do other things at home, such as handcraft, sewing, making mats, etc., because, 1) Reduction of time to collect lots of firewood, and 2) can cook various dishes at the same time.	
Problems	Solutions
◆ No time for construction of stoves, since only a few people have skills to construct stoves (only three!)	◆ Train more people so as to improve the work. ◆ Community has to give them time by leaving some part of the community work.
◆ Collecting stones for the construction of stove are time consuming.	◆ Decided to use bricks made of mud instead of stones.
◆ It was smoky in the room.	◆ Decided to put chimney and problem was solved.
◆ Problem of transport since there is long distance from one area to another is a problem on diffusion.	◆
◆ At the beginning, the design of the stove was not favoured by the community people.	◆ Had changed the design to modern style and people like it.
◆ Though people can work for handicraft with using the extra time produced, there is no market since the quality is not competitive….	◆ Ask for information to RDA.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Train people in neighbouring community	June, 2003	Those who know the technique
◆ Train more people on stove construction, including neighbouring areas.	By July, 2003 (during winter)	Sub committee
◆ Contact to RDA to obtain information on skill training for handicraft utilization of spare time.	July, 2003 (during winter)	Sub committee

3. <u>Water Spring Protection</u>

1) Major activities done

Major Activities	Implemented schedule
1. The sub committee was selected.	October, 2002
2. Materials and tools were delivered to the community.	March, 2003
3. The maintenance fee (E25/year) to be paid was decided.	
4. The construction of the facility.	May- June, 2003

2) Participation

Community:	Made efforts for construction the facility with providing labour force.
Traditional leaders:	Allocated land and supported the work.
NGO(SFDF)	Helped to construct the facility.
JICA	Provided knowledge and skills, funded materials and technical skills.

3) Evaluation

The activity was started with an expectation that 1) obtain clean water for drinking, washing and bathing, and 2) develop and improve the community. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ The facilities were constructed. ◆ Could get clean water and less fear toward water-oriented diseases. ◆ Feel community has been developed in this way.	
Problems	Solutions
◆ The fencing has not been done yet.	◆ Continue the work.
◆ The maintenance fee has not been collected.	◆ Collect them.
◆ The constitution has been made but not presented to Umphakatsi (elders)	◆ Firstly write it down and present to Umphakatsi.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Fencing of the spring (Ngcyaini)	By June, 2003	Sub committee
◆ Complete the construction (Eni)	By August, 2003	Sub committee
◆ Plant fruit trees around fences	After fencing	Sub committee
◆ Collect maintenance fee		Sub committee

4. <u>Grazing, feedlot, fodder-plot scheme</u>

1) Major activities done

Major Activities	Implemented schedule
【Grazing scheme】	
Meetings have been held several times.	
2 committees were selected of the grazing area	Jun- Aug, 2001
Record is kept by the development committee	
【Fodder plot】	
2. Sub-committees (grazing, feedlot, fodder-plot) were formed.	
3. Constitution and work plan was made for the work to continue	
4. The site for feed lot and grazing scheme was allocated by Umpakatsi.	Sept, 2001
5. The development committee has done the work in collaboration with NGOs	
6. Managing fee collection with keeping records.	
7. Bank account	Not yet be opened
8. Received training courses fattening cows and how to keep them for sale.	

2) Participation

Community:	Participated in the construction work and made constitution.
Development committee:	Development Committee is leading the work. Development committee set meeting with elders for solving various problems.
Traditional leaders:	Gave the land to the committee for the activities to be done and also encouraged to the community for the work.
Government	Helped on training the committee members.
NGO	Provided the community technical skills about the work.
JICA	Provided the work with funds for construction, materials and tools.

3) Evaluation

There are some advantages obtained by the activity, and at the same time they encountered some problems shown as below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ The series of meetings were held, and keeps the records and list of the members participated. ◆ Constitution for grazing scheme was made. ◆ The work plan was made for improving the work. ◆ Community is aware of the work., ◆ Elders of Umphakatsi are now aware and familiar with the work. ◆ Obtained the knowledge how to fence.	
Problems	Solutions
◆ Some people are not attending meetings and not participating in activities.	◆ Need to discuss in the community how more people will attend meetings, especially about the time of meeting. ◆ Need to revise the member list.
◆ Since the work being delayed, the work plan made needs to be revised.	◆ The work plan will be revised.
◆ The community people are still not yet sure how to use and manage the fenced area, feedlot, and fodder plot areas.	◆ JICA has to assist on training on how to use the feedlot and management skills.
◆ The collected money has not been in bank.	◆ Open bank account.
◆ Need more understanding and assistance by Umphakhatsi.	◆ Needs to include elders within the committee in order to work together. ◆ Development committee will ask for training course for leaders.
◆ Constitution of feedlot has not yet made.	◆ Constitution will be made by collaboration between community and elders.
◆ A part of the fence in grazing scheme and feedlot in Engyaini has been cut.	◆ Those who cut the fence will be punished by elders.
◆ Planting of grass in the feedlot and fodder site have not been completed.	◆ Sub-committee need to motivate people for planting grasses.
◆ Committee members are not sure how to monitor the activities.	◆
◆ The gate of feedlot is often left opened since it locates on a route to pass by.	◆
◆ The cows, which are going to be grazed and fattened in the feedlot, have not been selected.	◆
◆ The water spring inside the grazing scheme in Ngcyaini has not been fenced yet.	◆
◆ Rotation use of grazing camps has not been managed.	◆

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Start using grazing scheme	During rainy season	Sub committee
◆ Apply the knowledge and experience of what we have learnt		Development committee
◆ Open a bank account	As soon as possible	Sub committee
◆ Reconstruct the fence damaged and complete unfinished part.	As soon as possible	Sub committee

◆ Complete planting of grass in the feedlot and fodder site	November (during rainy season)	Sub committee
◆ Look and see whether we still continue doing the work what we expected to be done.	End of July	Sub committee
◆ To see if the constitution is still workable and consider the right way to proceed the activity.	End of July/ August	Sub committee
◆ Register the sub-committee officially		
◆ Expand further grazing area if the committee continued to lead the activity.	Next year	Sub committee

5. <u>Development Committee</u>

1) Major activities done

Major Activities	Implemented schedule
1. First meeting was conducted with Umphakatsi, and a development committee was formed.	June, 2001
2. Study tour to Lesotho was conducted for development committee	September, 2001 (4days)
3. Regular meetings were held, twice a month.	June 2001- now
4. The work has planned and started.	February, 2002
5. Consultation meetings were held.	March- July, 2002
6. Sub committees were formed	July, 2002
7. Series of training were held at Mphophoma, New Mbuluzi, etc.	Sept& Oct, 2002, March, 2003
8. Inter location tour was conducted.	August, 2002 9,10 June, 2003

2) Participation

Community:	Assisted on the formation of the development committee and sub-committees, made work plan, participated in the series of activities,
DC:	Arranged meetings, planning of various activities, assist drafting the constitution for the each work, Formulating divisions of work / sub- group for the series of work, attending the series of training.
Traditional leaders:	Allowing and welcoming the assistance of JICA, Assisted by choosing the areas for the activities, support and encourage the community to do the work by conducting meetings, solving the problems encountered during the process of the work.
Government	Assisted by explaining about the work and monitoring, arranged transport and administrative matters for the training course,
NGO	Provide technical skills, knowledge labour force for construction of the facilities, Trained leaders through the leadership training course.
JICA	Funded the projects by buying materials and tools for the constructions, series of training courses, giving advises to the community in the process of activities.

3) Evaluation

The activity was started with expectations that development committee will; 1) Monitor and supervise the development and improvement of the work which has been started in the community and their management, 2) Lead the community and the work, and 3) Motivate community people to participate in the activities. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ Committee members have gained knowledge and skills of leadership. ◆ Committee members learnt how to work with community people and communicate with them. ◆ The work has been developed and achievement was obtained. ◆ Constitution was drafted after several discussions with community people. ◆ Penalties and punishment for those who break the rules were discussed and agreed. ◆ Some people volunteered a lot (almost daily) with their labour effort. ◆ Some structures and facilities for the activities were constructed.	
Problems	Solutions
◆ Majority of the community people have not been attending meetings and participating in the activities.	◆ They need training for using the completed structures.
◆ Community people are not sure how to use some of the structures constructed since training has not been done enough.	◆ Need training for using the completed structures.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Revise the work plan	June – August, 2003	Development committee and Sub committee
◆ Continue the work for Spring protection in Eni		
◆ Spring protection committee should assist other community to get clean water.		

6. <u>Other Discussions</u>

- The dongas at Ngcayini were trained, but the one at Eni has not been done. There was a confusion that people understand the one at Eni will be also rehabilitated by the pilot project. JICA explained that it is included in the Master Plan, but not in the period of pilot project.
- Development committee should be able to solve the delay of the activity in feedlot, how to use their feedlot in order to make use of it.
- There should be cooperation and collaboration among community members including elders.
- It was requested that the government should facilitate the meeting for the community and elders to solve the series of problems.

F.17.2 Proceeding of the Self-evaluation Workshop (Zikhoteni)

Date: 14 June 2003, 11:15- 14:30
Participants: Community(M68, F;57), MOAC (Masuku, Khoza, Tsenjiwe, Philsile), JICA (Tanabe, Shibata, Masumura, Kono, Fujita, Maclaurin, Kamweti, Okata), Surveyor (3)
Facilitator: Khoza

Starting with prayer, Mr. Benard Nxumalo, an acting chief welcomed community people and stated the purpose of the meeting. Followed by the words by Mr. Tanabe, each sub-committee presented the result of the activities and evaluation.

1. <u>Community garden</u>

1) Major activities done

Major Activities	Implemented schedule
1.Talked about selection of committee members, together with development committee and NGO.	June, 2002
2. Fenced the garden under the help of NGO.	
3. Constitution was made and drafted but not yet presented to traditional leaders.	
4. Membership fee of E60.00 was agreed to be paid per person.	
5. NGO came to show and educate how to dig plots and worked together.	
6. Training was conducted to the members on vegetable planting inside the plots by NGO.	
7. Monitoring is done by the sub-committee.	

2) Participation

Community:	There are 17 members in the sub committee. Made lots of effort for the work, especially fencing.
Development Committee:	Supported all the work done in the garden.
Traditional leaders:	Allocating land to the community for the activities.
Sub-committee	Supervise and support the activities.
Govt. Staff	Provided heavy machinery such as tractor for ploughing etc., sending extension officer to assist the community.
NGOs	Worked with lots of effort with providing knowledge and skills and labour force. Advised on drafting constitution (community garden).
JICA	Assisted in a way of providing knowledge, skills, equipments, materials of the garden, and tools and funded all!

3) Evaluation

The activity was started with an expectation that 1) to alleviate poverty, 2) improve life by obtaining vegetables, 3) increase income for paying school fees for children. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ The garden has already started to produce vegetables and hence we can have more balanced diet! ☺ ◆ Moreover, people can sell the surplus! ◆ Water is available for irrigation. ◆ School children and teachers could also get water now.	
Problems	Solutions
◆ The garden facility has not been yet completed, since pipes for extension is not yet installed.	◆ Ask Inkundla centre to assist water pipe for extension.
◆ Need of planting trees around the garden.	

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Plant trees around the garden	Sept, 2003	Development committee
◆ Plough and sow maize	Aug, 2003	Sub-committee
◆ Present the constitution made to Umphakatsi	Aug, 2003	Sub-committee
◆ Build and construct a market for sale of vegetables	Dec, 2003	Sub-committee
◆ Ask for assistance from some donors in order to start poultry farming beside the garden	Aug, 2004	Development committee / Sub-committee

2. <u>Improved Cooking Stoves</u>

1) Major activities done

Major Activities	Implemented schedule
1. Sub-committee for construction of cooking stove was formed.	Aug, 2001
2. The committee was trained how to construct the stove by JICA (Ms. Ogawa) at one of the homestead (Mrs. Msibi's).	
3. The community is being trained and continue to construct stoves.	

2) Participation

Community:	Made lots of effort to collect stones and mixing mud.
Development Committee:	Encouraged the community people to work.
Traditional leaders:	Gave permission to visit homesteads for stove construction.
JICA	Introduced and trained stove construction with stones and mud!

3) Evaluation

The activity was started with an expectation that; 1) the reduction of firewood and hence money will saved, 2) reduction of time for cooking, and 3) educate and train other people on stove construction even to neighbouring areas. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities
◆ 28 stoves were constructed. ◆ Using it, could save lots of time, since can cook various dishes at the same time and no need to fetch lots of firewood for long distances. ◆ Could save firewood to almost half amount. It means reduced the expense for buying firewood! ☺ ◆ Could utilize the saved money for educating their children. ◆ The skilled people can assist other people and neighbouring community to construct more stoves. ◆ People are eager to construct more stoves and there are lots of demands. ◆ Obtained knowledge how to utilize cheap or free local materials such as mud and stones. ◆ Upgrading the skill of construction of stoves, e.g. adding chimney, make storage for firewood, make cupboard for putting dishes and pots, etc. ◆ Feel like we are modern now just like the people in town since we have cooking stove at home! ☺

Problems	Solutions
◆ There is no constitution at the moment.	◆ Draft the constitution.
◆ Although the sub-committee was formed for construction of cooking stove, the members are only engaged in construction and development committee was managing the extension activity.	◆ Reform the sub committee.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Construct more stoves.		People who obtained skills and experience of construction of stove.
◆ Certain amount of money will be collected under the name of maintenance fee for building water tank, and open a bank account.		All members of cooking stove committee.

3) Water Spring Protection

1) Major activities done

Major Activities	Implemented schedule
1. Chose the site together with community, elders and JICA.	
2. Sub committee was formed.	Not yet
3. Delivered material at Letheni	June, 2003
4. Construction of facility	

2) Participation

Community:	17 beneficiaries in Letheni, 50 beneficiaries in Galile
Sub committee	Made effort wherever possible to monitor the progress of the activity.
Traditional leaders:	Allocated land to the activity.
Development committee:	Worked hand in hand with the sub-committee to proceed the activity.
NGO(SFDF)	Has to assist in construction of springs.
JICA	Help by funding materials and NGO, providing knowledge and skills for the work.

3) Evaluation

The activity was started with an expectation to obtain clean water for drinking, washing and bathing. However, we are not sure if we could achieve expected outputs, since the structure has not been constructed.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ The construction of the facility will get started very soon.		Development committee

4) Soil Conservation

1) Major activities done

Major Activities	Implemented schedule
1. Sub committee was selected by community members	Dec, 2002
2. Construction of contour terraces and planted trees.	

2) Participation

Community:	There are 43 members.
Traditional leaders:	Allocated the land. Monitored trees planted.
Government	Assisted by providing equipment, heavy machines for making contour terrace, and nursery trees, sending extension worker for further support.
NGO	Gave technical knowledge and skills, and worked a lot.
JICA	Funded for all activities including seedlings and fencing the site, giving good advise on the process of activities.

3) Evaluation

The activity was started with an expectation that; 1) reduction of degraded area by planting trees, and 2)for alleviating poverty by means of obtaining fuel wood and poles for construction. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ Trees are growing very well on the gully reclamation site. ◆ Soil erosion and degradation is being reduced on the site where the trees were planted. ◆ The soil is recovering back to its origin bit by bit.	
Problems	Solutions
◆ Need to slash grasses for preventing fire hazards.	◆ Slash grasses so as to reduce weeds.
◆ Although the area was fenced, no maintenance has been done.	◆
◆ Goats and other animals are coming into the conservation site and disturbing trees.	◆ Need to discuss with community people including Umpakatsi. ◆ Talk with the owner of the cattle.
◆ No constitution made yet.	◆ Make constitution.
◆ Some of the trees on contour terrace are damaged by termites.	◆ Control the termites using chemicals. ◆ Need of training on termites control.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Plant more trees in unplanted forestation area.		
◆ Constitution will be made	July, 2003	Development committee members

5) <u>Nursery</u>

5) Major activities done

Major Activities	Implemented schedule
1. The construction work has been started.	May, 2002
2. Decided to collect joining fee of E10 for the people participated in construction work and E250 for the people who didn't participate in the work. (At the beginning it was agreed to make it E60, but it was changed with considering the labour forces provided by the participants.)	
3. Members were registered (14 members)	

1) Participation

Community:	14 members are registered in the nursery.
Traditional leaders:	Gave permission and allocated the land to be used. Also helped on problem solving.
Government	Helped by producing heavy machines for construction.
NGO	Assisted with labour force and efforts. Helped on sharing experience and skills of the work with the community. Participated eagerly for educating the community people.
JICA	Assisted in providing materials and funded for the facility

2) Evaluation

The activity was started with expectations to utilize the nursery as 1) To alleviate poverty by selling nursery trees(especially fruit trees) and selling fruits to community people, 2) obtain trees for wind break, 3) produce indigenous trees for soil conservation, 4) Obtain important trees which are on the verge of extinction for traditional and cultural use, and 5) Improve the knowledge and experience of nursery management in order to extend to other areas in the future. There are some

advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ The water tank built beside nursery can also provide water to homesteads. ◆ The nursery construction is going well. ◆ Feel that the community as a whole would be improved and developed.	
Problems	Solutions
◆ The nursery has not been completed yet.	◆ Continue the work.
◆ There is a fear of damage nursery trees by termites.	◆ Need technical knowledge on how to control termites.
◆ The joining fee for the people who did not participate in the construction work is too expensive!	◆

3) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Construction of nursery has to be completed.	Within 2003	Sub committee member
◆ Seedlings should be produced for planting.		
◆ Constitution on managing nursery should be drafted and finalised.		
◆ Training on management of the nursery will be held.	17-19June, 2003-2005	Sub committee, MOAC

6) <u>Development Committee</u>

1) Major activities done

Major Activities	Implemented schedule
1. Formation of development committee	Aug, 2001
2. Meeting was held at Umphakatsi to introduce JICA	
3. The committee was sent to Lesotho to be trained about leadership.	Sept, 2001
4. The meeting was held again at Umphakatsi for the report of the committee leaders and their reported about the study tour in Lesotho.	Sept, 2001
5. The plan of activities was made.	Oct, 2001
6. Start and continue the series of activities	June, 2002 - now
7. The development committee analysed what to be done in the community under assistance from JICA.	
8. Sub committees were formed.	
9. Leadership training course was held.	Mar, 2003
10. Inter location monitoring was held	June, 2003

2) Participation

Community:	Community participated in all necessary activities in general. (especially for collecting stones for stoves, and digging canal for water pipe in the garden).
Development committee:	Monitored all the activities. Participated in the series of trainings in order to lead and supervise the activities properly.
Traditional leaders:	Welcoming the assistance of JICA and allocated the land for the activities. Several meetings were arranged by elders.
Government	Providing training, transport for the series of tours and trainings, heavy machines and equipment for construction of structures, tree seedlings for plantation, and sending extension officers for assistance.
NGO	Help the community to form sub committees and making constitution. Providing technical knowledge and labour force to help community.
JICA	Assisted government by agreeing to help this community. Funded majority of the activity. Arrangement of the leadership training. Catering during the trainings and meetings.

3) Evaluation

The activity was started with expectations that 1) They will supervise all activities and their achievements without failure, 2) Soil to be conserved and recovered, 3) existing dongas will be rehabilitated, 4) development of the community, 5) Obtain trees within the community, 6) Obtain water for irrigation in the garden as well as nursery, school and even some homesteads, 7) be able to train other people in neighbouring community. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ Thanks to the series of trainings, the leadership has been achieved at most of the activities and leading the success. ◆ The work has been successful in general. ◆ Dongas are prevented not to expand rapidly. ◆ Trees are growing well and soil has been conserved in the area of contour terracing. ◆ Feel improvement and development of the community! (Especially the achievement of community garden, and obtaining water for the nursery, the garden and for the school.)	
Problems	Solutions
◆ Though sub committees were formed, most of the work have been done by the development committee.	◆
◆ Leadership is not still strong enough to lead the community.	◆ Ask assistance from the government.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Train community people to be respectful.	Few months later	Development Committee / government agency
◆ Make constitution as a community	Aug, 2003	Development Committee
◆ Train neighbouring communities	2004	Development Committee

7) <u>Other Discussions</u>

- Expectation to have water supply system in the community is increasing. (People seem having interest to utilize the water tank for the nursery.) Community people are willing to provide labour force for building waterways. It will be requested for the assistance of government to build rural water supply system. It is expected by the community members to be managed by the development committee by 2004.
- It was asked about the possibility to construct more facilities for other spring site. It was explained that the development committee as well as sub-committee should make efforts to think of it from learning what to be done in the pilot project.
- For planting trees in degraded area, plant indigenous trees as well as exotic trees which will be provided by the government. About fruit trees, the community people have to buy trees for themselves.
- In general, most of the activities held in Zikhoteni is under control of development committee, not by sub-committees. The opinion was raised to say that the development committee is not necessarily right. It does not mean there are problems in development committee, however, all problems happening in the community should be clear to the community in order to solve them.
- As like other target areas, would like to build grazing site and to install feedlots system, and even further want to develop dairy cow keepings by 2005.
- The community would request the connection of electricity to Inkhundla centre by December, 2003.

F.17.3 Proceeding of the Self-evaluation Workshop (Macdvulwini)

Date: 21 June 2003, 11:00- 14:30
Participants: Community(M48, F;46), MOAC (Khoza, Tsenjiwe, Philsile), JICA (Tanabe, Shibata, Masumura, Kono, Maclaurin, Okata), Surveyor (2)
Facilitator: Khoza

Starting with prayer, Indvuna welcomed community people and stated the purpose of the meeting. Followed by the words by Mr. Tanabe, each sub-committee presented the result of the activities and evaluation.

1) <u>Community garden (Mhulatane)</u>

1) Major activities done

Major Activities	Implemented schedule
1. Meeting with community people	Mar. 2002
2. 30 members have been selected.	Apr. 2002
3. Rules and regulations made by 25 members	Aug. 2002
4. Collected membership fee of E20.00 and E80.00 for maintenance fee.	Aug. 2002
5. Opening bank account	Sep. 2002
6. Construction of garden started and completed.	Jul. 2002
7. Water piping facilities has installed.	Jul.- Oct. 2002
8. Ploughing, cultivating and application of fertilizer	Mar-May. 2003
9. Training on planting	Mar- May. 2003
10. Plat and grow vegetables	Mar-now,
11. Started to sell the products	June, 2003

1) Participation

Community:	About 45% of the community showed interest and made effort to the work..
Development Committee:	Encourage the community on the process of the activities and conducting meetings, and keeping records.
Traditional leaders:	Providing land and solving disputes by conducting meetings.
Govt. Staff	By providing transport to workshops.
NGOs	By sharing knowledge and skills also by helping with their tools.
JICA	By providing funds of all projects.

2) Evaluation

The activity was started with an expectation to improve life by obtaining vegetables. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ 2 ha of garden was constructed. ◆ Committee conducted meeting and discussed the policy for work. ◆ Constitution was made and every member has agreed and has it. ◆ Vegetable production has been started. ◆ Membership fee was collected. ◆ The participants are already selling vegetables.	
Problems	Solutions
◆ There are participants who were absent at work or come late.	◆ It was agreed to come to the garden twice a week.
◆ Sub committee has not been trained on leadership.	◆ Ask for training of sub-committee members.
◆ On soil sampling, they did not warn there are some vegetables like beetroot is not good for soil.	◆ Need of more chemicals or implement soil sampling survey again.

◆ Constitution was written in English and not all members that can read and understand English.	◆ Translate the constitution in Siswati.
◆ The water pipes are not facilitated for sprinkler.	◆ Arrange the pipes according to slopes.

3) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Planting of fruit trees on boundaries of garden	By Aug. 2003	Sub-committe
◆ Build shelter and storage.	-	Sub-committee
◆ Seek market	-	PPMU, community NGOs
◆ Seek trader	-	PPMU, Development committee

2) <u>Community garden (Mbeka)</u>

3) Major activities done

Major Activities	Implemented schedule
1. Plan was designed.	Feb. 2002
2. Sub-committee for garden was formed.	May. 2002
3. Constitution was made.	May-June. 2002
4. Membership fee (E20.00) has been started to be collected and put in the bank.	May. 2002
5. Fencing	Dec. 2002- Feb2003
6. Removal of stumps.	Apr. 2003
7. Water pipes has been installed.	June. 2003

2) Participation

Community:	By putting efforts and labour force.
Development Committee:	By encouragement to the community and participating to the work and solving problems.
Traditional leaders:	Provided land and allocation of the land, also solving problems which development committee could not afford.
Govt. Staff	Government gave training.
NGOs	By sharing knowledge, skills and labour force, also by providing materials and tools.
JICA	By providing materials for the structures and funding the project activity.

3) Evaluation

The activity was started with an expectation to improve life by obtaining vegetables. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ The garden has been constructed although it has not yet been plantes. ◆ Sub-committee was formed. ◆ Constitution was almost made by the members. ◆ Joining fee (E20.00) has been collected. The bank account was opened. It was helpful and useful, as they had already bought receipt book.	
Problems	Solutions
◆ Since there was a dispute among the community about the site, it was failed to start in the previous selected and allocated site and was suspended for 6 months.	◆ Traditional leaders and development committee talked to the community and it was solved.
◆ Sub-committee not well trained.	◆ NGOs, government and other association

	may help on the training.
◆ Constitution was not fully completed and sill needs to be completed, and not yet distributed to every member.	◆ The draft of the constitution was given to NGO to ask for advice.
◆ Maintenance fee has been collected half as some members contributed only half the agreed amount.	◆ The committee has powers not to accept those who had not paid.
◆ The stumps have not all removed and members were not all participating to the work.	◆ Members should come to work with their tools.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Start ploughing and planting.	As soon as possible	Community, sub-committee members, JICA
◆ Waterways sills are to be done.	By July, 2003	NGOs
◆ Planting of trees around the garden.	By Aug. 2003	Community
◆ Build Shelter and storage	2004	Sub-committee
◆ Seek market for vegetables	2004	Government
◆ Get tractor for ploughing	2004	Government and other donor

3) <u>Improved Cooking Stoves</u>

1) Major activities done

Major Activities	Implemented schedule
1. JICA team came	2001
2. Training was done.	July - Aug. 2002
3. Stove construction	Aug. 2002
4. Some members were trained how to construct the stove.	Feb. 2002
5. Sib committee was formed.	May. 2002
6. Stone making and construction was done on different areas.	
7. Monitoring about stoves construction was done	Mar. 2003
8. Stove construction on different areas was done	Apr. 2003
9. Sub-committee together with those who had interesting improved stoves constructing stoves.	- up to now.

2) Participation

Community:	By stove construction and collecting of stones.
Development Committee:	Encouragement to community to build stoves.
JICA	By training and educating on how to construct stoves.

3) Evaluation

The activity was started with an expectation that; 1) the reduction of firewood, 2) Poor people now can have stove, and 3) sub-committee members are trained to be able to diffuse in different areas. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities
◆ 18 stoves were constructed.
◆ Reductions of cutting indigenous trees, which are lives, not dry.
◆ Reduction of fire hazards and danger.
◆ Using it, could save lots of time, since can cook various dishes at the same time and no need to fetch lots of firewood for long distances.
◆ Saved money can be used for other purpose.

◆ Even those who cannot afford to buy modern stove, can have a stove.	
Problems	Solutions
◆ It is difficult to reach to the different and distant areas.	◆ Ask assistance to RDA.
◆ The committee of Ngwempisi side was not attending meetings.	◆ Development committee should look after the process of the work to encourage them.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Construct more stoves in other areas where they there is needs.	2003 and 2004	Sub-committee
◆ Ask assistance from Eni and Ngcayini to teach more improved stoves.	June 2003	Sub-committee

4) <u>Grazing and feedlot</u>

1) Major activities done

Major Activities	Implemented schedule
1. The series of meetings have been conducted.	Occasionally
2. Main committee for the scheme was formed.	May. 2002
2. Sub-committee was chosen.	Aug. 2002
3. Constitution was made and the cattle for each homesteads was counted.	Aug. 2002
4. Sub committee was trained.	Mar. 2003
5. Feedlot was constructed	Nov. 2002 – May. 2003
6. Grasses were planted in the feedlot	Feb. 2003
7. Grazing area was fenced.	Dec 2002- Apr. 2003

2) Participation

Community:	Contributed to draft constitution, counted the cattle. Put lots of efforts for construction work.
Development Committee:	By encouraging the members to continue with the work. Work for the activities with providing their labour force.
Elders	Elders allocated the sites for the activities. Solved a problems together with development committee.
Govt. staff	Preparations of educational workshops, provide transportation of tours to other areas to see the development in other TA. Arranged workshops and members were enlightened.
NGOs	By working together with the community during construction.
JICA	Funded and supported the projects.

3) Evaluation

There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ Sub-committees were formed and were trained, and gained knowledge about the work through OJT. ◆ The community and traditional leaders being aware of the work. ◆ List of members has been made. ◆ 4 paddocks were made in the grazing area. ◆ The bank account was opened for keeping maintenance fee at Swazi Bank. ◆ The records have been kept.	
Problems	Solutions
◆ Have not completed the work in time.	◆ Traditional leaders may help to solve the problem.
◆ Many community members are not	◆ Not only traditional leaders, but

cooperative.	development committee also find solution on community problems. ◆ meetings with the community should be conducted.
◆ There should be a place for loading and transposing the cattle.	◆ Need to discuss.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Build a shelter in the feedlot.	-	Development committee with government
◆ Build storage for chemicals and foods	-	Government
◆ Improve access road to the grazing site.	-	Government and community
◆ Transpose cattle to be sold.	-	Community
◆ Expand activity to dairy cow management	-	Community
◆ Expand grazing camps to other areas	-	Community

5) <u>Water Spring Protection</u>

1) Major activities done

Major Activities	Implemented schedule
1. Agree the site with community people.	Jan-Feb. 2001
2. Allocation of land	Jan. 2003
3. Committee was selected and started working.	Feb. 2003
4. Construction work	Feb. – Apr. 2003
5. Maintenance fee has been collected.	Feb. – Mar. 2003
6. Started using the facility	Feb. 2003

2) Participation

Community:	80% of the members participated in the activity with their efforts and being supportive and also contributed to the maintenance fee.
Traditional leaders:	By welcoming and allowing the work to be done, and allocated the land.
Development committee:	Encouragement to the community for the series of work, also by choosing the sub-committee.
Govt. staff	By explaining to the community about the work. Also encourage people to take care of the water source. Provided transport for training course, etc.
NGO(SFDF)	Assisting to make work plan.. Provided labour force.
JICA	Funded all materials.

3) Evaluation

There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;.

Advantages obtained by the activities	
◆ Sub-committee was formed. ◆ The facility was constructed. ◆ Maintenance fee was collected. ◆ The spring is protected.	
Problems	Solutions
◆ Collected maintenance fee has not been in the bank.	◆ Open a bank account.
◆ Sub-committee members have not been trained.	◆ Expected to be trained by NGOs
◆ No constitution /rules were made.	◆ Get together and make it for making sure how to protect the spring.

◆ The maintenance fee is not enough.	◆ Still need to be collected and keep them in bank.
◆ Not sure how to maintain them when it gets old.	◆ Need to be trained.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Put wire for drying clothes.	-	Sub committee and traditional leaders.
◆ Need two more showers	-	Development committee and sub-committee

6) <u>Soil Conservation</u>

1) Major activities done

Major Activities	Implemented schedule
1. JICA team came to see dongas.	2001
2. Umpakatsi held a meeting for identifying the site for donga rehabilitation.	2001
3. Sub-committee was formed.	July, 2002
4. Making regulations	July, 2002
5. Planning of work	Aug, 2002
6. Site selection	Aug, 2002
7. Training	Sept, 2002
8. Sowing grass on the terraces	Jul- Oct, 2002
9. Monitoring and maintenance	Oct 2002- June, 2003

2) Participation

Community:	Around 50% of the community participated in the work.
Traditional leaders:	10% of the traditional leaders cooperated in allocating land and encourage people to work.
Development committee	50% of the committee participated in the work.
Sub-committee	Only 2% of the sub committee members participated in the work.
Government	Government helped by transport to the Lesotho tour, training tour, and other monitoring tours. RDA helped by educating how to do the work.
NGO	Educating and sharing their experiences on soil erosion, prevention and conservation.
JICA	JICA play a big role by funding all the pilot projects.

3) Evaluation

The activity was started with an expectation that; 1) reduction of degraded loss of soil, and 2)train gully with planting trees inside the gully and on the terrace. There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ Sub-committee was formed and monitoring well. ◆ The rules and regulations were made. ◆ Members are aware where a new gully would appear around their houses. ◆ Grass was planted on the terrace. ◆ Can feel the reduction on the loss of soil. ◆ Committee was trained how to remove small shrubs growing on terraces. ◆ Community members also received training.	
Problems	Solutions
◆ Sub-committee and members do not have enough knowledge.	◆ Sub-committee has to be trained more. ◆ There are some members trained already.

◆ Sub-committee was formed but being active only 20%, since were so busy for grazing projects.	◆ Since the work on grazing scheme has finished, the problem might be solved. ◆ All absents have to pay E15.0 each day.
◆ No trees were planted yet.	◆ Collect money from the community to buy seeds.
◆ No money for buying seedlings.	◆
◆ Some members of the sub-committee left the committee for	◆ Welcome other members to join the committee.
◆ Participants have not following the rules, but no money for distributing the constitution.	◆ Provide the regulations to all community members, but every members must pay E1.50 for the photo copying.
◆ Fencing has not been done to prevent small animals, which disturbs trees growing.	◆ Ask assistance to JICA
◆ Need bulldozers for more work, but it's too expensive.	◆ Ask assistance to the government or JICA

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Planting of trees on the terraces.	2003	Sub-committee
◆ Want to sow Kikuyu grass.	-	Sub-committee
◆ Community must collect money to buy seeds or seedlings.	-	Sub-committee
◆ Continue rehabilitation of dongas in other areas.	-	Sub-committee
◆ Get money from somewhere or many be JICA should provide the community fence to prevent sheep and goats invasion.	-	JICA…..*It won't be provided……*

7. Development Committee

1) Major activities done

Major Activities	Implemented schedule
1. Establishment of development committee.	Jul-Aug, 2002
2. Establishment of constitution	Jan – May, 2002
3. Conducting meetings.	Sep- Nov. 2002
4. Meeting with traditional authority.	Sep – Dec, 2002
5. Monitoring sub-committees	Dec2002- Apr, 2003
6. Tour to Lesotho	Aug-Sep, 2002
7. Inter location tour	June-July, 2002 June, 2003
8. Community encouragement	Jul 2002 - now
9. Training on leadership	Jan-Feb, 2002 Mar, 2003
10. Monthly meetings with respect to elders.	Every month

2) Participation

Community:	Selected development committee members. Provided labour force to construction works. Around 60% of the community has supported the development committee on the works.
Development committee:	Arrangement of work plans. Arrangement of shelters to keep tools and materials for the structure. Monitored activities.
Traditional leaders:	Allocating and giving land for the structures. Allowing development in the area. Encouraged members to be involved to the work.
Government	Bringing JICA team to meet with community. Educating on keeping cattle. Encouragement of collaboration among community. Arrangements and preparation of training. Let the community be aware of and take care of structures.

NGO	Provided tools and sharing their knowledge with community. Trained the community on technical skills. Provided labour force and made effort to the activities.
JICA	Reviewed all the work. Funded the project. Brought NGOs to assist the process of the activities. Monitored the work.

3) Evaluation

There are some advantages obtained by the activity, and at the same time they encountered some problems as shown below. The solutions against the problems were discussed as follows;

Advantages obtained by the activities	
◆ All committee members who are remaining in the committee have been monitoring the work. ◆ The development committee had been able to lead and to encourage community to participate in the activities, although could have only the half of the community participants. ◆ The development committee is interested in to continue the work, though some of the members are already old, since we had gained and benefited skills and technical know ledges. ◆ Traditional leaders were supportive to development committee on the works.	
Problems	Solutions
◆ Some members of the committee had left, as there was no incentive like money.	◆ Select other members.
◆ Some members became absent during the work activities.	◆ Put penalties to the people who did not obey the rules.
◆ People in some areas were not interested on the work.	◆ Traditional leaders will talk with those members.
◆ Some community members were not interested on development of community.	◆
◆ Most of members of the development committee are at old age and it is difficult to continue the work need to walk long distance.	◆ To select youth instead of olders.

4) Future plan

Activities to be done	Schedule	Responsible person/ organisation
◆ Plough and plant in the garden for Mbeka.	During rainy season	Sub-committee, development committee and NGOs.
◆ Review of development plan	2003	Traditional leaders and development committee
◆ Start feeding cattle in the feedlot	2003	Traditional leaders, sub-committee, and extension officers.
◆ To plant grass in the fodder plot.	Rainy season	Community, traditional leaders and NGOs.
◆ Promote dairy cow management	-	-
◆ Extend other grazing areas, feedlot and fodder plot, since the community is too large to be covered by only one.	-	-

8. Other Discussions

◆ Needs to install water supply system and electricity in the community.

◆ It is true that now people have skills and knowledge on donga rehabilitation, so those who have knowledge may help others who don't know.

◆ Donga site is fenced by bared wire. It was requested for JICA to provide barbed wire. JICA commented that JICA provided bared wire for the purpose of soil conservation. If people want to plant fruit trees, they need to manage to buy the fence on their own expense.

- It was mentioned that there is a problem on the rout to send cattle to the grazing area since there is a plantation site. There was already an agreement between Umphakatsi and the grazing committee, however if it is still a problem, it should be discussed and solved in Umphakatsi.
- It was requestied to build another spring protection site for school. It was responded that it is not sure.
- One speaker wanted to know about materials left by the NGOs. It was said that the materials belong to NGOs who are responsible according to the contract between JICA and the NGO.

F.18 Results of the Study Tour to Lesotho

a. Schedule of the Study Tour

The study tour was conducted during September 17 to September 21, 2001 with the cooperation of Range Management Division, Private Bag A82, Maseru 100, Lesotho.

The program of the tour is as follows.

Date	Program
17th Sep.	Going to Lesotho
18th Sep.	Welcome by range management division of Lesotho and introduction of participants from Swaziland Discussion with Grazing Association (GA) committee members in Leribe district Observation of rangeland and cattle
19th Sep.	Welcome by Berea committee members and farmers Inspection of soil conservation project in Berea district i.e. – Stone lines – Tree planting – Diversions – Dam construction – Grass seeding (only explanation)
20th Sep.	Meeting for sharing experience and attempt for soil conservation and range management in each chiefdom among participants from Swaziland Return to Swaziland

b. Places Visited

1) Controlled range management site where range management is being practiced by participatory manners. (in Leribe district)

2) Soil conservation site where participatory soil conservation projects are being carried out targeting at whole river basin of a river. (in Berea district)

c. Participants of the Tour

In total, 41 persons participated in the study tour. The breakdown of the participant is as follows.

1) 29 members (including eleven women) of the pilot project-implementing committees in 3 target areas.

2) 3 members of responsible administration officers at Inkhundla level in 3 target areas

3) 3 extension officers in charge of the pilot projects

4) 5 counterparts from the Ministry of Agriculture and Co-operatives

5) 1 member of JICA study team, who is in charge of natural environment and environmental assessment

d. Status of the Study Tour

Each participant of the tour listened to explanations by officers and committee members of Lesotho with earnestness, made notes of it and actively questioned about problems or benefits by the projects. Obviously, they were highly impressed by the land rehabilitation method and interested in how the people of Lesotho have wrestled with these problems.

Furthermore, participants from Swaziland had a meeting on the last day and share present conditions and past attempts to improve the degraded land in each chiefdom, despite it was not planned in the original schedule. They actively discussed the matters and had a frank exchange of views. It was so useful. One participant said at the meeting, "Before I came to Lesotho, I had no idea how to deal with soil erosion. But, I will seriously think the matter and how to rehabilitate the land after coming back to Swaziland."

e. Analysis on the Results of the Study Tour

Analysis on the results of the study tour is given below based on the opinion survey sheets, which were filled in by 29 members out of 32 members (farmers and Inkhundla Indvunas), who participated in the study tour from 3 target areas.

Questions	Yes	No	Don't know	Normal	Average	Maintain as it is
Q.1.Do you think lands in your Chiefdom are degraded?	28	0	1 (no answer)	-	-	-
Q.2. Do you think it is necessary to take any measures to prevent degradation?	29	0	0	-	-	-
Q.3. Are you participating in any activities to prevent further degradation?	19	10	0	-	-	-
Q.4. Do you think cattle number is too much in your rangeland?	17	3	4	-	5	-
Q.5 Do you think number of cattle needs to be controlled in rangeland?	22	2	3			2
Q.6 What are the three most important lessons you have learned through this tour?	See below					
Q.7 How are you going to utilize your experience in Lesotho when you go back?	See below					
Q.8 How do you think about the length of the tour?	Short	Appropriate	Long	No Answer		
	19	7	0	3		
Q.9 Comments on the tour if any.	See below					

Analysis of Q.6

Q: What are the three most important lessons you have learned through this tour?

Predominant answers to the question from participants are in below.

- The way of rangeland management (by fencing, control of the number of cattle)
- The way of preventing donga development by planting trees and using stones

Besides, followings are seen in some answers.

- Importance of community solidarity and cooperation
- Importance of discipline law in community
- Grazing for commercial purpose only
- Involvement of community in the fight against soil erosion
- Importance of government technical assistance
- The way of collecting and managing money
- The way of feeding or taking care of cattle
- Purchase of special bull for improving cattle
- Importance of motivation

Analysis of Q.7

Q: How are you going to utilize your experience in Lesotho when you go back?

Almost of participants answered they would tell the people in their community about their experience or what they learned in Lesotho. Some people specified what they will convey in their chiefdoms, namely importance of participation, importance of community unity and cooperation, importance of law, the way of manage of grazing land and so on. Besides, some persons replied that they would put their experience into practice. Followings are seen in the answers.

– I will try to encourage people to organize an association in my community.
– I will plan how to start project with people in my area.
– I will pay money for fund of the soil conservation work to ask other's cooperation.
–

Analysis of Q.9

Q: Comments on the tour if any

Major comments can be summarized as follows. Many positive opinions are seen in the replies.

– The tour was so successful and helpful.
– We could learn many things through the tour.

On the other hand, many people answered that the tour period was too short to see or visit some implementing places for rehabilitation of land, their comments are shown below.

– I wanted to visit zero-grazing place.
– I wanted to visit people who plant grasses.
– I wanted to see daily cattle.
– I wanted to visit a nursery or a farm.

Furthermore, following remarks are seen in other answers.

– Lesotho is suitable place for the tour, because they have the same problem in Swaziland.
– The tour was eye-opener on what other communities are doing for protect environment.
– Lesotho people are so active in the projects.
– Lesotho people warmly welcomed us.
– The tour gave me a challenge to implement of the project successfully in our area as well as in Lesotho.

From the above survey results, it may be said that the study tour has ended successfully even the period was a little short for them. It is thought that the tour was very fruitful for people to start and manage the pilot project in each chiefdom.

The opinions given in the opinion survey sheets will be utilized in course of implementation of the pilot projects.

Annex G

G Community Development

G.1 List of Community-based Projects

G.1.1 Kukhanyeni Inkhundla: TA-1

Table G-1: List of Community-based Projects (Kukhanyeni Inkhundla: TA-1)

Inkhundla	Chiefdom	Chief's name	Project Title
Kukhaneni	Eni	Mandanda	Poultry Mahlavuse Association Aselulekane Association
	Moyeni	Mshede Dlamini	Moyeni Market Youth's Garde
	Ebutfongweni	Mntfane Nkosi	Water Project
	Maliyaduma	*Mandanda Mtsetfwa*	Phutsanani Burial & Supermarket Bonisanani Mayeni Garden Vusasive Association Maliyaduma Fence Making Macelane Garden Macelane Preschool
	Ngwazini Mbeka	Matatazela Lusendvo	Mahlavuse Association Untfombo Wabomake Association -
	Nswaceni	Nkosini	Farmers Shed
	Mkhulamini	Malunge	Mgobhogi Piggery Lugedzeni Poultry Group Siyakhula Fisheries Asigamulelane Sibonelo Mlonyeniligushede Titamele Wwomen's Group Vukani Kusile Zamokulhe Garden Masibonisane Burial Society Zamokulhe Farm Shed Sukumani Bomake Bonisanani Thembaletfu Chresh Mkhulamini Clinic
	Sankolweni	Msukusuku	Piggery Poultry Project
	Engcayini	Mandanda	Ngome Farmers Association Inhlanyelo Ngwane Mill Ludvondvolo
	Kantunja	Ndlovuyagwane	Vattle Feeding Forest Project
	Nkiliji Royal Kraal	Mkhumbi	Nkiliji Multipurpose Shed Nkiliji Garden Nkiliji Youth Club Nkiliji Water Project
	Nyakeni	Malunge	Nyakeni Water Project Nyakeni Market Malunge Sewing Nyakeni Poultry Piggery Group Mlothane Dewing Group
	Bhekinkosi	Mshede Dlamini	Shibani Association Piggery Group Poultry Farming Garden
	Nsenga	*Mandanda Mtsetfwa*	Nsenga Sewing Group Nsenga Shed Phaphama Association Thembaletu Association

Source: (1) Community Development Department, DPM; (2) Household Baseline Survey, JICA

G.1.2 Shiselweni I Inkhundla: TA-2

Table G-2: List of Community-based Projects (Shiselweni I Inkhundla: TA-2)

Inkhundla	Chiefdom	Chief's name	Project Title
Shiselweni	Ekwayiweni (Manyandzeni)	Ngome	Masubmasibambisane Garden Kusile Manyandza Khanyisani Manyandza Garden Manyandzeni Evangerical Church Khula Mntungwa Market Associaiton Shiselweni I Apostolic Church
	Mahagane	Velaphi Hlophe	Mcinso Garden Phakamani Sewing
	Mabonebulawe	Salebona Tshangase	Tetameleni Bomake Sewing St. Jones Church Isambulo Church Nsonjwana Cattle Pasture Sivule Electricity Group Mavundluthi Siyathuthuka Cattle Pasture Nomngwinyi/Hlengela Cattle Pasture Qhubekani Poultry Association Mvunyane Cattle Pasture Masiphula High School Mabona Church Vukazakhe Cattle Pasture Masiphula Primary
	Mkhwakhweni	Mlomokazulu	Dumenkungweni Community Market Welcome Primary School St. Julianas Primary School Jerusalem Church Mhlangas Cooperative Garden
	Zikhotheni	Mlokothwa	St. Anselm Primary School Vunulani Bomake Market Mbandzeni Women's Garden Siyakhula Garden Association Libandla Lajesu Church Zamani Madoda Garden Bubele Benkosi Garden Mabhudlweni Poultry Association Emseni Church

Source: (1) Community Development Department, DPM; (2) Household Baseline Survey, JICA

G.1.3 Ngwempisi Inkhundla: TA-3

Table G-3: List of Community-based Projects (Ngwempisi Inkhundla: TA-3)

Inkhundla	Chiefdom	Chief's name	Project Title
Ngwempisi	Bhadzeni II Royal Kraal	Mduze Dlamini	Farm Shed Carpentry Stores
	Dladleni	*Lusendvo Fakudze*	-
	Lushikishini	Mhlaba Motsa	Farm Shed Piggery Poultry Gardening Sewing Maize Farming
	Macudvulwini	Sithondo Dlamini	Poultry Piggery Forestry Carpentry Sewing
	Mahhashini	Mleshe Dlamini	Water Project
	Bhadzeni I	*Lusendvo Fakudze*	Bambanani Poultry Vuke Utentele Nkanyezeni Burial Society
	Mgazini	F. Hobohobo	Gardening Farm Shed Association Sewing Community Police
	Khabonina	Mhlaba	Farmers Association Sewing Poultry Youth Club
	Ngcoseni	Mlobokazane Fakudze	Garden Associations Mancubeni Irrigation Embilingwane Poultry Buhlabuhalangene Cattle Asibemunye Women Poultry Khutsatelani Women Garden Tamani Women garden
	Velezizweni	Ndwandwa II	Sukumani Poultry Timisele Multipurpose Nhlanhleni Poultry Tfuftukani Piggery Intamakuphila Gardening Vulamehlo Mtimane Farmers Association Mgulube Gardening Nsalitje Sewing Phaphamani Sewing Phakamani

Source: (1) Community Development Department, DPM; (2) Household Baseline Survey, JICA

G.2 PDMs for Pilot Projects

G.2.1 PDM for Soil Conservation Pilot Project

Location: Eni, Ngcayini, and Macdvulwini Chiefdoms
Duration: 2001 – 2003

Narrative Summary	Verification Indicators	Means of Verification	Important Assumptions
Overall Goal Improvement of degraded land	- Vegetation recovery - Gully stabilization	- Monitoring report	• No change of policy on land degradation • The communities continue the project.
Project Purpose Stabilization of sheet erosion and gully training	- Vegetation recovery at contour terrace area - Accumulation of sedimentation in the gully	- Monitoring report	• No severe climate conditions
Outputs 1. Conservation works completed and maintained 2. Awareness raising and sensitization on soil conservation 3. Vegetation recovery at contour terrace areas 4. Gully stabilization	1. Frequency of workshops 2. Change of awareness of the community people on soil conservation 3. Increased vegetation coverage 4. Accumulation of sedimentation	1. Monitoring records 2. Record of evaluation workshops 3. Monitoring records	• The community continues the project. under support from the government agencies
Activities 1. Chiefdom workshop 2. Sub-committee formation 3. Selection of the site 4. Explanation of the project by PPMU and NGO 5. Construction works 6. Monitoring and mid-term evaluation workshop 7. Soil conservation training 8. Monitoring and terminal evaluation workshop	Input [Japanese side] 1. Manpower: Soil conservation expert and Social infrastructure expert 2. Materials: Fencing wire and posts; treated poles; gates; cement and stone chips; piping and plumbing; fertilizer) 3. Machinery and tools: Fencing tools; transport; maps; air photos	[Swaziland side] 1. Government manpower: Extension officer; extension workers; transport for monitoring tours 2.Community: Labour; locally available rock and sand; meeting place; cash savings for maintenance	Pre-conditions • MOAC and communities agree to implement the project

G.2.2 PDM for Grazing/Range Management Pilot Project

Location: Eni, Ngcayini, and Macdvulwini Chiefdoms
Duration: 2001 – 2003

Narrative Summary	Verification Indicators	Means of Verification	Important Assumptions
Overall Goal Soil erosion is reduced and land	- Ground cover	Range condition	

conditions return to normal	increased by 100% - Range condition all increased to fair or good condition - Water available in rangelands	assessments	• No adverse socio-political, economic and financial and environmental conditions, neither during nor after implementation
Project Purpose Rangelands under controlled management and livestock sold in good condition	- Range management activities implemented by February 2003 - Fodder produced and used for livestock fattening by March 2003 - Livestock sold well fleshed for high prices by September 200 - Fully functioning management and control by September 2003	- Range management records - Feedlot records - Livestock condition assessments and sales prices - Records of management committee	• The seasons following implementation not adverse in any way
Outputs 1. Plans prepared for controlled management of rangelands 2. Fenced grazing scheme erected and under controlled grazing 3. Feedlots erected and cattle being fattened 4. Fodder plots established and productive 5. Monitoring procedure developed for implementation	1. Plans developed by March 2002 and finalized by September 2002 2. Fencing erected by September 2002 3. Feedlots erected by September 2002 4. Fodder plots planted by January 2003 5. Range condition assessment plans developed by March 2003	1. Range management plans 2. Fence inspection 3. Feedlot inspection 4. Fodder plot inspection 5. Monitoring guidelines	• Community training sessions well attended • Lessons learnt in training effectively implemented
Activities 1. Chiefdom workshop on the project implementation and management 2. Sub-committee formation 3. Selection of the site 4. Explanation of the project by PPMU and NGO to the community 5. Construction works 6. Monitoring and mid-term evaluation workshop 7. Range management training 8. Monitoring and terminal evaluation workshop	Input [Japanese side] 1. Manpower: Soil conservation expert and Social infrastructure expert 2. Materials: Fencing wire and posts; treated poles; gates; cement and stone chips; piping and plumbing; fertilizer) 3. Machinery and tools: Fencing tools; transport; maps; air photos	[Swaziland side] 1. Government manpower: Extension officer; extension workers; transport for monitoring tours 2.Community: Labour; locally available rock and sand; meeting place; cash savings for maintenance	• Sites selected • Sufficient funds and material available • Communities abide by agreement for cost and work sharing • Government support provided Pre-conditions • Communities and their leaders interested in participating the project • Government committed to active support of activities

G.2.3 PDM for Agro/Community Forestry Pilot Project

Location: Eni, Ngcayini, and Macdvulwini Chiefdoms
Duration: 2001 – 2003

Narrative Summary	Verification Indicators	Means of Verification	Important Assumptions
Overall Goal Degraded land improved	- Ground cover increased by 100% - Range condition all increased to fair or good condition - Water available in rangelands	Range condition assessments	No adverse socio-political, economic and financial and environmental conditions, neither during nor after implementation
Project Purpose Improvement of degraded land through provision of seedlings, afforestation and agro-forestry activities	- Seedlings for afforestation and agro-forestry activities provided - Technical trainings on nursery management conducted - Technical training for agro-forestry conducted	- Monitoring report	・ No severe climate conditions
Outputs 1. Community forestry sub-committee formulated 2. Nursery established and maintained 3. Seedlings provided to the community people 4. Afforestation conducted	1. Sub-committee meetings 2. Nursery maintenance conditions 3. Number of seedlings distributed 4. Number of trees planted	1. Sub-committee records 2. Sub-committee records 3. Monitoring records 4. Monitoring records	・ The community continues the project. under support from the government agencies
Activities 1. Chiefdom workshop on the project implementation and management 2. Sub-committee formation 3. Selection of the site 4. Construction works 5. Monitoring and mid-term evaluation workshop 6. Nursery management and afforestation training 7. Monitoring and terminal evaluation workshop	**Input** [Japanese side] 1. Manpower: Agro/community forestry expert 2. Materials: Fencing wire and posts; treated poles; gates; cement and stone chips) 3. Machinery and tools: Fencing tools; transport; maps; air photos	[Swaziland side] 1. Government manpower: Forestry officer; forestry extension officers; extension workers; transport for monitoring tours 2.Community: Labour; locally available rock and sand; meeting place; cash savings for maintenance	**Pre-conditions** ・ MOAC and communities agree to implement the project

G.2.4 PDM for Community Garden Pilot Project

Location: Eni, Ngcayini, and Macdvulwini Chiefdoms
Duration: 2001 – 2003

Narrative Summary	Verification Indicators	Means of Verification	Important Assumptions
Overall Goal Improvement of degraded land	Soil in the gardens is well protected from erosion	Monitoring report S	・No policy change of the government on land management
Project Purpose Improvement of living conditions including nutrient improvement, increased agricultural income, etc.	- Improved nutrient conditions - Increased agricultural income	- Interview survey	・ No severe climate conditions
Outputs 1. Community gardens constructed and maintained 2. Sub-committee formed with proper functioning of the project facilities 3. Vegetable production continued	1. Utilization of community gardens 2. Amount of membership fee 3. Production of vegetables	1. Monitoring records 2. Record of sub-committee 3. Monitoring records	・The community continues the project. under support from the government agencies
Activities 4. Chiefdom workshop on the project implementation and management 5. Sub-committee formation 6. Selection of the site 7. Explanation of the project by PPMU and NGO to the community 8. Construction works 9. Monitoring and mid-term evaluation workshop 10. Range management training 11. Monitoring and terminal evaluation workshop	**Input** [Japanese side] 1. Manpower: Irrigation/agriculture expert and Social infrastructure expert 2. Materials: Fencing wire and posts; treated poles; gates; cement and stone chips; piping and plumbing; fertilizer) 3. Machinery and tools: Fencing tools; transport; maps; air photos	[Swaziland side] 1. Government manpower: Extension officer; extension workers; transport for monitoring tours 2.Community: Labour; locally available rock and sand; meeting place; cash savings for maintenance	**Pre-conditions** ・ MOAC and communities agree to implement the project

G.2.5 PDM for Improved Cooking Stove Pilot Project

Location: Eni, Ngcayini, Zikhoteni and Macdvulwini Chiefdoms
Duration: 2001 – 2003

Narrative Summary	Verification Indicators	Means of Verification	Important Assumptions
Overall Goal Increased forest cover	Increased forest cover	Observation and interview survey	・ No policy change of the government on land management
Project Purpose Reduction of consumption of firewood	- - Firewood consumption reduced by 30 to 50 %	- Interview survey	・ No adverse climate conditions
Outputs 1. Participants learn how to make the improved cooking stove 2. Improved cooking stove groups formed at each community 3. Experienced people disseminate the know-how to other people 4. Participants evaluate their activities	1. Number of improved cooking stoves constructed 2. Number of groups 3. Dissemination activities 4. Monitoring and evaluation results	1. Monitoring records 2. Monitoring records 3. Monitoring records 4. Record of evaluation workshops	・ The community continues the project.
Activities 1. Seminar on effectiveness of cooking stove 2. Demonstration 3. Sub-committee formation 4. Extension of stoves by the sub-committees 5. Monitoring and mid-term evaluation workshop 6. Monitoring and terminal evaluation workshop	**Input** [Japanese side] 1. Manpower: Soil conservation expert and Social infrastructure expert 2. Materials for workshops such as paper, pen, board, etc. 3. Transportation	[Swaziland side] 1. Government manpower: Facilitators from MOAC; transport for monitoring tours 2.Community: Labour; locally available stones, clayey soil, water; and meeting place	The participants continue the project. **Pre-conditions** ・ MOAC and communities agree to implement the project

G.2.6 PDM for Water Source Protection Pilot Project

Location: Eni, Ngcayini, Zikhoteni and Macdvulwini Chiefdoms
Duration: 2001 – 2003

Narrative Summary	Verification Indicators	Means of Verification	Important Assumptions
Overall Goal Soil erosion is reduced and land conditions return to normal	- Ground cover increased by 100% - Range condition all increased to fair or good condition - Water available in rangelands	Range condition assessments	• No adverse socio-political, economic and financial and environmental conditions, neither during nor after implementation
Project Purpose Secure protected clean water sources established in rangelands near homesteads	- Functioning management and control of protected water sources by September 2003	- Monitoring report	• No severe climate conditions
Outputs 1. Selected watering points and sources protected 2. Monitoring procedures developed for implementation	1. Selected watering points and sources protected by March 2003 2. Water quality assessment plans developed by July 2003	1. Monitoring records 2. Monitoring records	• Community training sessions well attended • Lessons learnt in training effectively implemented
Activities 1. Chiefdom workshop on the project implementation and management 2. Sub-committee formation 3. Selection of the site 4. Explanation of the project by PPMU and NGO to the community 5. Construction works 6. Monitoring and mid-term evaluation workshop 7. Monitoring and terminal evaluation workshop	Input [Japanese side] 1. Manpower: Soil conservation expert and Social infrastructure expert 2. Materials: Fencing wire and posts; treated poles; gates; cement and stone chips; piping and plumbing) 3. Machinery and tools: Fencing tools; transport; maps	[Swaziland side] 1. Government manpower: Extension officer; extension workers; transport for monitoring tours 2.Community: Labour; locally available rock and sand; meeting place; cash savings for maintenance	Participants continue the project Pre-conditions • MOAC and communities agree to implement the project

G.2.7 PDM for Pilot Project Management Unit Project

Location: Mbabane and all the pilot project areas
Duration: 2001 – 2003

Narrative Summary	Verification Indicators	Means of Verification	Important Assumptions
Overall Goal Smooth implementation of the Master Plan (MP)	At least 75% of the projects proposed in the MP will be implemented by 2020.	Monitoring and evaluation reports	MOAC decides to implement other projects
Project Purpose Smooth implementation of pilot projects (PPs) through capacity building activities	At least 75% of PPs are operated by August 2003.	Monitoring and evaluation reports	MOAC decides to implement the Master Plan
Outputs 1. Improvement of project management skills of PPMU staff 2. Improvement of project management skills of community people	・Monitoring surveys and evaluation works are conducted efficiently. ・GIS operation is conducted by PPMU staff ・At least 4 times of seminars or workshops will be held in PP areas.	・Monitoring and evaluation reports ・GIS training record ・Monitoring and evaluation reports	PPMU staff continue to work in MOAC
Activities 1. Monitoring and evaluation 2. Community Development 3. Technical support 4. GIS operation	Input [Japanese side] 1. Manpower: Organization development expert & GIS expert 2. Equipment (2 units of computers with GIS software)	[Swaziland side] 1. Government manpower: PPMU management staff and project coordinators 2. Transport for monitoring tours 3. A digitizer for GIS operation 4. Office space	Pre-conditions MOAC and communities agree to implement the project

G.3 Evaluation Summary Sheet of Pilot Projects

G.3.1 Soil Conservation

Objective: To prevent and stabilize sheet erosion and train gullies to stabilize

Input and Activities	Beneficiary Of The Project	Main Project Effects	Lessons Learnt
1. Inputs provided include: -GOS staff, NGO and the Study Team as technical support staff -Material for soil conservation works including empty bags, cement, earth work implements, bulldozers & operators 2. Activities included: - Discussion and decision making - Organization and management (as VDC sub-committee) - Planning with NGO - Consultation with elders and site selection - Training - Conservation work with NGO (participatory way) - Monitoring	1. Grazing herd-men, cattle owners, pilot area communities benefited directly including Ngcayini (79 house holds in TA-1), Zikhoteni (721 house holds in TA-2) and Macdvulwini (400 households in TA-3) by joining in a participatory approach, obtaining work advantage, experience and skill. 2. Community cadres in 3 committees by joining participatory debates with NGO for planning and decision making on implementing sites, joining inter-location tours, training, holding self-evaluation workshops and acquiring hand-on experience. 3. Farmers/communities as a whole in 3 target areas indirectly benefited from the project experience. 4. Staff of GOS also could increase their knowledge and experiences on soil conservation works and mobilization of beneficiary through participatory works and workshops. 5. An NGO increased performance skill and experience by joining.	1. 3 sites of contour terracing works and 3 sites of gully training works planned with community leaders and worked in 3 TAs. 2. Completed implementation works on schedules and on designs. 3. On-site training has been made in TA-1 and TA-3 for inhabitants by the hand of local NGO and GOS counterparts. 4. Beneficiary people participated in conservation works and learned how to do works and maintenance. 5. Through repeated workshops, all stakeholders learned causes of land degradation and relevant countermeasures, thus building awareness and feeling necessity of taking measures to control erosion. 6. Experienced people can now teach their neighbors how to implement conservation works with official assistance to procure material required to implement works.	1. M/P should mobilize RDA staff to formulate work plans/ designs, to assist chiefdoms concerned for implementation of conservation works and to provide inputs. 2. Awareness building and sensitization are essential to effectively involve stakeholders into soil conservation activities. Back-ground education for school children and enlightenment of adult are required. 3. Conservation works should be coupled with more attractive and fast ripening activities like IGAs, otherwise stakeholders will soon reluctantly be bored with works. 4. Majority of the stakeholders still cling to overgrazing, the direct cause of degradation and never agree to take measures that may alter current traditional livestock holding system. Any criticism on overstocking is a taboo in front of those who keep cattle.

G.3.2 Grazing/Range Management

Objective: To have rangelands under controlled management and livestock sold in good condition

Input And Activities	Beneficiaries Of The Project	Main Project Effects	Lessons Learnt
1. Inputs provided included: • technical support staff from study team, government and NGO • materials for grazing scheme fence erection, fodder plot establishment and fattening unit infrastructure construction. 2. Activities included: • Discussion and determination of agreements (especially decision making) • organisation and management • planning • endorsement by elders and site selection/allocation • training • construction • raising/keeping finances • record keeping.	1. Farmers and community members in three pilot area communities benefited directly, namely Eni (49 homes), Ngcayini (79 homes) (TA1) and Macudvulwini (400 homes) (TA3) by actively joining in participatory approach and getting hands-on experience. 2. Five committees' community leaders and members by actively joining participatory discussions, planning, decision making, organising community members' activities, joining inter-site visits, training, self-evaluation and report back workshops and developing hands-on experience. 3. Farmers/communities as a whole in the three target areas benefited indirectly by having the project in their area which they have visited and to which they can refer. 4. Staff in Ministry benefited by learning and joining in participatory approach method with community members, and getting hands-on experience of interventions tried. 5. Two NGOs by participating in a different approach to community involvement in activities	1. Three grazing schemes planned with communities and constructed (TA1 & TA3), along with two fattening units (TA1 & TA3) and one fodder plot (TA1). 2. Start to implementing controlled grazing management made in three schemes (TA1 & TA3) and feeding improved fodder to four cattle being fattened in one scheme (TA1). 3. General training session provided by government to all three grazing scheme committees; specific training session on fodder production and beef fattening provided to both feedlot committees by a local NGO; various informal training sessions on planning, constitution making, organisation provided by study team to two central, three grazing scheme and two feedlot committees. 4. All farmers (about 160) who participated in construction activities now have some hands-on experience.	1. Timeliness of implementation is crucial and follows timely training, organization and planning. 2. Early specific training on all aspects of planning, monitoring, participation and management of units is vital along with all aspects of leadership training if farmers are to be able to carry out the management of units on their own. Written technical extension material in Seswati needs to be prepared and distributed. 3. Continuous systematically planned sustainable extension and training programs are critical to ensuring farmer participation and on-going involvement, especially in times of problems, doubt and stress. 4. Promotion of commercialisation of financially viable activities is important. 5. To this end, three suitably knowledgeable and experienced officers, appropriately based at RDA's, should be specifically charged with responsibility and accountability for implementation of these initiatives.

G.3.3 Agro/Community Forestry

Objective**:** To contribute to rehabilitation of degraded lands and to have sustainable supply of forestry material.

Input and Activities	Beneficiaries of the Project	Main Project Effects	Lessons Learnt
1. Input provided included: - Material for nursery construction, and building, Nursery tools and equipment, Fertilizer and chemicals, Polythene pots, barbed wire for fencing afforestation, area, seeds for improved fallow and rehabilitation purposes. - water supply weirs at the spring and the main river, storage, tank and pipes - Technical support from study team and NGO. - Material for Training of community members .2. Activities included: - Training on nursery management - Organization and management - Establishment of integrated tree nursery - Woodlot Afforestation - Seed procurement - Seed procurement - Germination of seedlings - Constitution formulation - Production of the necessary guidelines on nursery, afforestation, and improved fallow.	1. Farmers and community members of the TA2. That is all five chiefdoms of 2468 homesteads. 2. Community from other Target Areas during the inter-location tours. 3. The ten committee members who received intensive training at Malkerns Research Station 4. The Forestry Section Staff who have interacted with the project, learning some new aspects eg community nursery ownership and dry land afforestation 5. The Swazi Conserve NGO which facilitated in nursery work and afforestation gained new insight in the environmental programme 6. Private sector which was involved in water supply and nursery design 7. Several traders who provided material for nursery and fencing. .	1. One integrated tree nursery site which is fenced off, with water supply, buildings and seedbeds constructed with community participation. 2. Three ha of woodlot established with facilitation of NGO and community participation in physical work of planting and soil doing conservation activities. 3. Seedlings for Improved fallow germinated and transplanted in polythene tubes ready for distribution to farmers. 4. Community sensitized on nursery, afforestation and improved fallow techniques. 5. Ten nursery committee members trained formally at Malkerns Research Station 6. Sensitized school on nursery activities.	1. The community members to be kept interested in the project by timely motivation, e.g. inter-location study tours. 2. Training to be given to the relevant Forestry section officers as part of capacity building. 3. Three Foresters in respective proximate RDA to be given extra duties on pilot project 4. Forestry Section to provide on skilled technician to each community nurseries. 5. Malkerns Research Station (Forestry Seed Centre) to provide necessary back up in research, dissemination of research information and training on technical nursery matters, afforestation and agro-forestry of improved fallow. 6. Material supply for nursery, afforestation fencing, and initial seedlings to community for improved fallow.

G.3.4 Community Garden

Objective: To support soil conservation and create an income source for stakeholders

Input and Activities	Beneficiary Of The Project	Main Project Effects	Lessons Learnt
1. Inputs provided include: - GOS staff, NGO and the Study Team as technical support staff - Material for water conveyance works and field reclamation including pipes, cement, earth work implements, bulldozers & operators 2. Activities included: - Discussion and decision making - Organization and management (as VDC sub-committee) - Planning with NGO - Consultation with elders and site selection - Training on production - Construction works with NGO (participatory way) - Agree on constitution - Garden management - Monitoring	1. Farmers, pilot area communities benefited directly including Zikhotheni (17 households in TA-2), Mulatane (24 households in TA-3) and Mbeka (68 households in TA-3) by joining in a participatory approach, on planning, organizing, implementation and training. 2. Cadres in 3 committees (VDCs) by joining participatory debates with NGO for planning and decision making on implementing sites, joining inter-location tours, training, holding self-evaluation workshops and acquiring hand-on experience. 3. Staff of GOS could increase their knowledge/experiences on works and mobilization of beneficiary through works and workshops. 4. An NGO increased performance skill and experience by joining	1. 3 sites of water conveyance works and 3 sites of land reclamation works planned with community leaders and works has been completed in 2 TAs. 2. Completed implementation works on schedules and on designs. 3. On-site training has been made in TA-2 and TA-3 for members by local NGO and GOS counterparts. 4. Beneficiary people participated in vegetable growing on equitably allotted plots and harvested high quality produce that has been sold to middlemen who visit regularly the gardens. 5. Women members could gain recurrent income from gardens that enables them to sustain their families without relying on their husbands' unstable incomes.	1. M/P should involve RDA staff to formulate work plans/ designs, to assist chiefdoms concerned for training/implementation of garden project and to provide inputs. 2. In opening new community garden it is imperative to find available water sources and sites of garden nearer to water sources and to chiefdom living quarters, by effort of committee members and RDA staff. 3. Community garden project should be coupled with water and soil conservation works in order to maintain required water supply to gardens, otherwise water supply may be affected in desertification. 4. Since regular input supply is pre- requisite for the maintenance of vegetable production, stable route for input procurement should be secured for sustainable activity. 5. Vegetable species should be diversified as much as possible to avoid inner outlet competition.

G.3.5 Improved Cooking Stove

Objective: Reduction of consumption of firewood

Input and Activities	Beneficiaries of the Project	Main Project Effects	Lessons Learnt
1. Activities: - Seminar on effectiveness of cooking stove (1day / TA) - Demonstration (1 kitchen・1 day, / TA) - Formation of cooking stove committee - Extension of stoves by the each committee	- Around 25 to 40 women participated in the seminar. - Demonstration was held at 3 household (1 HH/TA) - The committees were formed (TA1: 4 members, TA2: 4 members, TA3: 12 members (3 /sub-committees x 4	- 15, 17, 28 stoves were constructed in TA1, 2 and 3, respectively (Totally 60). - Save fuel wood (40-50 % reduced) - Creation of time due to reduction of cooking time (60% cut: cooking time of lunch used to	- Promotion of improved cooking stove would be placed as one of the tool to promote participation of the community people (especially women) in the Master Plan. - Focus on potential deforestation areas

- Planned the strategy of diffusion and set the target numbers (20, 303, and more than 100 in TA1, TA2 and TA3 respectively). - Maintenance by each owner - Diffusion of stoves is going slow because of 1) too busy for other pilot project components and 2) distance between homesteads. 2. Input: - Technique to construct the stove (expert) from the Study Team - Materials by the participants - Labour force by the participants - Transportation for the stove committee members by beneficiaries (if any)	sub-committees). Those members got skills of construction of stoves. - Since 15, 17, 28 stoves were constructed in TA1, 2 and 3, respectively, totally 60 households were benefited.	be 2.2h and now 0.9h in average). The utilisation of saved time could contribute to increase women's possibility to participate in other activities in the society or in other income generating activities. - Improvement of living environment (37% of users raised as the motivation to install the stove, and 50% of the users states that they are content to modernise their kitchen).	regarding the effectiveness of reduction of fuel wood. - Coordination with the home economic section of MOAC for more strategic dissemination, under coordination with RDA extension staff, with utilising the skilled community women.

G.3.6 Spring Water Source Protection

Objective: To have secure protected clean water sources established in rangelands near homesteads

Input and Activities	Beneficiaries of The Project	Main Project Effects	Lessons Learnt
1. Inputs provided included: • Technical support staff from study team and NGO • Materials for fence, water reticulation and infrastructure construction 2. Activities included: • Discussion and determination of agreements (especially decision making) • Organisation and management • Planning • Endorsement by elders and site selection/allocation • Training • Construction • Raising/keeping finances • Record keeping	1. Farmers and community members in three pilot area communities benefited directly, viz. Eni (TA1), Ngcayini (TA1), Zikhoteni (TA2) and Macudvulwini (TA3). 2. Community leaders and committee members by joining participatory discussions, planning, organising community members activities, inter-site visits, training, self-evaluation and report back workshops and developing hands-on experience 3. Community members in the three target areas benefited indirectly by having project in their area which they have visited and to which they can refer. 4. Staff in Ministry benefited by joining in participatory approach with community	1. Active participation of six communities in protecting water collection sites near their homesteads. 2. Six water sources protected against cattle trampling and erosion. 3. Collected water is now pure, clear, palatable and uncontaminated. 4. Communities at all six sites have already started to use water points and facilities for washing clothes and personal bathing. 5. Families (about 100) who participated in construction activities now have hands-on experience.	1. Timeliness of implementation is crucial and follows timely training and planning. 2. Specific training on all aspects of maintenance important. 3. Hygiene around washing and water collection facilities important – healthy toilets should be built and rubbish disposed of in the vicinity of water collection and washing points.

	members and getting hands-on experience of interventions tried.		

G.3.7 Pilot Project Management Unit

Objective: Smooth implementation of the Pilot Projects through the capacity building activities

Input and Activities	Beneficiaries of the Project	Main Project Effects	Lessons Learnt
1. At initial stage, 3 officers from Land Use Planning Section (LUPS) were appointed as the PPMU management staff. In addition, 2 RDA extension officers and a rural development officer were appointed as the project coordinators. 2. Performance of PPMU management staff was considerably satisfactory. 3. Two of PPMU management staff obtained the skills of GIS operation for project management. 4. Of the 3 project coordinators, performance of the project coordinator of Ludzeludze RDA was fairly satisfactory, but that of other RDAs (Ngwempisi and Hluti) was not so much satisfactory. 5. Training programme in the fields of soil conservation, range management, horticulture, forestry and feedlot were carried out during March and June 2003.	1. PPMU headquarters (Land Use Planning Section of MOAC): 3 officers 2. MOAC extension officers (soil conservation, range management, forestry, horticulture, irrigation, socio-economy): 7 officers 3. MOAC regional offices at Manzini, Mankayane and Shiselweni: 4 officers 4. Ludzeludze RDA: 5 staffs 5. Ngwempisi RDA: 3 staffs 6. Hluti RDA: 2 staffs 7. Participants in the training programme: about 200 people	1. PPMU management staff could accumulate the experiences on the project management through the implementation of the pilot projects. 2. PPMU local staff at RDA level could accumulate the experiences on the project management through the implementation of the pilot projects. 3. Community leaders and community people who participated in the projects could obtain practical knowledge on the project management through the implementation of the pilot projects and the training programmes organized by PPMU.	1. Establishment of the Project Management Unit (PMU) is considered to be indispensable for the implementation of the Master Plan. Organization structure of the PMU will basically be the same as the PPMU. 2. In the Master Plan stage, the project manager should be appointed as a permanent staff for the project. 3. It is recommended that the extension officer at Luve RDA should be appointed as the Project Coordinator for TA1 (Kukhanyeni) to cover the eastern part of the area, in addition to the current Project Coordinator. 4. The extension officers at Shiselweni agriculture office should give more frequent technical support for the project coordinator at Hluti RDA (TA2). 5. The extension officers at Manzini agriculture office should give more frequent technical support for the project coordinator at Ngwempisi RDA (TA3).

G.4 Benefit Cost Analysis

The results of the benefit cost analysis of main projects are presented in the following tables.

Table A: Benefit Cost Analysis of Community Garden Project

Project Year	Calendar Year	Net Benefit	Investment Cost	O&M Cost	Total Cost	Net Cash Flow	Discount Factor	Present Value
1	2004	26,000	102,005	8,692	110,697	-84,697	0.909	-76,998
2	2005	34,840	0	26,077	26,077	8,763	0.826	7,242
3	2006	52,000	0	34,769	34,769	17,231	0.751	12,946
4	2007	52,000	0	34,769	34,769	17,231	0.683	11,769
5	2008	52,000	0	34,769	34,769	17,231	0.621	10,699
6	2009	52,000	0	34,769	34,769	17,231	0.564	9,726
7	2010	52,000	0	34,769	34,769	17,231	0.513	8,842
8	2011	52,000	0	34,769	34,769	17,231	0.467	8,038
9	2012	52,000	0	34,769	34,769	17,231	0.424	7,308
10	2013	52,000	0	34,769	34,769	17,231	0.386	6,643
11	2014	52,000	0	34,769	34,769	17,231	0.350	6,039
12	2015	52,000	0	34,769	34,769	17,231	0.319	5,490
13	2016	52,000	0	34,769	34,769	17,231	0.290	4,991
14	2017	52,000	0	34,769	34,769	17,231	0.263	4,537
15	2018	52,000	0	34,769	34,769	17,231	0.239	4,125
16	2019	52,000	0	34,769	34,769	17,231	0.218	3,750
17	2020	52,000	0	34,769	34,769	17,231	0.198	3,409
18	2021	52,000	0	34,769	34,769	17,231	0.180	3,099
19	2022	52,000	0	34,769	34,769	17,231	0.164	2,817
20	2023	52,000	0	34,769	34,769	17,231	0.149	2,561
		840,840	102,005	556,304	658,309	0.179		47,037

IRR	17.9 %
NPV	47,037
B/C	1.13

1) Investment cost

Item	Amount (E)
Garden fence	13,032
Water intake	43,890
Piping	35,992
Tools	9,091
Total	102,005

2) Annual operation and maintenance cost (O&M)

Item	spec/size	specification	Quantity	Unit Cost	Amount (E)
Production labour	240days	**240x48persons**	11,520	2	23,040
Seed/implements			192	25	4,800
Fertilizers/chemicals	4ha	0.6ton/ha	2.4	480	1,152
Miscellaneous	7.5% of the total cost				5,777
Total					34,769

3) Annual benefits

Benefit Items	Quantity	Unit Cost	Amount(E)
a. Salable vegetables (4ton/ha x 4)	16	3,000	48,000
b. Litter for cattle feed	8	500	4,000
Total			52,000

Table B Benefit Cost Analysis of Integrated Nursery Project

Unit: Emalangeni

Project Year	Calendar Year	Net Benefit Total	Incremental Costs			Net Cash Flow	Discount Factor at 10%	Present Value at 10%
			Investment Cost	O & M Cost	Total Cost			
1	2004	12,900	112,000	10,650	122,650	-109,750	0.909	-99,773
2	2005	38,700	0	31,950	31,950	6,750	0.826	5,579
3	2006	51,600	0	42,600	42,600	9,000	0.751	6,762
4	2007	51,600	0	42,600	42,600	9,000	0.683	6,147
5	2008	51,600	0	42,600	42,600	9,000	0.621	5,588
6	2009	51,600	0	42,600	42,600	9,000	0.564	5,080
7	2010	51,600	0	42,600	42,600	9,000	0.513	4,618
8	2011	51,600	0	42,600	42,600	9,000	0.467	4,199
9	2012	51,600	0	42,600	42,600	9,000	0.424	3,817
10	2013	51,600	0	42,600	42,600	9,000	0.386	3,470
11	2014	51,600	0	42,600	42,600	9,000	0.350	3,154
12	2015	51,600	0	42,600	42,600	9,000	0.319	2,868
13	2016	51,600	0	42,600	42,600	9,000	0.290	2,607
14	2017	51,600	0	42,600	42,600	9,000	0.263	2,370
15	2018	51,600	0	42,600	42,600	9,000	0.239	2,155
16	2019	51,600	0	42,600	42,600	9,000	0.218	1,959
17	2020	51,600	0	42,600	42,600	9,000	0.198	1,781
18	2021	51,600	0	42,600	42,600	9,000	0.180	1,619
19	2022	51,600	0	42,600	42,600	9,000	0.164	1,472
20	2023	51,600	0	42,600	42,600	9,000	0.149	1,338
		825,600	112,000	681,600	793,600	0.047		-33,192

IRR	4.7 %

1) Investment cost

Item	Amount (E)
Land preparation	55,000
Water intake	5,000
Piping	14,000
Water tank	30,000
Fencing	8,000
Total	112,000

2) Annual operation and maintenance cost (O&M)

Item	spec/size	specification	Quantity	Unit Cost	Amount (E)
Nursery labour	120 days	8 persons	240	35	8,400
Poly-pots	bottomless	polyethylene	200,000	0.15	30,000
Fertilizers/chemicals	50kg bag	compound	14.0	300	4,200
Total					42,600

3) Annual benefits

Benefit Items		Quantity	Unit Cost	Amount (E)
a. Pot saplings	180,000 x 80%	144,000	0.3	43,200
b. Earth seedlings	20,000 x 70%	14,000	0.6	8,400
Total				51,600

IRR = 4.7 %
B/C = 0.92

Table C ; Benefit Cost Analysis of Soil Conservation Project

Unit: Emalangeni

Project Year	Calendar Year	Net Benefit Total	Incremental Costs			Net Cash Flow	Discount Factor at 10%	Present Value at 10%
			Gully Training	Contour Terracing	Total Cost			
1	2004	0	6,968	10,003	16,971	-16,971	0.909	-15,428
2	2005	2,600	0	0	0	2,600	0.826	2,149
3	2006	3,467	6,968	0	6,968	-3,501	0.751	-2,630
4	2007	5,200	0	0	0	5,200	0.683	3,552
5	2008	5,200	6,968	0	6,968	-1,768	0.621	-1,098
6	2009	5,200	0	0	0	5,200	0.564	2,935
7	2010	5,200	6,968	0	6,968	-1,768	0.513	-907
8	2011	5,200	0	0	0	5,200	0.467	2,426
9	2012	5,200	6,968	0	6,968	-1,768	0.424	-750
10	2013	5,200	0	0	0	5,200	0.386	2,005
11	2014	5,200	0	10,003	10,003	-4,803	0.350	-1,683
12	2015	5,200	0	0	0	5,200	0.319	1,657
13	2016	5,200	0	0	0	5,200	0.290	1,506
14	2017	5,200	0	0	0	5,200	0.263	1,369
15	2018	5,200	0	0	0	5,200	0.239	1,245
16	2019	5,200	0	0	0	5,200	0.218	1,132
17	2020	5,200	0	0	0	5,200	0.198	1,029
18	2021	5,200	0	0	0	5,200	0.180	935
19	2022	5,200	0	0	0	5,200	0.164	850
20	2023	5,200	0	0	0	5,200	0.149	773
		78,867	34,840	20,006	54,846	0.107		1,066

IRR	10.7 %
NPV	1,066
B/C	1.03

1) Investment cost for gully training

Item	Spec/size	Specification	Quantity	Unit Cost	Amount (E)
Empty bag	3mx10m	used cloth	240	18	4,320
Cement	0.6ton	portland	24	55	1,320
Shovel	scew tip	w = 40cm	0	80	2
Stine-pick	6 kg		0	120	2
Labour	2psn x 4d	masonry	8	35	280
Wheel barrow	100kg		0	280	14
Insurance		24hrs	8	15	120
Miscellaneous	15% of the total cost		15%		909
Total					6,968

2) Investment cost for contour terracing

Item	Spec/size	Specification	Quantity	Unit Cost	Amount (E)
Hoes	ordinary		0.03	30	1
Rake	nos		0.01	25	0
Shovel	scew tip		0.03	80	2
Stone-pick	10 kg		0.02	120	2
Labor (man-day)	6psn x 1d	rainyseason	125	35	4,375
Wheel barrow	100kg	wage	0.01	280	3
Leveling kit			5	863	4,315
Misceraneous	8%		15%		1,305
Total					10,003
Works with farm implements					
work efficiency	1 laborer	cutting 80 m2 / day		cost to cut terraces on	
1ha amount to :	100 m	16m interval	6laborers/ha		

3) Annual benefits

Benefit Items	Spec/size	Quantity	Unit Cost	Amount(E)	Amount(E)
a. Grazing grass conservation	18	1	5	50	4,500
b. Prevention of dam sediment	20	1	110 x 10	1.2	26,400
c. Prevention of gully formation	20	0.05	1	1,200	1,200
d. Creating IGA opprtunities	18	0.1	120	15	3,240
e. Improving water conservation	20	1	800 x 0.4	1	6,400
Total					41,740

Table D： Benefit Cost Analysis of Feedlot Fattening Project

Project Year	Net Benefits	Investment Costs	O & M costs	Total Costs	Net Cash Flow	Discount Factor at 10%	Present Value at 10%
1	14,850	45,940	28,320	74,260	-59,410	0.909	-54,009
2	29,700	0	30,444	30,444	-744	0.826	-615
3	45,000	0	30,444	30,444	14,556	0.751	10,936
4	45,000	0	30,444	30,444	14,556	0.683	9,942
5	45,000	0	30,444	30,444	14,556	0.621	9,038
6	45,000	0	30,444	30,444	14,556	0.564	8,216
7	45,000	0	30,444	30,444	14,556	0.513	7,470
8	45,000	0	30,444	30,444	14,556	0.467	6,790
9	45,000	0	30,444	30,444	14,556	0.424	6,173
10	45,000	0	30,444	30,444	14,556	0.386	5,612
11	45,000	0	30,444	30,444	14,556	0.350	5,102
12	45,000	0	30,444	30,444	14,556	0.319	4,638
13	45,000	0	30,444	30,444	14,556	0.290	4,216
14	45,000	0	30,444	30,444	14,556	0.263	3,833
15	45,000	0	30,444	30,444	14,556	0.239	3,485
16	45,000	0	30,444	30,444	14,556	0.218	3,168
17	45,000	0	30,444	30,444	14,556	0.198	2,880
18	45,000	0	30,444	30,444	14,556	0.180	2,618
19	45,000	0	30,444	30,444	14,556	0.164	2,380
20	45,000	0	30,444	30,444	14,556	0.149	2,164
	854,550	45,940	606,756	652,696	201,854		44,037

IRR	19.5%
NPV	44,037
B/C	1.15

1) Investment cost

Item	Spec/size	Specification	Quantity	Unit Cost	Amount (E)
Barbed wire	200m x 4	netwire	1,600	4.5	7,200
Fencing pole	L1.8m,i=7m	creosoted	320	20	6,400
Pipe gate	h =1.5m	w = 4m	1	1,400	1,400
Water intake	L=6m, d =1m	block	1	3,000	3,000
Water reservoir	d=1.5m, h=1m	masonry	1	12,000	12,000
W. conveyance	L=500m, 2in.	etan.pipe	500	5	2,500
Land preparation	bulldozer	24hrs	24	350	8,400
Manual labour	reclamation	4ha / 36psn	144	35	5,040
Total	0	0	2,591	16,815	45,940

2) Annual operation and maintenance cost (O&M)

Item	spec/size	specification	Quantity	Unit Cost	Amount (E)
Production labour	180days		1,080	20	21,600
Seed/implements	seed 24pcts		192	25	4,800
Fertilizers/chemicals	4ha	0.8ton/ha	3.2	600	1,920
Miscellaneous	7.5% of the total cost		5,570		2,124
Total					30,444

3) Annual benefits

Benefit Items	Quantity	Unit Cost	Amount(E)
Salable carcass	30	1,500	45,000
Total			45,000

Annex H

H Organization and Institutional Development

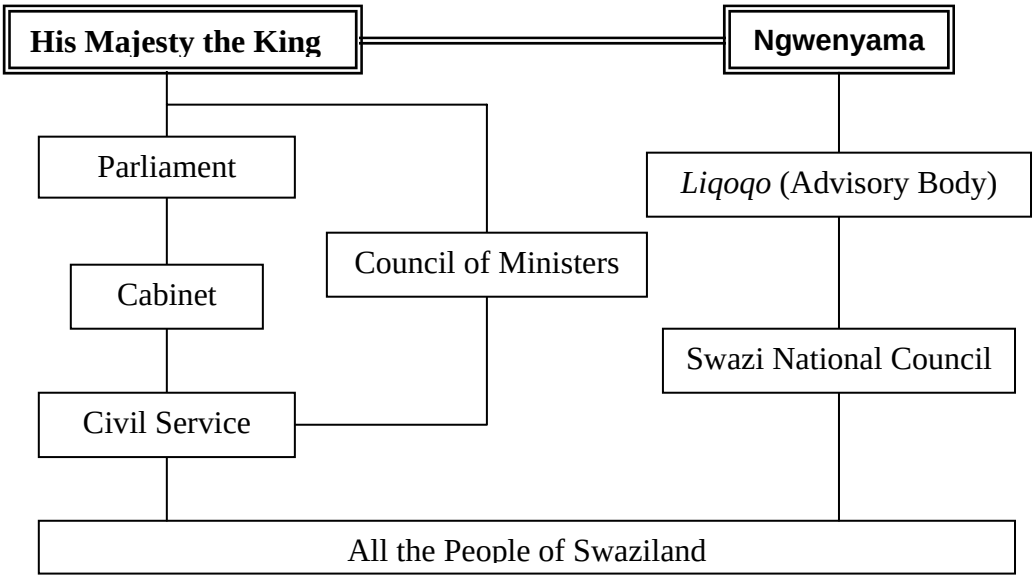
H.1 Diarchical System in Swaziland

(Refer to Chapter 2, Section 2.1)

H.1.1 The Diarchical System

In Swaziland executive authority is vested in the king (Ngwenyama) and is exercised through a dual system of government. All legislation and executive powers are vested in King in Council. Appointments and removal of Ministers is the prerogative of the King and he rules as the King in Council. Thus the immediate lines of accountability and responsibility are from the Ministers in Council to His Majesty. The Ngwenyama also exercises his powers as Head of State via the Swazi National Council. It consists of every adult and its purpose is to advise the Ngwenyama on all matters relating to the traditional institutions and culture of the Swazi Nation as regulated by Swazi Law and Custom. In addition to the Council itself there is also an Inner Council or Liqoqo which manages the day to day affairs of the Swazi National Council. The main scope of this traditional authority with its law making functions concerns legislation regarding land, minerals, and Swazi Law and Custom.

The Monarch therefore receives advice from two parallel and separate bodies, Cabinet under the parliament system and the Swazi National Council under the traditional authority.



Source: Copied papers collected by JICA Preparatory Survey Team

H.2 Review of Current Policies and Strategies

(Refer to Chapter 2, Section 2.2)

H.2.1 National Development Strategy (NDS)

a. National Basic Strategy

The NDS document has been compiled on the basis of the report of the stakeholders group and it will provide a long-term framework (25 years) within which short and medium-term development plans will be formulated.

Flowing from the NDS are social and economic transformation processes which His Majesty's Government has embarked upon - namely, the Economic and Social Reform Agenda (ESRA), the Public Sector Management Programme (PSMP) and the Internal Structural Adjustment Programme (ISAP).

The current three-year rolling development plan and ESRA I and ESRA II, which are management tools, were prepared by Government on the basis of the draft National Development Strategy.

b. The Vision

Following extensive consultations as well as detailed analytical reviews of Swaziland's social and economic performances since independence, challenges and opportunities were identified. Consequently the stakeholder representative groups settled on the following vision:

"By the Year 2022, the Kingdom of Swaziland will be in the top 10% of the medium human development group of countries founded on sustainable economic development, social justice and political stability".

What this vision states is that twenty-five years from the year 1997, Swaziland will have considerably improved its world standing in terms of measurable indices of human development. In its quest for the improved standing, it will rely on sustainable economic development; social justice; and political stability.

Underlying the vision is the focus on the quality of life in the country. The critical dimensions of the quality of life are poverty eradication, employment creation, gender equity, social integration and environmental protection. These dimensions are, in turn, crucially linked to education, health and other aspects of human resource development. These indices can be used to monitor movement towards the vision on a regular basis. Because other countries are also trying to improve their conditions, this vision is actually a moving target. What Swaziland is essentially saying is that it wants to move up the ladder for enhancing human capacities.

The vision will be attainable if vibrant economy and human and social developments are taken care of. It is within the capacity of the Swazi nation to ensure that conditions necessary for achieving the vision are indeed satisfied.

c. Strategies in Land Use and Agriculture

c.1 Land Use and Tenure

- Develop a land allocation policy that will ensure that both men and women have equal access and ownership opportunities especially on SNL
- Review and up-date the Land Speculation Control Act of 1972 to promote development projects minimize the requirement for land transactions and encourage investment and credit availability.
- Formulate an effective mechanism for settling land disputes on Swazi Nation Land.
- Explore possibilities of improving the present land tenure system.

c.2 Food Security

- Promote production of crops and livestock for domestic and international markets by both small and large scale farmers.
- Encourage diversification of agricultural production whilst intensifying production of

high valued crops and stock.

- Promote food management, processing and storage techniques at both national and household level and facilitate optimal distribution of food within households, communities and regions.
- Monitor progress of government food security programmes, evaluate their impacts, and revise programmes according to agricultural production.
- Devote part of the revenue accruing from agricultural commodity taxes to the promotion of growth within the industry where the taxed product originates.
- Participate in the development of a food security risk mapping, identify vulnerable areas and promote appropriate packages for the different areas.

c.3 Agricultural Land Use

- Re-orient agricultural production such that activities are in accordance with the agro-ecological zones. Arable land must be used for growing crops and grazing land be confined to livestock.
- Strengthen the afforestation and reforestation programmes with particular emphasis on addressing fuel deficit areas and degraded landscapes.

c.4 Rational Land Use

- Address with greatest urgency the necessary institutional arrangements in order to eliminate the negative aspects directly affecting land use; taking into consideration that the land is held in trust for the nation and that there are many agencies involved with land issues (including the chiefs).
- Bring about land use changes for highly eroded land and land with arable potential currently under grazing or forest.
- Produce guidelines in the form of a manual to address settlements and resettlements, urbanization, industrial development, environmental protection and conservation.
- Intensify the efforts to modify the land tenure system such that it is consistent with increased production and employment.
- Ensure that resettlements are effected in an efficient manner that will give way to development projects whose overall and ultimate objectives will bring about improvements in the well-being of Swazis.
- Develop programmes that are based on a clear historical and socio-economic understanding of land and its uses.
- Promote the production of crops suited to the different agro-ecological zones.
- Guide the irreversible shift from rural to urban land use by appropriate land policies.
- Prioritize land use giving considerations to economic, environmental, demographic and social concerns.
- Provide solutions for a more rational use of the land in the rural sector.
- Develop a clear land use policy for both crop and livestock production.
- Revise and consolidate conservation legislation.

c.5 Community Participation and Empowerment

- Include community participation as a primary component in natural resource management.
- Explore possibilities of smallholder game farming, agro-tourism, eco-tourism and cultural-tourism.
- Promulgate legislation to encourage investment on SNL.

c.6 Forestry

- Develop new commercial forestry plantations only in those highveld areas with sufficient rainfall and low potential for other agricultural use, taking care not to disturb ecological and population balance.

c.7 Livestock

- Streamline livestock marketing activities so as to relieve the pressure on land.
- Determine livestock activities to be carried out in the different ecological zones on the basis of climatic conditions.
- Discontinue grazing in the Highveld and Upper Middleveld where there is a bigger potential for crop production. Shift the grazing to areas with low crop production potential.
- Develop livestock production in those parts of the Lower Middleveld and Lowveld which are not suitable for crop production.
- Promote proper livestock management and facilitate the commercialization of the livestock sector; especially on SNL.
- Encourage adequate livestock and pasture research.
- Promote group livestock community groups so as to internalize the social costs of using land.

c.8 Co-operatives

- Train co-operatives in organizational and leadership skills.
- Promote the formation of groups, especially among those who otherwise would have difficulty gaining access to productive resources (e.g., women, youth and the physically disabled).
- Support co-operative movement formations of associations, interest groups and foster understanding within the participants - of these formations.

c.9 Community Participation

- Encourage and promote the concept of community participation in the use and management of the natural resource base.
- Formulate policies that facilitate community participation.
- Include and encourage community participation in every development endeavour.
- Provide effective support to communities to effectively participate in the

development and management of the natural resource base.

c.10 Empowerment

- Design effective methods to support members of the special groups to gain access to income generating opportunities.
- Develop entrepreneurship and enhance access to special credit programmes and equity financing to facilitate small business start up in rural areas.
- Increase the budget allocation for rural development.
- Ensure that all programmes executed in the areas of agriculture, livestock, cooperatives and rural development are designed so that they achieve: a balanced division of roles and responsibilities among men, women, youth; equitable access to and control of resources; and equitable access to the benefits of development.
- Promote awareness on the sustainable use of natural resources.
- Integrate gender issues into mainstream research and policy initiatives in the field of rural development.
- Attract direct investment in rural areas and ensure that there is no urban bias in the provision of infrastructure.
- Improve and decentralize administrative powers and authority between local government and central government.

H.2.2 National Environment Policy (NEP).

The National Environment Policy, which is being piloted, builds on the analysis and recommendations contained in the SEAP and represent the next step in promoting sound environmental management across all areas of decision making. The policy focuses on the general principles and approaches, which should be adopted by any part of government, traditional structure, and organization and individual in undertaking any activity, which may affect the environment. The policy will play a key role in integrating a range of policies into a comprehensive national policy framework designed to achieve equity-led growth and sustainable development in Swaziland. The policy also embraces the regional and global environmental responsibilities that Swaziland has undertaken as a party to various multilateral environment agreements.

Land related objectives of the policy are:

- To reduce soil erosion and reverse the desertification process.
- To reduce environmental damage caused by mining and to ensure that disused sites are adequately rehabilitated.
- To ensure that environmental considerations are fully integrated into the process of authorizing mining, mine plans and operation, closure and rehabilitation of mines.

Strategies to be used are:.

- The responsibility for controlling land degradation on private and communal grazing and arable areas will be placed in the hands of the private land users and the community.
- Where appropriate, funds will be made available to communities from the environment fund to assist them to undertake their responsibilities.

- Land use planning in non-urban areas will be based on agro-ecological zoning approach, which takes into account differences in habitat and vegetation.
- The government will take steps to involve all stake-holders, particularly local communities in decisions on land use and environment management.

H.2.3 Economic and Social Reform Agenda (ESRA).

The Government of Swaziland has felt that unless substantial remedial action is taken now, Swaziland will face serious economic and social difficulties even before the start of the next millennium. Those difficulties would subsequently continue to worsen. The remedial measures, decided on by government, are set out in the Social and Economic Reform Agenda (ESRA). ESRA does not try to cover the full spectrum of government activities, though it does of necessity, embrace a considerable number of them. ESRA is a set of time-bound targets which government has to meet over the coming three year period. It has been concluded that if the targets are substantially met, Swaziland will start again to achieve good economic growth and improved social services. The preparation and implementation of the NAP and NEF are part of the ESRA programme being closely supervised and monitored by the Prime Minister's office.

H.2.4 Poverty Alleviation Programme.

Government has identified poverty alleviation as one of its main priorities. While this has been addressed indirectly and in somewhat a fragmented fashion in the past, it has become necessary to formulate direct strategies which are to be prioritized in a coherent framework. Government has enlisted the support of the World Bank to assist in the strengthening of existing and development of new implementation structures at the local and central government levels. Government has allocated a sum of US$ 2.5 million over the past three years for community development activities. A further US$ 3.3 million has been allocated to cater for the implementation of employment creation activities in the rural areas of the four regions of the country.

H.2.5 Livestock Development Policy

This policy is mainly for promoting the commercialization of livestock farming by local communities. It addresses ways and means through which government will support and encourage farmers to improve their stock qualities for better financial gains. It also promotes livestock production together with conservation of range resources. This policy was adopted by government in 1997 and is currently being implemented.

H.3 Order No. 2 of 1953

(Refer to Chapter 2, Section 2.2)

ORDER BY NGWENYAMA IN LIBANDLA (King in Council)

ORDER NO. 2 OF 1953

The Ngwenyama by virtue of Swazi Law and Custom and in terms of Section 9 (I) (q) of Proclamation No. 79 of 1950 has been pleased to publish this Order making provision for the construction and protection of anti-soil erosion works.

1. No person living on Native area or on property purchased for the Swazi Nation shall plough up and down the slope of a hill, but they shall always plough across such slope.
2. It is desirable that grass filter strips should be left in ploughed land at such intervals as may be from time to time agreed upon by the Swaziland Administration and the Ngwenyama in Council. Where such strips have been marked by order of a Lincusa (representative) of the Ngwenyama it shall be an offence if a person destroys, reduces the size, or otherwise damages such grass filter strips.
3. Contour furrows and water disposal dams may be constructed at such places as may be decided by the Lincusa of the Ngwenyama. it shall be an offence if any person damages any such contour furrow or water disposal dam purposely or by avoidable negligence.
4. Where considered necessary by the Lincusa of the Ngwenyama fencing may be erected for the protection of water disposal dams, dongas or eroded areas and it shall be offence for any person to interfere with or damage such fence.
5. Any person who commits an offence against this Order may be charged before a Native Court and if found guilty may be sentenced to pay a fine which must not exceed £10 and if he has not got to the money to pay such fine may be imprisoned for a period not exceeding three months. Where any person has been convicted of willful damage to fencing, he may, if the Court thinks it, be required to bear the cost of repair to such fencing.
6. Where any contour furrow or water disposal dam is constructed in terms of this Order, the responsible chief shall take such steps as may be considered necessary to secure that the contour furrow or disposal dam is kept in good repair.

BY ORDER OF THE PARAMOUNT CHIEF

1st APRIL 1953 MBILAZISENGWA SHONGWE
NDVUNA

1st APRIL 1953 POLYCARP DLAMINI
SECRETARY OF THE NATION

Source: CRDB

H.4 Order No. 4 of 1954

(Refer to Chapter 2, Section 2.2)

ORDER BY NGWENYAMA IN LIBANDLA

ORDER NO. 4 OF 1954

The Ngwenyama by virtue of Swazi Law and Custom and in terms of Section 9 of Proclamation No. 79 of 1950, has been pleased to publish this Order providing for the Appointment of a Central Rural Development Board, and setting out its function and duties.

1. The Board appointed by the Ngwenyama, known as the Central Rural Development Board, is hereby empowered to act in terms of this order.
2. The chairman of the Board shall submit to the Ngwenyama a report dealing with the condition of the resources, i.e. water, soil, grass and timber, on land held by the Nation.
   The report shall cover among other things:
   a) method of settlement
   b) present division of land into arable and grazing areas; and
   c) present grazing control method.
3. The Board shall recommend to the Ngwenyama the steps to be taken for the protection of these resources and for the improvement of grazing control methods.
4. Where the recommendations of the Board have been accepted by the Ngwenyama, the Chairman with the approval his Board may issue orders providing for:
   a) the removal of kraal to selected sites
   b) the division of land into arable and grazing areas
   c) the rotation of grazing
   d) the burning of grass
   e) the protection of particular catchment areas; and
   f) the removal of livestock to selected areas in the Territory.
5. Whenever action has been taken in terms of paragraph 4 (f), it shall be the duty of the Chief of the area concerned to ensure that the number of livestock in such areas does not exceed the number permitted by the Board.
6. Any person contravening the provisions of this order, or of the orders issued in terms of paragraph (4) hereof, shall be guilty of an offence and liable on conviction to a fine not exceeding E25 or to imprisonment with or without hard labour for a period of not exceeding six months.

BY ORDER OF THE PARAMOUNT CHIEF

17TH NOVEMBER 1954 — MBILAZISENGWA SHONGWE NDUNA

17TH NOVEMBER 1954 — POLYCARP DLAMINI SECRETARY OF THE NATION

Source: CRDB

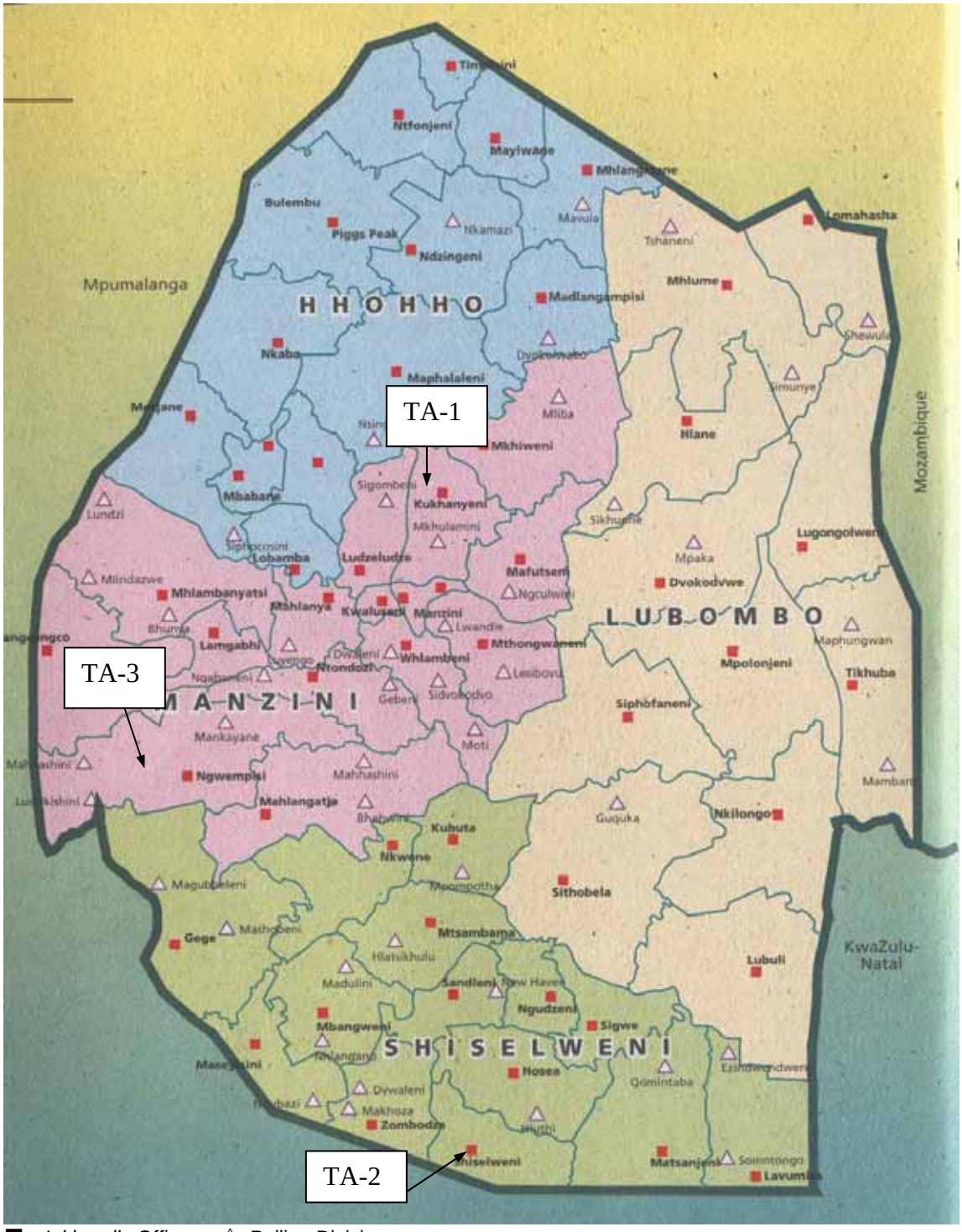
H.5 *Tinkhundla* System

(Refer to Chapter 2, Section 2.2)

1. At the time of independence in 1968, Swaziland inherited a form of government closely modelled on the British Westminster System. There were 22 *Tinkhundla* that are non-political centres aimed at stimulating such rural development as agriculture, roads and resettlement plans, and spearheaded by ex-servicemen using skills acquired during their military service.[1]
2. When King Sobhuza II restored a bicameral parliament in 1978, he introduced the tinkhundla system of government, which is designed to blend western democracy with Swaziland's own traditional structures. *Tinkhundla* is the plural of inkhundla, which means a meeting place, and the term applies to rural centres of administration. Members of Parliament were chosen from among candidates nominated by the tinkhundla whose names were put to the King for his approval (or otherwise). It is generally acknowledged, however, that during Sobhuza's reign, the Parliament had very little power. The monarch tended, instead, to rely on his advisory body, the Liqoqo, whose members were mostly drawn from the nobility.
3. Reform was introduced in 1992, by Mswati III, when he established new electoral arrangements. The "*Inkhundla*" was formally defined as "the common delineated areas (constituency) for both local and national government". The number of tinkhundla was increased to 55 [2] in 1993, each of which has a representative in the House of Assembly. A further 10 members are appointed by the King.
4. The *Tinkhundla* system of representative government has a dual role. First, it provides the channel for Swaziland's electoral system. It represents a traditional process of consultation and discussion at grass roots level, the election of local candidates in their own communities, and the candidates' representation of the needs of their communities locally, at national level and in Parliament. Second, *Tinkhundla* is the system through which the Kingdom of Swaziland is managed. The system aims to decentralize power and government administration to such an extent that the delivery of State services and administration is both assured and efficient.
5. Parliament consists of the House of Assembly and the Senate. The House of Assembly comprises 65 members (MPs), of whom 55 members are elected from 55 *Tinkhundla*, each representing each *Inkhundla*, and a further 10 members are appointed by the King. The Senate consists of 30 members, of whom 10 members are elected by the House of Assembly and 20 are appointed by the King-in-Council for the specific purpose of serving cultural, economic and social interests and contributing to the good government of Swaziland.
6. Each *Inkhundla* has a Constituency Headman (*Indvuna Yenkhundla*) as the chairman of its *Inkhundla* Committee. The remainder of the Committee members is made up of councillors (*Bucopho*) elected to represent each chiefdom in the *Inkhundla*.
7. At the top of the Administrative hierarchy are the Prime Minister and Deputy Prime Minister. Reporting to the latter are the administrators of four regions: Hhohho, Manzini, Shiselweni and Lubombo.

[1] A Unique Approach to Democracy, Deputy Prime Minister's Office
[2] Location of 55 *Tinkhundla* is presented in Annex I.6.

H.6 Location of *Tinkhundla* Offices in Swaziland



■ *Inkhundla* Office △ Polling Divisions
Source: A Unique Approach to Democracy, Deputy Minister's Office

Figure H-1: Location of *Tinkhundla* Offices in Swaziland

H.7 Roles and Functions of Government Agencies

(Refer to Chapter 3, Section 3.1.3)

H.7.1 Role of Ministry of Agriculture and Co-operatives

Policy objectives of agricultural sector activities as laid down in previous National Development Plans are as follows.[3]

1) Improving nutritional levels;
2) Achieving of basic food self-sufficiency and food security;
3) Increasing agricultural exports;
4) Creating employment opportunities through promoting agribusiness;
5) Boosting rural incomes;
6) Conservation and development of soil and water resources;
7) Establishment of an appropriate livestock development strategy which will ensure proper rationalization and coordination of the livestock industry;
8) Improvement of the management and conservation of the rangelands and the promotion of forage production and utilization;
9) Commercialisation of livestock development and implementation of a cost recovery policy;
10) Improvement and strengthening of disease control measures, surveillance and diagnostic efficiency; and
11) Promoting the development of viable cooperative activities.

In achieving these objectives, the Ministry will continue to promote the intensification of agricultural production amongst small-scale farmers on SNL.

a. Land Use Planning Section

This section has a) overall ministerial responsibility for natural resources surveys, b) serves as a custodian of prime agricultural land in that it appears land capability assessment for the country and alerts against encroachment on prime agricultural land by urban and other development, c) establishes and implements criteria for land conditions such as overgrazing, erosion, bush encroachment and grazing capacity. This section is also responsible for the following.

1) To ensure a more orderly development of land and water resources particularly on Swazi Nation Land.
2) To carry out soil surveys and capability assessment to ensure a more rational allocation of land use and provide a sound base for land evaluation purposes.
3) To develop land use plans, including resettlement plans, to guide rural development.
4) To ensure through land use planning that the natural pastures are not degraded by improper stocking rate.
5) To foster an equitable balance between exploitation and conservation of natural resources, particularly range and soil resources.

[3] Development Plan 2001 - 2003

6) To carry out engineering designs for rural access roads, small dams for supplying water to small-scale irrigation schemes etc.

7) To provide technical advice and assistance to other ministries and other departments concerned with land and its utilization.

8) To promote soil conservation practices on arable land.

9) To prepare land purchase documents for the ministry where government intends to buy with the purpose of resettling communities or any other relevant activities.

b. Department of Agriculture

This department is one of the original structures of MOAC. Today, the provision of extension services to smallholder farmers remains as the principle objective of the department. The mandate of the department is to equip Swazi farmers with relevant skills and knowledge to ensure increased agricultural productivity and improved standards of living among the people.[4]

MOAC's major goals in agriculture and extension services are: i) increased crop production to achieve national self-sufficiency in maize; ii) expanding fruit and vegetable production as a means of increasing rural income and improving nutrition; and iii) encouraging cash crop production amongst small-scale farmers. Achieving these goals will involve the introduction of new crops to farmers as well as the intensification of production of existing crops and improving management and delivery of extension services to farmers.

b.1 Agriculture and Extension Services

Extension services on farming are rendered directly to farmers by extension workers at the Rural Development Area office (RDA). There are 17 RDAs in the whole country, four in Hhohho Region, four in Manzini Region, four in Lubombo Region and five in Shiselweni Region. The Target Area 1 (Kukhanyieni Inkhundla) is under both Central RDA and Bhekinkosi/Mliba RDA, Target Area 2 (Shiselweni Inkhundla) is covered by Hluti RDA, and the Target Area 3 (Ngwempisi Inkhundla) is under Ngwempisi RDA. Each RDA office has an extension officer, several extension workers and crop specialists. For example, Ngwempisi RDA has an extension officer, 8 extension workers, 1 tobacco specialist, 1 horticulture specialist, 1 mechanization specialist and 1 home economics specialist. As for animals, there are one veterinary specialist and one poultry specialist under the extension officer. RDA gives services of leasing tractor to farmers at a cheaper rate (E80/hour) than private lease. When an extension officer and extension workers need to give training to farmers, a Farmers' Training Center is available at Nhlangano.

Extension workers are obliged to report on their work to the extension officer monthly. An extension officer at RDA has to report monthly as well to a senior extension officer at the Regional Administrative office, who must report quarterly to a senior agricultural officer in the MOAC. Each extension worker has his territory for his services. When an extension worker meets a problem occurring in the farm that he cannot answer at once, he may bring the problem through the extension officer to a subject matter specialist in agricultural research station who will coordinate with researchers on the matter. When soils matter in a farm, an extension worker may bring the soil sample to the research station for analysis. The agricultural research station also gives extension workers necessary training on new technology and new information.

[4] Report on Organization of The Ministry of Agriculture and Co-operatives, prepared in February 2001 by ZIMKEN Management Consultants, Zimbabwe.

b.2 Forestry Section

Main roles of Forestry Section are: i) to help alleviate environmental degradation and the shortage of fuel wood arising from the lack of trees; ii) to help speed up and strengthen the process of policy change in the area of deforestation, and iii) to satisfy community needs taking into account land sources degradation.

c. Department of Livestock and Veterinary Services

MOAC's overall goal in the livestock sub-sector is to transfer and equip livestock procedures with adequate knowledge and skill for the proper management and improvement of all available resources for an efficient and sustainable livestock industry which will foster positive contributions to the growth of the national economy. Priority areas in this sub-sector are as follows.

1) Increased off-take of cattle, poultry and dairy production to meet market demand and reduce the volume of imports;
2) Improved range management and rehabilitation to prevent overgrazing and control land degradation;
3) Improved livestock quality and condition through proper breeding and selection, and improved supplement feed preparation;
4) More effective livestock and livestock products marketing and trade through better marketing facilities and information;
5) Strengthening livestock extension activities under the Veterinary Department and the upgrading of the Veterinary and Farmer Training Centre to cover basic livestock extension and technology;
6) Better control of tick and tick-born diseases, parasites and other diseases of economic importance, and the provision of basic support data for livestock development, veterinary public health and animal health promotion through livestock and veterinary research.

The Department of Veterinary Services, headed by a Director, has two divisions: the Division of Animal Health, headed by a Senior Veterinary Officer, and the Division of Animal Production, headed by a Senior Animal Husbandry Officer - these senior staff are based in Mbabane.

The Division of Animal Health has four sections: Diagnostic and Investigations Laboratory (headed by a Veterinary Officer in Mbabane), Veterinary Public Health (headed by a Veterinary Officer in Mbabane), Epidemiology Unit (headed by a Veterinary Officer in Mbabane) and the Field Services Section. The Field Services Section is divided into four regions, and each of these sections is headed by a Regional Veterinary Officer and assisted by a Veterinary Officer - these are based at Manzini, Nhlangano, Piggs Peak and Siteki.

The Division of Animal Production has the following sections: Range and Pasture Management Section, Beef Extension Section, Dairy Section, Breeding Section, Piggery Section, Poultry Section, Hides and Skins Section and an Animal Nutrition and Feeds Laboratory; all sections are headed by an Animal Husbandry Officer except for the Range and Pasture Management Section and Poultry Section which have, respectively, a Range Management Officer and a Senior Poultry Officer at their head. Most senior staff are based at Manzini (except for Livestock Marketing and Breeding (Mbabane) and Animal Nutrition (Malkerns)) and, ideally, there would also be an Extension Officer there as well for the Manzini Region. In addition, within each region there should be field extension staff beef and poultry for Manzini Region are responsible for Kukhanyeni and Ngwempisi Tinkhundla, and staff based at Hlathikulu for Shiselweni Region are responsible for Shiselweni Nkundla.

The Ministry exercises control over a wide range of responsibilities, including support services, co-operatives and marketing. It exercises control in the sector through two main institutional roles: control over the agricultural parastatal sector marketing boards, and the Central Cooperative Union (involved in marketing of inputs and produce). It is involved in research, delivery of extension and veterinary services, and provides inputs at subsidized prices.

Livestock marketing used to be controlled by the government-owned Swaziland Meat Industries (SMI) (which had a franchise to export meat to Europe) and the Swaziland Dairy Board (SDB). These have now been sold to private enterprises and government now only has a regulatory function in these areas. Simunye Sugar Co. now own Swazi Meat Industries (at Matsapha) and another company owns Swazi Meat Wholesalers (at Ngwenya). The previous SDB-owned dairy is now owned by Pamalat (in Matsapha) and another company owns Family Fun (also in Matsapha).

Research is conducted at the central Malkerns Research Station which has out-stations, basically one each in each of the different agro-ecological zones of the country (Lowveld Experiment Station, Big Bend; Nhlangano Experimental Farm, Nhlangano; Hebron Experimental Plot; Mangcongco Experiment Plot; Luve Experiment Plot).

Extension is applied almost exclusively to the SNL sector. In the case of livestock, at each regional headquarters (viz.: Manzini, Hlathikulu, Piggs Peak and Siteki) there is a Livestock Extension Officer for each of beef production and poultry production. Other subject matter specialists are called from Manzini as and when required to service the different regions. What happens is that assistance is channelled from communities through agricultural extension staff based at the four Rural Development Area (RDA) centres in each region to the regional livestock staff or to the national extension staff in Manzini. In addition, as there is no supporting field extension service for livestock other than the professional subject matter specialists, there is the on-going development of training and liaison with Veterinary Assistants as well as the RDA Extension Assistants.

There are only three Range Management Officers in the Department of Veterinary and Livestock Services, all based at Manzini to provide assistance nationwide, two for communal range management and one for range management on government ranches.

Government provides subsidized livestock breeding and fattening programs. It runs livestock breeding stations across the country which provide tested “improved” bulls to farmers, as well as four Sisa Ranches which allow farmers to have their animals maintained and/or fattened off the SNL.

Tibiyo is a quasi government/royal establishment, originally set up with funds provided at the end of the Second World War for ex-servicemen. The operations of Tibiyo are essentially those of commercial production on the various Tibiyo estates, with the profits being used in development projects across the country.

Various NGOs exist across the country that aims to assist farmers, mainly on SNL to plan and fund development projects. Examples include the Yonge Nawe NGO which has assisted in setting up group ranches (fenced grazing schemes) on communal land, and also a youth beef fattening unit. Although registered, these NGOs are not obliged to interact with the Ministry of Agriculture and Co-operatives in any way and there is no means of co-ordination or liaison between the NGOs and the Ministry other than on a personal basis (note however that there is some coordination between NGOs through the Co-ordinating Assembly of Non-government Organizations (CANGO)); unfortunately, this has at times resulted in inappropriate messages and information being passed as they sometimes lack the necessary technical expertise. However, the NGOs complement the government effort and are a source of grants and fund-aid for rural communities that government is not able to match.

There is a complicated overlap of traditional and modern governance systems with respect to rural development. Rural development is based in the Deputy Prime Minister's Office to which the heads of the development wards, the 55 Ndvuna ye Nkundla, report directly and by-passing line ministries. These Ndvuna are elected from within their own nkundla communities by the families themselves. The Ndvuna ye Nkundla are essentially the executive officers of the nkundla. There is a Bukapo be Nkundla who is appointed by the Chief to represent the chiefdom at the nkundla; these Bukapo bring requests from each of the chiefdoms. These are screened at the nkundla level and are then taken to the necessary authority or institution for action and assistance as the case might be.

The Chief himself also has a council and from this council there is appointed an Usumbe. The Usumbe advises the Chief's council on matters relating to range and natural resource matters.

d. Department of Cooperative Development

The primary objectives of the department are to:

1) Help people form cooperatives in order to obtain supplies and services at low cost;
2) Advise people on developing existing resources through cooperative action to enhance their standard of living;
3) Improve services and operating efficiency of cooperative members;
4) Inform the public on how cooperatives work and benefit their members;
5) Help educate all types of cooperatives in developing themselves;
6) Improve and stabilize the net income of the members;
7) Conduct the cooperatives business in a manner that will earn and retain the favorable regard of members, customers, employees, suppliers and the public; and
8) ensure that societies adhere to all internationally recognized cooperative principles.

e. Related Parastatal Organizations

In connection with the activities of the Department mentioned above, there are some quasi-governmental organizations as follows

e.1 Central Cooperative Union

Central Cooperative Union (CCU) is the apex body of the cooperative movement in Swaziland and was formed in 1971 by the four cooperative regional Unions. But they were abolished in 1992, and CCU unifies directly the primary cooperative societies. There are 32 primary cooperative societies at present. CCU had a bitter experience of losing its fame in the past due to non-recovery of loans to cotton producers. The biggest service of CCU at present is to supply farm input such as maize seed, vegetable seed, farm chemicals and some farm equipment at 25 depots in the whole country. It sells also fertilizers provided under Japanese aid, KR2, and deals with consumer goods these days. CCU also provides insurance services such as crop insurance, life insurance, etc. For example, Ngwempisi depot located at the RDA compound sells farmers farm input at present as follows;

e.2 National Maize Corporation

National Maize Corporation (NMC) is a parastatal institution dealing with maize only. NMC is also entitled to import and export maize. It buys maize from farmers at the front to rural farms with the gazetted price, keeps maize in the grain silo, and sells the maize to consumers at the locality. NMC has a purchase office within the compound of RDA near the small-scale maize producers. NMC offers farmers credit for farm input as well, totally 2 million Emalangeni a year in 2000/01. It is going to extend its business to groundnuts.

NMC is important for farmers, because whenever farmers want to sell maize, there is a market for sale always.

e.3 National Agricultural Marketing Board

National Agricultural Marketing Board (NAMBOARD) is a parastatal institution that deals with agricultural produce. It was established in 1985 under the National Agricultural Marketing Board Act 1985 (Act No. 13 of 1985). The main functions of the NAMBOARD are:

- To register wholesale distributors, importers and exporters of scheduled products,
- To facilitate in such a manner as it may consider appropriate, the production, distribution and sale of scheduled products,
- Where required to do so, advice government in all matters related to availability and demand of scheduled products, and
- To perform such other functions that may from time to time be determined by the minister of Agriculture and Cooperatives.

NAMBOARD deals with maize excluding maize seed, maize products including animal and poultry feeds, rice, fresh fruits, and vegetables excluding seed potatoes

f. Agricultural Research Section

The Agricultural Research Section of MOAC is responsible for applied and adaptive research on crop and livestock nutrition as well as socio-economic research. Under this Section, there are six agricultural research stations, of which Malkerns Agricultural Research Station is a central station. The other stations are Nhalangano Experimental Station, Low Verd Experimental Station, Luve Substation, Mangcongco Substation, and Hebron Substation.

When an extension worker finds some new problems at a farm, he should report it to a subject matter specialist at the central Malkerns Agricultural Research Station through the extension officer whom he is subject to. The specialist consults the matter with a relevant researcher who tackles it through a study when necessary and tries to solve it. Researchers should call extension workers, inform them new technologies and give them training when required. The central station is also extending services for soil analysis when requested by a farmer through an extension worker.

g. Economic Planning and Analysis Section

Economic Planning and Analysis Section of MOAC is responsible for the appraisal and monitoring of agricultural development programs and projects. The main role of the section is to provide socio-economic analysis and planning support to MOAC in undertaking its mandate. The section assists the ministry in several important ways, they are:

1) Developing and updating its strategy and policy, with socio-economic information and analysis relevant to the agricultural sector;
2) Providing socio-economic input into the formulation and implementation of the agricultural development programs;
3) Assisting in the preparation and presentation of the annual capital;
4) Gathering, analysing and storing relevant information on agricultural production, marketing and project implementation, and
5) Liaising and supporting donor mission and consultations linked to the agriculture sector and assessing their reports.

H.7.2 Role of Ministry of Tourism, Environment and Communications and Swaziland Environment Authority

This ministry and authority a) establish standards and guidelines relating to the pollution of water, land and as well as those relating to noise and other forms of environmental pollution, b) develop in cooperation with other Government authorities economic measures to encourage environmentally sound and sustainable activities, c) promote training and education programs in the field of environment to create national awareness of environmental issues, d) ensure the observance of proper safeguards in the planning and execution of all development projects, including those already in existence, that are likely to interfere with the quality of the environment, and e) initiate measures for the coordination and enforcement of environmental protection legislation. The organization chart of Swaziland Environment Authority is given in Figure H-2. As is seen from the chart, the authority is currently operated only by 9 staffs, accordingly its present activities is limited.

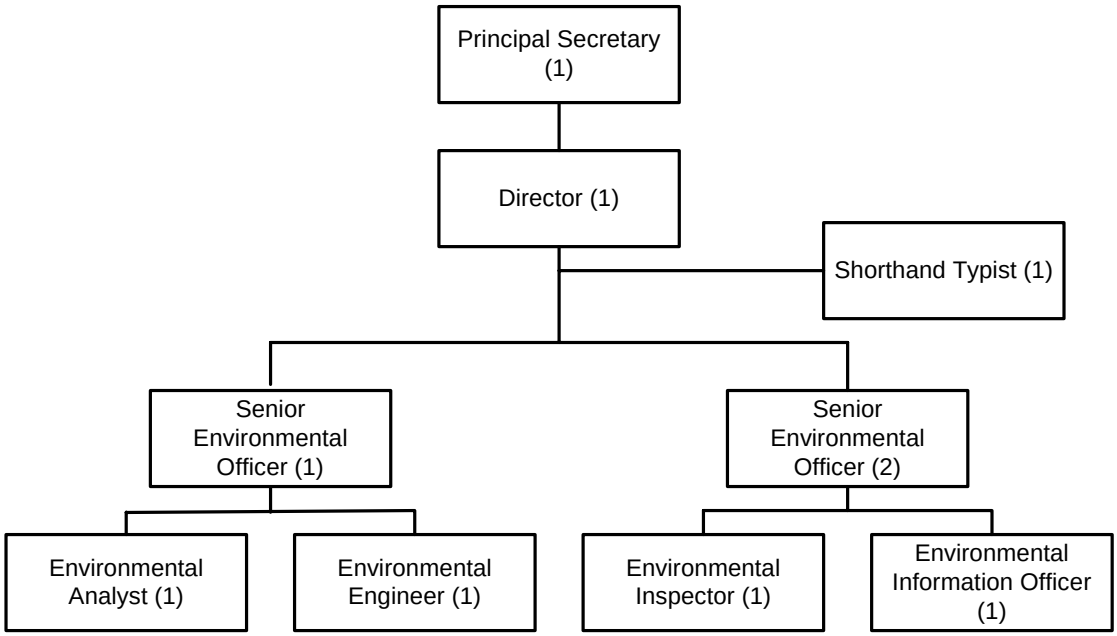


Figure H-2: Organization of Swaziland Environment Authority

H.7.3 Role of Ministry of Natural Resources and Energy

The role of this ministry is to ensure the proper coordination, development, management, preservation and enforcement of optimal and environmentally acceptable utilization of the country's renewable and non-renewable resources as well as the development and maintenance of cadastral surveys, mapping and land valuation standards and procedures.

H.8 Application Form for Regional Development Fund

REGIONAL DEVELOPMENT FUND - APPLICATION FORM

Region: ..... Inkhundla: .....

1. Particulars of Applicant

a) Full Names of Applicant (Association/Community/Group) : _____

_____

_____

b) Executive Committee Members

Chairperson/President : .....
Vice Chairperson/President: .....
Secretary : .....
Vice Secretary : .....
Treasurer : .....
Committee Member : .....
Committee Member : .....

c) Total Membership : .....

d) Proposed Project Location : .....
.....

e) Physical Address : .....
.....

f) Postal Address : .....
.....

g) Telephone Number: ……

2. Particulars of Project

a) Type of Project for which grant is required (tick one)

Infrastructure ○
Income Generation ○

b) Project Details:

……
……
……
……
……
……

c) Purpose for which the funds are required (list items to be acquired) :

……
……
……
……
……
……
……

d) Amount Requested …… is based on the following preferred supplies:

Name of Supplier	Item required	Amount
……	……	……
……	……	……
……	……	……
……	……	……
……	……	……

.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

e) List of attachment required:

Motivation (Yes/No)
Business Plan (Yes/No)
Quotation (Yes/No)
Tax Clearance (Yes/No)
Comments from Technical Adviser / Relevant Officer (Yes/No)

f) Sale of product, availability of clients' market (where applicable):

.....
.....
.....
.....
.....
.....

g) Management ability and project related skills:

.....
.....
.....
.....
.....

h) Estimated number of People to be employed by the proposed Project:

.....
.....

i) Number of Beneficiaries/Homesteads: .....

3. Contribution by Applicant (if amount requested is in excess of E100,000.00)

Type of Contribution:

a) Cash Value (attach proof) E……..

b) In kind (attach proof)

c) Cash Value E…….. Plus In kind (attach proof)

4. Certification

This is to certify that thee above information given is true and correct, and it has been discussed by the Executive Committee and the Association's members:

	Name	Signature	Date
Chairperson :	……	……	……
Secretary:	……	……	……
Treasurer:	……	……	……

5. Recommendations of Applications

a) Chiefdom Level

	Name	Signature	Date
Secretary	……	……	……
Community Leader/ Chairperson Bandlancane	……	……	……
Chief/ Indvuna	……	……	……

Chiefdom Stamp: .....

b) Inkhundla Level

	Name	Signature	Date
Indvuna yeNkhundla	.....	.....	.....
Parliamentarian	.....	.....	.....

Inkhundla Stamp: .....

Decision of the Regional Project Committee

Decision:

.....
.....
.....
.....
.....

.....	.....	.....
Chairman	Secretary	Date

Application Number ___ ____ ___

H.9 Example of the Seminar for Community Leaders and Members

(Refer to Chapter 5, Section 5.5.4)

1. Objectives of the Seminar

   The objectives of the seminar are; i) to educate community leaders and members on land degradation problems and what they can do as community members; ii) to raise awareness on soil conservation techniques and strategies that may be useful; and iii) to educate development committee members on how to manage the projects.

2. Expected Output from the Seminar

- Participants will have a better understanding of problems of land degradation and need for the implementation of soil conservation works in their respective communities;
- Participants will have a practical knowledge on the soil conservation techniques and strategies;
- Participants will have a better understanding of project management skills.

3. Participants

- Members from four chiefdoms in the pilot project areas, viz. Eni, Engcayini, Zikhotheni and Macdvulwini chiefdoms.

4. Agenda

- State of land degradation in Swaziland
- State of land degradation in three pilot project areas
- Population growth in a degraded land resource
- Problems on range management in Swaziland
- Problems on range management in three pilot project areas
- Community participation
- Modern livestock management techniques
- Community projects and their management

H.10 Outline of Training Program for the Pilot Projects

(Refer to Chapter 5, Section 5.6.4)

H.10.1 Training Program prepared by PPMU in collaboration with NGOs

Training program was prepared through a series of discussions made by PPMU staff, JICA Study Team, and relevant NGOs. Firstly, PPMU prepared the training program for the smooth implementation of the pilot projects in November 2002. Then, based on the said program, a workshop was held on 26th November 2002 at MOAC for the formulation of the detailed training program. PPMU invited the government officials from the relevant departments of MOAC and representatives from four NGOs. Through the workshop, discussion was made among the government officials, NGOs representatives and JICA study team. Training items, training dates and the selection of the trainers for each item was tentatively decided.

Training for community gardens at Zikhoteni and Mhlatane started from early March 2003. The leadership training for the traditional leaders and the community development committees also started from the middle of March 2003. Other trainings were conducted during May and July 2003.

It has been observed that the collaboration between the government officials and NGOs has been promoted through the implementation of the training program.

H.10.2 Leadership Training

Leadership training for the traditional authorities was conducted on 14th March 2003. The training for development committee members at Eni, Ngcayini, Zikhoteni and Macdvulwini was conducted from 17th March to 19th March 2003. Both trainings were carried out at Mpophoma Conference and Training Centre at Malkerns.

A month after the initial training a day was spent with each of the three development committee as follow up or monitoring and evaluation to ascertain whether the participants grasped what they were trained on.

Table H-1: LEADERSHIP TRAINING SCHEDULE

TIME	DAY 1	DAY 2	DAY 3
8.30	REGISTRATION OFFICIAL OPENNING ⌘ Introductions ⌘ Project overview - MOAC ⌘ Official opening by Chief ⌘ Workshop Objective	⌘ Recap ⌘ Community Structure/chain of command	⌘ Recap ⌘ How can we plan effectively ⌘ How do we obtain resources for our project ⌘ Records management ⌘ business planning
10.00	TEA BREAK	TEA BREAK	TEA BREAK
10.30	⌘ Leadership - qualities of a good leader - leadership styles - roles and responsibilities	⌘ Community organization, mobilization and motivation ⌘ Conflict resolution	FINANCE ISSUES ⌘ making a cash flow plan ⌘ keeping Financial records
1.00	LUNCH	LUNCH	⌘ End of seminar evaluation
2.00	⌘ Leadership continued - managing relations with traditional authorities - understanding the constitution - group dynamics, do we work well together Afternoon break	⌘ Entrepreneurship ⌘ SWOT Analysis Afternoon break	⌘ Official closing by JICA Head of mission LUNCH – DEPARTURES
3.30 3.45	⌘ The Constitution, what is it? Guidelines for making a constitution End of day	⌘ HIV/AIDS and community development	

H.10.3 Community Garden

(1) Mhlatane Garden (TA3)

Training for community gardens at Mhlatane started on 3rdMarch 2003.

a) Twenty seven persons have been trained. Of these 18 are men. For a community garden scheme this is an unusually high number. More commonly women make up some 90% of the participants.

b) The program ran through March, April and May. It was conducted by Victor Dlamini, a vegetable specialist, on site. The lessons were held twice a week and commonly lasted about five hours each.

c) As of the 22.5.03, 78 plots were planted with a further 56 in various stages preparation. Of the planted plots 23 participants have 3 each, two have 4 each and one person has but one. A plot is 25 m2.

d) The number of plots planted to the different vegetables is:

Vegetable	No. of Plots	Area (m2)
Cabbage	24	600
Beetroot	19	475
Spinach	15	375
Mustard Spinach	11	275
Carrot	9	225

e) For the first six weeks of the programme the participants tried to be in the garden five days a week but thereafter two days became the norm as pressure was put on the community to attend to other JICA funded activities. For the first period the weekly percentage of members attending was: 71.9 64.4 68.5 67.4 77.8 and 66.7. When people came to the garden twice a week the percentage attendance was 83.3 85.2 and 77.8.

f) Savings. E1,964 banked and E 198 in hand.

g) One of the programme's aim was that each participant would plant at least 2 plots. This was exceeded. The average per person is 3.

h) The training planned to cover five major aspects of vegetable production. All have received attention but the great majority of the time was given to plot preparation, transplanting and maintaining the established plot. The work on harvesting has been limited to Spinach and Mustard Spinach. Fifteen participants have had sales.

i) From what can be seen in the garden the training has produced attractive results as the photographs which come with the report show. There are matters needing some attention. The plots are better described as leveled rather than backsloped. It would be good to see mulch in all basins and there are signs of Boron deficiency in the beetroot.

(2) Zikhoteni Garden (TA2)

Training for community gardens at Zikhoteni started on 3rdMarch 2003.

a) Seventeen (17) persons have been trained 16 of whom are women.
b) The programme ran through March, April and May and was conducted by Victor Dlamini, a vegetable specialist with some 20 years of practical experience.
c) The officer has worked with the participants on the Wednesday of each week

spending on average 4 hours in the garden.

d) As noted in the progress report of 25.3.03 much of te backsloping and the incorporation of basic fertilizer scheduled for stage 4 was done during the early part of stage 5.

e) As of the 21.5.03, 56 25m2 plots were planted. Most participants (10) have 3 plots, six have 4 and only one has 2. Eleven plots await planting.

f) The number of plots planted to the different vegetables is:

Vegetable	No. of Plots	Area (m2)
Tomato	13	325
Cabbage	11	275
Mustard Spinach	8	200
Green Pepper	7	175
Spinach	5	125
Carrot	5	125
Beetroot	4	100
Lettuce	3	75

g) It has been normal practice for the women to be in the garden five days a week. The percentage of members attending for the five working days of each week was as follows: 88.7 73.7 91.2 75.3 83.5 87.1 91.2 90.6 92.6 and 96.5.

h) There was a tendency for the parents to send their children to the garden during school holidays. This was stopped but at the same time it was made clear to the adults that the children were welcome as long as a parent was there. The course was for adults and one did not want them missing lessons.

i) The training planned to cover five aspects of vegetable production – plot preparation, transplanting and maintaining the established plot were covered in some depth. Limited attention was given to seedling production and, with most crops still immature, harvesting has hardly been addressed.

j) All in all the trainees have produced crops of commendable quality as attested by the photographs.

k) The participants have E800 in a bank account and E90 in hand.

(3) Mbeka Garden (TA3)

Training for the community garden at Mbeka was conducted on 30th June and 1st July 2003.

a) Objective was to train participants in the different aspects of planning, growing and production of vegetables.

b) The training items included the following:

- Planning a vegetable production program.
- Land and seed bed preparation (Demonstration).
- Seedling production.
- Agronomic practices and crop management.
- General pest Management.
- Disease control on vegetables.
- Variety recommendations for various vegetable crops.

- Basic equipment for vegetable production.
- Harvesting and packaging.

c) Thirty seven farmers from Mbeka area joined the training course held at Mbeka church.

d) Ms. S. Mamba (Senior Extension Officer) delivered the opening remarks on the first day of the training programme. Trainers were Mr. Maqhawe Shongwe (Horticulture Extension Officer), Mr. E. Kunene (Horticulturist), Mr. M. Dlamini (Acting Extension Officer), and Ms. Simelane (Horticulturist).

H.10.4 Nursery Management

Training programme on nursery management was organized by Forestry Section staff of MOAC for the development committee and nursery sub-committee members of Zikhoteni Chiefdom. The training was conducted from 17th to 19th June 2003 at Mpophoma Conference and Training Centre at Malkerns.

The trainers were Mr. Burton Mkhatshawa (Forestry Officer), Ms. Futhi Magagula (head of Tree Seed Centre), Ms. Lomakhaya (Home Economics Expert), and Mr. P. Dlaminiini (Horticulturist).

Participants for this training were as follows.

Name	Position
1. Albert Nxumalo	Chairperson, Nursery Sub-committee
2. Abednigo Nxumalo	Vice Chairperson, Nursery Sub-committee
3. Nonhlanlha Dlamini	Secretary, Nursery Sub-committee
4. C. K. Nxumalo	Vice secretary, Nursery Sub-committee
5. E. Nxumalo	Treasurer, Nursery Sub-committee
6. Agnes Nxumalo	Member, Nursery Sub-committee
7. Julia Nxumalo	Member, Nursery Sub-committee
8. Samson Dlamini	Vice Chairperson, Zikhoteni Development Committee
9. Khanyisile Simelane	Secretary, Zikhoteni Development Committee
10. Busisiwe Mafu	Treasurer, Zikhoteni Development Committee
11. Burton Mkatshwa	Forestry Officer, MOAC
12. Futhi Magagula	Tree Seed Centre, Malkerns Research Centre
13. Dlamini P.	Horticulturist, Malkerns Research Centre
14. Lomakhaya	Bee-keeping specialist, Shiselweni Agriculture Office
15. Dr. David Kamweti	Forestry Expert, JICA Study Team

H.10.5 Feedlot Management

a) The workshop was organized for committee members of Ngcayini, Eni and Macudvulwini grazing schemes and feedlots. All these communities have benefited financially and technically from the JICA project. Each community was supposed to send four members but only ten members were present, absent were from Eni (1) and Ngcayini (1).

b) The workshop was held at Ngcayini Community Feedlot from the 2nd – 3rd July 2003 by Salile Investment & Swaziland Livestock Technical Services. On the first day there was a visit by the areas Bucopho Benkhundla and the Ministry of Agriculture & Cooperatives.

c) Training for Day 1 (2nd July 2003) included the following:
   i) Pasture management - pre and post harvest technologies of pastures
   ii) Preparation of fodder – harvesting techniques
   iii) Feeding – timing of feeding, size of cuttings and amount of feeds
   iv) Selection of animals – characteristics and body scoring of feedlots animals
   v) Storage of vaccines & feeds – proper storage of veterinary drugs and feeds
   vi) General management – Do's and don'ts in a feedlot.

d) Training for Day 2 (3rd July 2003) included the following
   i) Inoculation – practical vaccination of animals
   ii) Group discussions - decision making, problem solving, group dynamics, community structure, understanding the constitutions

   Under this topic everyone was participating / sharing ideas on specific issues.

e) Participants

The participants were ten in total, of whom three each from Eni and Ngcayini, and four from Macdvulwini chiefdom.

	Name & Surname	Participant's Chiefdom
1.	Angelina Khumalo	Ngcayini
2.	Busisiwe Manyisa	Ngcayini
3.	Siphiwe Khumalo	Ngcayini
4.	Abraham Dlamini	Eni
5.	Ndaba Dlamini	Eni
6.	Mshumpu Dlamini	Eni
7.	Caswell Motsa	Macudvulwini
8.	Titus Shongwe	Macudvulwini
9.	Abednigo Dlamini	Macudvulwini
10.	Jeremiah Kunene	Macudvulwini

H.11 Implementation of Capacity Building Plan (Phase-1)

(Refer to Chapter 5, Section 5.6.4)

	Training Items and Place	2004	2005	2006	2007	2008	2009
1	Inkhundla Meeting	3					
2	Chiefdom Workshop						
	Eni (TA1)	1					
	Ngcayini (TA1)	1					
	Nkiliji (TA1)	1					
	Nsenga (TA1)	1					
	Butfongweni (TA1)	1					
	Zikhoteni (TA2)		1				
	Manyandzeni (TA2)		1				
	Macdvulwini (TA3)		1				
	Bhadzeni II (TA3)		1				
	Velezizweni (TA3)		1				
3	Technical Training						
	Eni (TA1)		12				
	Ngcayini (TA1)		12				
	Nkiliji (TA1)		12				
	Nsenga (TA1)		12				
	Butfongweni (TA1)		12				
	Zikhoteni (TA2)			15			
	Manyandzeni (TA2)			12			
	Macdvulwini (TA3)				12		
	Bhadzeni II (TA3)				12		
	Velezizweni (TA3)				12		
4	Monitoring & Evaluation						
	Eni (TA1)			1		1	
	Ngcayini (TA1)			1		1	
	Nkiliji (TA1)			1		1	
	Nsenga (TA1)			1		1	
	Butfongweni (TA1)			1		1	
	Zikhoteni (TA2)				1		1
	Manyandzeni (TA2)				1		1
	Macdvulwini (TA3)				1		1
	Bhadzeni II (TA3)				1		1
	Velezizweni (TA3)				1		1
Workshop/Training (Number)		8	5	5	5	5	5
Technical Training (Number)		0	60	27	36	0	0

Note: The figures indicate the number of sessions to be conducted at each chiefdom.

Implementation of Capacity Building Plan **(Phase-2)** (Refer to Chapter 5, Section 5.6.4)

	Training Items and Place	2010	2011	2012	2013	2014	2015
1	Inkhundla Meeting	3					
2	Chiefdom Workshop						
	Mdayane (TA1)	1					
	Maliyaduma (TA1)	1					
	Bhekinkosi (TA1)	1					
	Ngwazini (TA1)	1					
	Mkhulamini (TA1)	1					
	Mabona (TA2)		1				
	Dumenkungwini (TA2)		1				
	Bhadzeni I (TA3)		1				
	Mhhashini (TA3)		1				
	Khabonina (TA3)		1				
3	Technical Training						
	Mdayane (TA1)		12				
	Maliyaduma (TA1)		12				
	Bhekinkosi (TA1)		12				
	Ngwazini (TA1)			12			
	Mkhulamini (TA1)			12			
	Mabona (TA2)			12			
	Dumenkungwini (TA2)				12		
	Bhadzeni I (TA3)				12		
	Mhhashini (TA3)				12		
	Khabonina (TA3)				12		
4	Monitoring & Evaluation						
	Mdayane (TA1)			1		1	
	Maliyaduma (TA1)			1		1	
	Bhekinkosi (TA1)			1		1	
	Ngwazini (TA1)			1		1	
	Mkhulamini (TA1)			1		1	
	Mabona (TA2)				1		1
	Dumenkungwini (TA2)				1		1
	Bhadzeni I (TA3)				1		1
	Mhhashini (TA3)				1		1
	Khabonina (TA3)				1		1
Workshop/Training (Number)		8	5	5	5	5	5
Technical Training (Number)		0	36	36	48	0	0

Note: The figures indicate the number of sessions to be conducted at each chiefdom.

Implementation of Capacity Building Plan **(Phase-3)** (Refer to Chapter 5, Section 5.6.4)

	Training Items and Place	2016	2017	2018	2019	2020	2021
1	Inkhundla Meeting	3					
2	Chiefdom Workshop						
	Sankolweni (TA1)	1					
	Ntunja (TA1)	1					
	Nyakeni (TA1)	1					
	Swaceni (TA1)	1					
	Mbeka (TA1)	1					
	Mcinsweni (TA2)		1				
	Lishikishini (TA3)		1				
	Mgazeni (TA3)		1				
	Dladleni (TA3)		1				
	Ngcoseni (TA3)		1				
3	Technical Training						
	Sankolweni (TA1)		15				
	Ntunja (TA1)		15				
	Nyakeni (TA1)		13				
	Swaceni (TA1)			12			
	Mbeka (TA1)			12			
	Mcinsweni (TA2)			12			
	Lishikishini (TA3)				12		
	Mgazeni (TA3)				12		
	Dladleni (TA3)				12		
	Ngcoseni (TA3)				12		
4	Monitoring & Evaluation						
	Sankolweni (TA1)			1		1	
	Ntunja (TA1)			1		1	
	Nyakeni (TA1)			1		1	
	Swaceni (TA1)			1		1	
	Mbeka (TA1)			1		1	
	Mcinsweni (TA2)				1	1	
	Lishikishini (TA3)				1	1	
	Mgazeni (TA3)				1	1	
	Dladleni (TA3)				1	1	
	Ngcoseni (TA3)				1	1	
Workshop/Training		8	5	5	5	10	0
Technical Training		0	43	36	48	0	0

Note: The figures indicate the number of sessions to be conducted at each chiefdom.

H.12 List of Community Development Committee Members (Pilot Areas)

(Refer to Chapter 5, Section 5.8.2)

Target Area	Chiefdom	Name	Position	Sex
TA-1	Ngcayini	Dumsani Masuku	Chairperson	Male
	Eni	Thbile Dlamini	Vice Chairperson	Female
	Ngcayini	Thulile Dlamini	Secretary	Female
	Eni	Nokuthula Mavimbela	Vice Secretary	Female
	Ngcayini	Jabulani Ntjalintjali	Treasury	Female
	Eni	Malungisa Shongwe	Member	Male
	Eni	Phumzile Matsenjwa	Member	Female
TA-2	Zikhotheni	Rueben Mapulango Nxumalo	Chairperson	Male
	Zikhotheni	Samson Dlamini	Vice Chairperson	Male
	Zikhotheni	Lindiwe Nxumalo	Secretary	Female
	Zikhotheni	Abednigo Nxumalo	Vice Secretary	Male
	Zikhotheni	Busisiwe Mafu	Treasury	Female
	Zikhotheni	Mnyamane Msane	Member	Male
	Zikhotheni	Mabuza Ephraim	Member	Male
TA-3	Macudvulwini	Dlamini Thembisile	Chairperson	Female
	Macudvulwini	Ndaba Hadebe	Vice Chairperson	Male
	Macudvulwini	Sandile Motsa	Secretary	Male
	Macudvulwini	Shaka Motsa	Vice Secretary	Male
	Macudvulwini	Vusi Bhemba	Treasurer	Male
	Macudvulwini	Priscila Dlamini	Member	Female
	Macudvulwini	Fanda Mtsetfwa	Member	Male
	Macudvulwini	Almon Zikalala	Member	Male
	Macudvulwini	Titus Shongwe	Member	Male

Annex I

I Pilot Projects

I.1 Stakeholder Analysis

Table I-1: Stakeholder Analysis in TA1 (Eni and Engcayini)

Beneficiaries	Negatively Affected Group	Decision Makers	Funding Agency /Group	Implementing Agency /Group	Community Leaders /Groups	Potential Opponents	Supporting Group
Community	Homesteads of the Project Site (in case of resettlement)	Indvuna	44 million Fund	Community Members	Chief	Thieves	Yonge Nawe
Cattle in Two Chiefdoms		Indvuna in the Inner Council	Japan	Chief	Indvuna	Drinkers	World Vision
Women in Two Chiefdoms	People who don't want to be helped	Development Committee (Musupe)	Contribution from Community	Youth	Development Committee	People who cut Fence	EEU Micro Project
Environment	Dead People (in case of moving graveyard)		NGO (Yonge Nawe)	MOAC	Inner Council	Stubborn People	MOAC
Community of Whole Inkhundla		Chairman of the Vegetable Growing Group	MOAC	MP	Leader of Women's Group	Jealousy among Community	Japan
Swazi Nation				Buchopho		Lazy People	
School Children		Committee of Sewing Group		Yonge Nawe		Cattle (eat trees)	
Cattle Owners		Chairman of the Maize Committee		Japan		Rain (make activities delay)	
		Community Meetings		Indvuna Yenkhundla		Death	
		Local People		Ministry of Health		Fire	
						People who don't come in time	

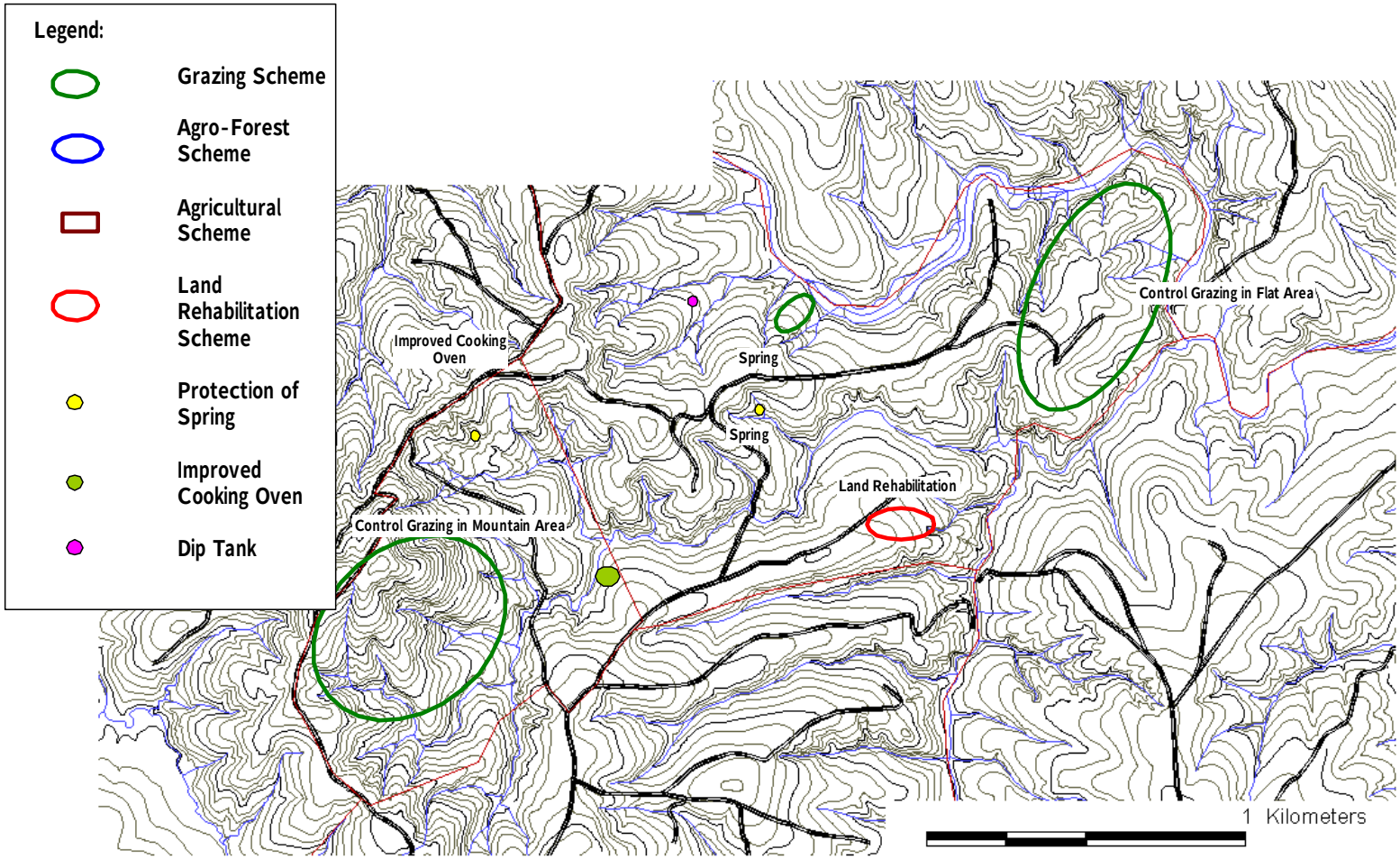
Table I-2: Stakeholder Analysis in TA2 (Zikhotheni Chiefdom)

Beneficiaries	Negatively Affected Group	Decision Makers	Funding Agency/Group	Implementing Agency/Group	Community Leaders/Groups	Potential Opponents	Supporting Group
Community	People with no interest in development	Chief	Community	Women's Organization	Induna	Nobody	Japan
Community by getting clean water		Inner Council	Red Cross	Community	Chairman of Committee		Extension Officer
Farmers	People who have title deed land	Yinduna	MOAC	Japan	Committee		EEC
Cows (prevent falling into gullies)		Chairman of organizations	Individuals	Yonge Nawe			NGO
Field		Community	Japan	MOAC			Tibiyo (funding NGO)
Children (can go to school)			Chinese Government				Yonge Nawe
Parents (can send children to school)			People who run big business				Red Cross
			44 million Fund				China
							World Vision
							DPM Office

Table I-3: Stakeholder Analysis in TA3 (Macdvulwini Chiefdom)

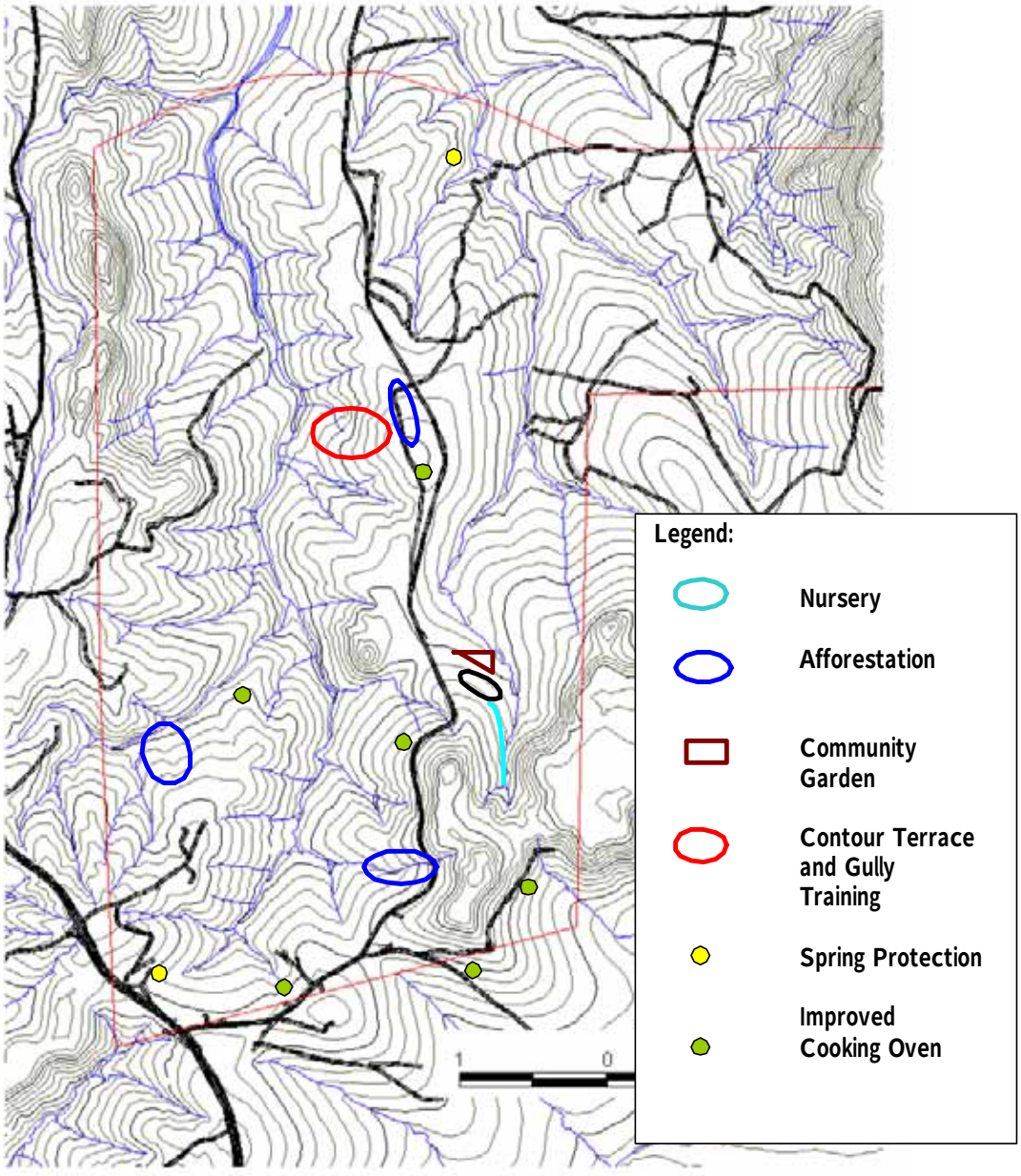
Beneficiaries	Negatively Affected Group	Decision Makers	Funding Agency/Group	Implementing Agency/Group	Community Leaders/Groups	Potential Opponents	Supporting Group
Farmer	People who like disputes	Princess	44 Million Fund	Japanese	Chief (as an Institution)	Rain	Ministry of Works
Future Generation	Those who won't come up with ideas on how they can convert degraded areas to IGA	Inkhundla	EU	MOAC	Japanese	Diseases	MOAC
Orphans		Member of Parliament	Japan	Ministry of Works (for equipment supply)	Community Police	Natural Disasters	SAPPI (Forestry Company)
Widows		Members of Fruit Growing Group	SAPPI (Forest Company)		Home Economist (MOAC)	Witchcraft (by jealousy)	Inkhundla
Old People	People who has Woodlot (might become a project site)	Local Community	MOAC	SAPPI (Forest Company)	Member of Parliament	Unfavorable Changes in Political Climate	EU
Whole Nation		Development Committee (formed 2 months ago)	SADF (NGO)	Prison Labor	Leaders of community under Chiefdom		Ministry of Enterprise
People in Inkhundla	Those who are jealous (in and around the chiefdom)		Community Contribution	Land Development Unit (MOAC)		Lazy People	NGOs
Cattle		Priest of Church	<How>	Extension Officers	Pastor of Church	Cattle Owners	JICA
Community	Cattle Owners	Head of Teachers	Donation (ex. E20 per homestead)	Community	Indvuna	Neighboring Chiefdoms	Yonge Nawe
Youth	Dead People (in case of replacement of grave yard)	Head of the Homesteads	They can sell vegetables		Inner Council	People who don't commit	
Nature		Inner Council	Casual Labor			Thieves	
School Children	Old People (too weak)	Chief (as an Institution)	They can sell Maize			Jealousd Community	
Cattle	Those who don't like development	Community Police	They can sell Mats				
Cattle Owners	Nobody		They can sell Dogs				
People who are interested in the Development Project	Lazy People						

I.2 Location of the Pilot Projects in TA1

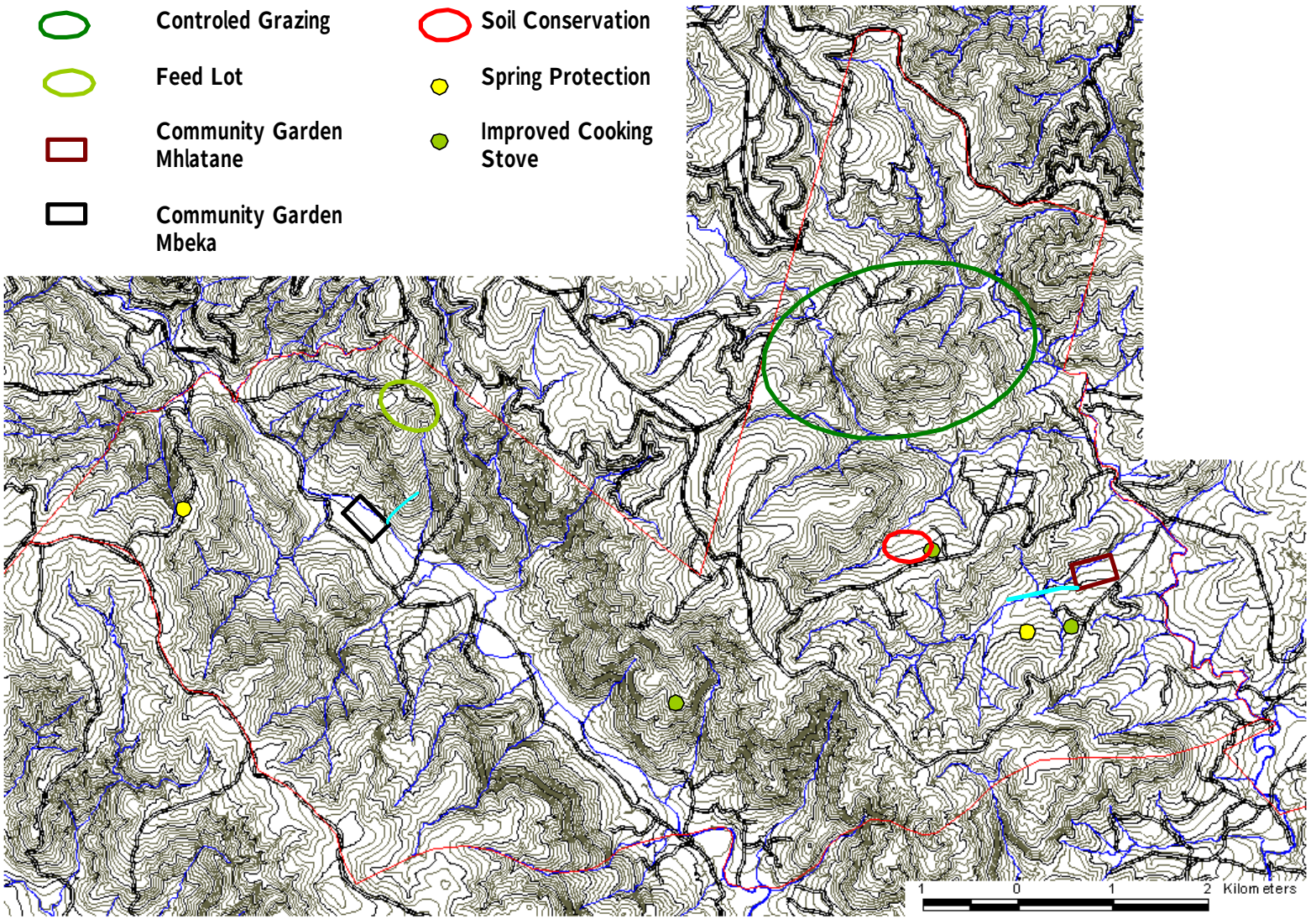


Location Map of Proposed Pilot Projects in Target Area 1

I.3 Location of the Pilot Projects in TA2



I.4 Location of the Pilot Proiects in TA3



I.5 Contour Terrace and Gully Training

Item	Contents	Remarks
1. Objective	1) Minimizing soil loss from surface 2) Improvement of vegetation in grazing area 3) Stabilization of gully from bottom	
2. Beneficiaries	TA1:7 households, TA2:40 households, TA3:18 households	
3. Implemented by	Communities supervised by NGO	
4. Location	TA 1 (Ngcayini Chiefdum) TA2(Zikhoteni Chiefdum) TA3(Macdvulwini	
5. Description of Projects		
(1) Outline: Contour Terrace	1) The width of contour terraces are fixed at 1.7 meter and their interval varies from topographic gradient, ranging 15.5 ～20.5m. The length of the terraces is also variable, ranging 20 ～36m, so that cattle can pass one block to another between two terraces of the same elevation. The surface of the terraces is planted with rhizomes of drought tolerant, palatable and readily available grass spieces	
: Gully Training	2) In order to retain clay material and let them sediment at the bottom of gullies, locally available materials such as stones, sand, tree blanches were heaped in the botom of gullies and induced sedimentation at the bottom.	
(2) Main Facilities	1) Contour Terrace 2) Drought Tolerant grass 3) Checks made of sand bag, stone brances	
(3) Maintenance by	1) Soil Conservation Committee	
(4) Schedule	1) One to two months in each location	
6. Project Cost	1) TA1:E70,000, TA2:E69,000, TA3:E51,000	

7. Actual Schedule

Description	2002 wet season 1	2	3	dry season 4	5	6	7	8	9	10	wet season 11	12	2003 1	2	3	dry season 4	5	6	7	8	9	Incharge
Planning and Detailed Design																						JICA, PPMU
Contract to NGO																						JICA
Implementation in TA1																						Community, PPMU, NGO
Implementation in TA2																						Community, PPMU, NGO
Implementation in TA3																						Community, PPMU, NGO
Training by NGO																		▼				NGO, JICA
Monitoring								▽					▽				▽					PPMU,JICA
Evaluation																						Community,JICA

I.6 Fenced Grazing Scheme

Item	Contents	Remarks
1. Objective	1) Minimize soil errosion caused by free grazing activities 2) Increase income from livestock by improvement of grazing land 3) Train controlled grazing management	
2. Beneficiaries	TA1at Eni:47 households at Engcayini:79 households, TA3:500 households	
3. Implemented by	Communities supervised by NGO	
4. Location	TA1 at Eni and at Ngcayini, TA3 at Ntabamhlophe hill	
5. Description of Projects		
(1) Outline:	1) Fencing was erected to control the grazing scheme and it was subdivided into four to six paddocks in order to control the places for cattle to feed. For Eni, for area of about 90 ha, for Engcayini, for an area covering 100 ha. For TA3, for an area of 390 ha	
(2) Main Facilities	1) Timber post and birbed wire fencing 2) Gate for livestock and human movement	
(3) Maintenance by	1) Grazing Committee	
(4) Schedule	1) Two months to erect fencing covering 100ha of grazing field. Schedule was depend on the feature of slope and condition of soil	
6. Project Cost	1) TA1:E170,000 TA3:E200,000	

7. Actual Schedule

Description	2002 wet season 1	2	3	dry season 4	5	6	7	8	9	10	wet season 11	12	2003 1	2	3	dry season 4	5	6	7	8	9	Incharge
Planning																						JICA, PPMU
Detailed Design																						JICA,PPMU
Contract to NGO for TA1																						JICA
Erection of Fence in TA1:Engcayini																						Community, PPMU, NGO
Erection of Fence in TA1:Eni																						Community, PPMU, NGO
Contract to NGO for TA3																						JICA
Erection of Fence in TA3																						Community, PPMU, NGO
Fenced Grazing																						Community
Training by MOAC															▼			▼				MOAC
Monitoring								▽					▽				▽					PPMU,JICA
Evaluation																						Community,JICA,PPMU

I.7 Feed Lot Beef Fattening Unit

Item	Contents	Remarks
1. Objective	1) Minimize soil errosion caused by free grazing activities 2) Increase income from fattening of surplus stock of sale 3) Introduce commercializing livestock management	
2. Beneficiaries	TA1: 126 households, TA3:500 households	
3. Implemented by	Communities supervised by NGO	
4. Location	TA1 at slope to the east of Ncebo dip tank, TA3 at near the Nkhundla Dip Site	
5. Description of Projects		
(1) Outline:	1) A feedlot structure was constructed which has an area of 140sqm concrete slabs, water trough and feed trough will be provided to feed 2) Fodder production field of 2 to 4 ha will be situated next to the feedlot to supply fodder to the cattle.	
(2) Main Facilities	1) Feedlot with concrete slab 2) Fencing 3) Fodder Field	
(3) Maintenance by	1) Feedlot Committee	
(4) Schedule	1) About 3 months for construction of feedlot and development of fodder. Fodder must be developted during rainy season	
6. Project Cost	1) TA1:E76,000 TA3:E89,000	

7. Actual Schedule

Description	2002										2003										Incharge
	wet season			dry season							wet season					dry season					
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	
Planning																						JICA, PPMU
Detailed Design																						JICA,PPMU
Contract to NGO for TA1																						JICA
Feedlot construction																						Community, PPMU, NGO
Fodder development																						Community, PPMU, NGO
Contract to NGO for TA3																						JICA
Feedlot construction																						Community, PPMU, NGO
Beef Fattening																						Community, PPMU
Training by MOAC															▼			▼				MOAC
Monitoring								▽					▽				▽					PPMU,JICA
Evaluation																						**Community,JICA,PPMU**

I.8 Integrated Tree Nursery

Item	Contents	Remarks
1. Objective	1) Eliminate shortage of tree seedlings 2) Soil conservation by afforestation 3) Income generation by sales of both tree and fruit seedlings	 
2. Beneficiaries	TA2: 2,338 households	
3. Implemented by	Communities supervised by NGO	
4. Location	TA2 at Zikhoteni Chiefdom, next to St. Aselem School.	
5. Description of Projects		
(1) Outline:	1) The nursery occupied around 3000㎡ out of the fenced area of 1ha and obtain water from adjacent stream. A designed seedling capacity will be 160,000 seedlings per year and the tree speices to be grown are those for afforesation, agroforestry and for rehabilitation purposes.	
(2) Main Facilities	1) Seed bed, Shade house, 2) Water Intake 3) Water Tank	
(3) Maintenance by	1) Nursery Committee	
(4) Schedule	1) About one year to construct nursery including water intake facilities	
6. Project Cost	1) E680,000	

7. Actual Schedule

Description	2002 wet season 1	2	3	2002 dry season 4	5	6	7	8	9	10	2002 wet season 11	12	2003 dry season 1	2	3	4	2003 dry season 5	6	7	8	9	Incharge
Planning		▭																				JICA, PPMU
Phase 1 Development																						
Detailed design					▭																	JICA,PPMU
Contract to NGO						▭																JICA
Water intaka and Tank							▭	▭	▭													Community, PPMU, NGO
Phase 2 Development																						JICA
Detailed design										▭												JICA,PPMU
Contract to NGO											▭											JICA
Seed bed, Shed, Store,etc												▭	▭	▭	▭							Community, PPMU, NGO
Production of Seedlings																		▭	▭	▭	▭	Community, PPMU
Training																		▼				PPMU,JICA
Monitoring								▽					▽				▽					PPMU,JICA
Evaluation																	▭	▭	▭			Community,JICA,PPMU

I.9 Afforestation Program

Item	Contents	Remarks
1. Objective	1) Soil conservation by afforestation 2) Eliminate the shortage of fire wood, pole 3) Establish community woodlots	
2. Beneficiaries	Communities in Zikhoteni Chiefdom, 720 households	
3. Implemented by	Communities supervised by NGO	
4. Location	TA2 Zikhoteni Chiefdom	
5. Description of Projects		
(1) Outline:	1) Afforestation was undertaken in the community area and will be planted and fenced off to protect the young seedlings from livestock browsing. Eucalyptus was selected for initial tree spiece to be planted for the sake of soil conservation as well as usage for poles and fuel wood in future.	
(2) Main Facilities	1) Fencing 2) Errosion Protection 3) Trees	
(3) Maintenance by	1) Afforestation Committee	
(4) Schedule	1) Planting in wet season is optimum.	
6. Project Cost	1) E190,000	

7. Actual Schedule

Description	2002												2003									Incharge
	wet season			dry season							wet season		dry season									
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	
Planning																						JICA, PPMU
Detailed Design																						JICA,PPMU
Contract to NGO																						JICA
Erection of Fencing																						Community,NGO,PPMU
Planting Seedlings																						Community,NGO,PPMU
Maintenance																						Community
Monitoring													△				△					JICA,PPMU
Evaluation																						Community,JICA,PPMU

I.10 Improved Fallow

Item	Content	Remarks
1. Objective	1) To increase soil fertility 2) To obtain higher crop yields 3) To improbe degraded land	
2. Beneficiaries	59 households	
3. Implemented by	individual farmers with assistance of JICA	
4. Location	Target Area 2 : Zikhoteni Chiefdom	
5. Description		
(1) Outline	1) *Sesbania sesban* will be planted at a spacing of one meter by one meter. In the same year, rows of maize will be planted as usual alternately between the rows of tree shrubs and in second year, tree shrubs will be left to grow alone. In third year, the trees will be harvested leaves and small twigs incorporated into soil while bigger branches will be used for 2) This method will be able to fix nitrogen and copious generation of organic matter which greatly improves soil structure besides injection of the necessary plant nutrients.	
(2) Main Facilities	1) Tree Speices as *Sesbania Sesban*	
(3) Maintenance	1) By individual farmer	
(4) Schedule	1) About three years	
5. Cost	1) E1,000 for purchasing seeds	

6. Actual Schedule

Description	2002 wet season 1	2	3	dry season 4	5	6	7	8	9	10	wet season 11	12	2003 1	2	3	dry season 4	5	6	7	8	In Charge
Planning																					JICA, PPMU
Detailed Design																					JICA, PPMU
Procurement of Seed																					JICA
Germination																					PPMU
Planting seedlings																					Community,PPMU
Monitoring																		△			PPMU, JICA
Evaluation																					JICA,PPMU,Community

I.11 Community Garden

Item	Content	Remarks
1. Objective	1) Soil Conservation by terracing effect. 2) Effective utilization of unused natural resources. 3) Income generation by communities 4) Raise women's status	
2. Beneficiaries	TA3:Mhlatane,27 households, Mbeka,30 households, TA2:Zikhoteni,21 households	
3. Implemented by	Gardem members supervised by NGO	
4. Location	TA3:Mhlatane, Mbeka, TA2:Zikhoteni,	
5. Description		
(1) Outline	1) Community gardens are developed with small irrigation facilities which use only gravity. Suitabel vegetables such as cabbage, tomato, spinach, carrot are planted and will consumed by communities. Extra production will be sold for their income generations.	
(2) Main Facilities	1) Water Intake and delivery pipe 2) Fencing 3) Plot development 4) Irrigation Pipe	
(3) Maintenance	1) Garden Committee but each plot was responsible by individual member.	
(4) Schedule	1) One year including group development	
6. Cost	1) E200,000 for one garden	

7. Actual Schedule(Zikhotheni Garden)

Description	2002 wet season 1	2	3	dry season 4	5	6	7	8	9	10	wet season 11	12	2003 1	2	3	dry season 4	5	6	7	8	In Charge
Planning(market survey,soil analysis)																					JICA, PPMU
Detailed Design					▭																JICA, PPMU
Contract to NGO(Phase 1)						▭															JICA
Group Development							▭	▭													Community, PPMU, JICA
Fencing, water intake								▭	▭												Community, PPMU, JICA
Contract to NGO(Phase2)										▭											JICA
Piping											▭	▭	▭								Community, PPMU, JICA
Plot Development													▭	▭							Community, PPMU, JICA
Training														▼	▼	▼					PPMU,JICA
Production of Vegetables															▭	▭	▭	▭	▭	▭	Community
Monitoring													△				△				PPMU, JICA
Evaluation																	▭	▭	▭		Community, PPMU,JICA

I.12 Spring Protection

Item	Content	Remarks
1. Objective	1) Protect community water source from degradation by erosion and pollution 2) Effective usage of existing resources 3) Reduce working loads and time for women and children	 
2. Beneficiaries	20 Households at one location staying near water source times 6 locations equal to 120 households	
3. Implementaed by	Community supervised by NGO	
4. Location	TA1:2 locations at Eni & Ngcayini, TA2:2 locations at Galile & Leten, TA3: 2 locations at Matfunjwa & Eboteni,	
5. Description		
(1) Outline	1) There are some water sources in each Target Area. These sources were not protected and utilized properly so that many sources were polluted by errosions and livestock. Therefore, those areas should be fenced and water sources will be well protected. Proper water intake, water tank washing basin and shower room were constructed.	
(2) Main Facilities	1) Water Intake 2) WaterTank (1200liter) 3) Washing Basin, Shower Room	
(3) Maintenance	1) Spring Protection Committee	
(4) Schedule	1) 2 weeks for 1 location	
6. Cost	1) E30,000 for one spring protection	

7. Actual Schedule

Description	2002 wet season 1	2	3	dry season 4	5	6	7	8	9	10	wet season 11	12	2003 1	2	3	dry season 4	5	6	7	8	Incharge
Planning																					JICA, PPMU
Detailed Design																					JICA,NGO
Contract to NGO																					JICA
Construction of Structure																					Community,NGO,PPMU
Monitoring													△				△				Community,PPMU,JICA
Evaluation																					Community,PPMU,JICA

I.13 Improved Cooking Oven

Item	Content	Remarks
1. Objective	1) To reduce firewood consumption 2) To reduce women's work load and cooking time 3) To reduce diseases caused by drinking unboiled water	 
2. Beneficiaries	Every households which have intension to implement. Possible beneficiaries are 140 in TA1, 721 in TA2, and 595 in TA3.	
3. Implemented by	Improved Cooking stove committee	
4. Location	At individual household.	
5. Description		
(1) Outline	1) Concept of improved cooking stove was introduced in Kenya by Japanese expert. This stove can be constructed only by locally available materials such as stone, sand, clay and water. 2) This stove has three openings and three dishes can be cooked simultaneously and heat efficiency is higher than convensional stoves, so that the consumption of firewood will be reduced.	
(2) Main Facilities	1) Improved Cooking Stoves	
(3) Maintenance	1) Individual Household	
(4) Schedule	1) It needs half day to construct with around 10 peoples. Material shall be prepared before construction.	
7. Cost	1) nill Locally available material such as clay, water, and soil were used	

8. Actual Schedule

Description	2002 wet season 1	2	3	dry season 4	5	6	7	8	9	10	wet season 11	12	2003 dry season 1	2	3	4	5	6	7	8	In Charge
Planning	▭	▭	▭																		JICA, PPMU
Demonstration by JICA		▭	▭																		JICA, PPMU
Extension of stoves by communities						▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	Community
Monitoring						△				△			△				△				PPMU,JICA
Evaluation													▭	▭	▭	▭					Community, PPMU,JICA