



mahlathini
development foundation



Water stewardship in the upper uThukela

Progress February 2024

Smallholder climate resilient agriculture and
water provision

SODI!



**Project outcomes:
(1 July 2022-14 March 2024)**

1. Conservation agriculture with VWB – runoff and water productivity

2. Improved access to water

3. Improved governance and water stewardship through multistakeholder engagement

PROPOSED	ACTUAL	COMMENTS
106 participants, 5-8 villages	124 participants	Increased number of participants across 5 villages
20ha	37,2ha	Increase in area planted
11 fodder trials	16 fodder trials	Lespedeza, tall fescue, turnip, sorghum, cow peas
Runoff replenishment: 500 000L/ha	240 000L/ha	Lower than expected due to flooding
Water access: 20 households	64 households	More households involved
Water access quantity: 7300kL	3700kL	Lower availability of water – still in progress
Water productivity replenishment: 8 million L	7 million L	Slightly lower than expected – due to flooding



Outcome	Activities	Progress (Milestone 3)
<p>CA with VWB for reduced runoff and water productivity</p>	<p>Development of CA farmer level trials for a minimum 25 participants with measurement of run-off, rainfall, bulk density, evapotranspiration and water productivity for around 8-12 participants.</p>	<ul style="list-style-type: none"> ✓ CA across 5villages:22 CMTs plus 102 farmer managed trials. crop growth monitoring (124 participants in total) ✓ CA trials (12,4ha), CA total (37,2ha), planned and planted for yr2 ✓ Runoff and rainfall results compiled for 8 participants, yr1, 5 participants yr2 ✓ Soil samples yr1: (17 CMTs and 5 other participants) analysed. ✓ Bulk density and WP undertaken for 8 participants (Sampling in May'23)
	<p>Inclusion of a range of options for cropping different varieties of maize, legumes and cover crops. Measurement of cropping areas, crop growth and yield for a minimum of 75 participants</p>	<ul style="list-style-type: none"> ✓ Range of trials including remedial fenced and fodder trials alongside strip cropping and block trials for intercropping and crop rotation ✓ Yield measurements for 25 CMTS and 50 participants (overall 75 participants)_ May'23
	<p>Fodder supplementation farmer level experiments undertaken for a minimum of 11 participants with monitoring of growth, yield and animal condition</p>	<ul style="list-style-type: none"> ✓ Fodder supplementation trials planted and monitored for 9 participants yr1 and 16 for yr2. ✓ Fodder biomass and feed quality analysis ✓ Fodder supplementation experimentation – 7 participants ✓ Fodder supplementation w/s for planning and



Outcome	Activities	Progress (Milestone 3)
Improved access to water at household level for both consumption and farming through community owned water provision projects.	Water committees and external service providers plan and implement a local water supply scheme through protection of at least 1 spring and reticulation to ~20 households	<ul style="list-style-type: none"> ✓ Vimbukhalo finalisation of localised scheme for 53 Households ✓ Follow up meetings re management and maintenance. ✓ Follow-up meetings and maintenance activities in Stulwane for protected spring and reticulation system (11 extra Households) ✓ Total of 2 700Kl of water access per annum (1 908Kl in Vimbukhalo and 792Kl in Stulwane) ✓ Stulwane/Costone: initiation of new water access process from 2 in stream springs in upper catchment for 75 households (additional 1 000Kl)



Outcome	Activities	Progress (Milestone 3)
<p>Improved governance and water stewardship in the communal tenure areas of the upper uThukela through multiple stakeholder engagement activities with the CRA learning groups</p>	<p>CRA learning groups undertake meetings and stakeholder engagement</p>	<ul style="list-style-type: none"> ✓ Attendance of the Bergville LM Extravaganza -6Dec 2022 ✓ Bergville regenerative agriculture farmers' open day – 23 February 2023 (focus on CC and water) ✓ UKZN-ESS: Thematic workshops in Stulwane and Ezibomvini: 28,29 March 2023 ✓ uThukela Water Partnership (11 April-core group, 23 May) ✓ CA annual review sessions for 4 villages (September 2023) ✓ uThukela Water Partnership -Northen Drakensberg Collaborative (NDC) – Core team meetings and stakeholder field visit to Costone/Stulwane (23 August-core group,28 September 2023) ✓ Resource conservation planning and implementation meetings in Ezibomvini and Costone/Stulwane – September and October 2023) ✓ Community level cross-visit to discuss resource conservation implementation and governance considerations from Ezibomvini-Costone/Stulwane (29 September 2023) ✓ UKZN-SAEON – Ecosystem services and resource conservation mapping community workshops and handover -18 October (Ezibomvini and Costone/Stulwane ~55 participants) ✓ CSIR Science Forum Pta-Dec '23 ✓ New partnerships for CA trials (liquid fertilizer and varieties) – Zylem and FSG (biochar)
 	 	

Layout of CA trials

BLOCKS (10x10m) x 10 plots	1 M	2 M+B	3 SCC	4 M	5 M+B
	10 M+CP /Pk	SCC	8 M+B	7 M	6 SCC
Strips (2mx50m) x10 strips	1 M				
	2 M+B				
	3 SCC				
	4 M				
	5 M+B				
	6 SCC				
	7 M				
	8 M+B				
	9 SCC				
	10 M+CP/Pk				
Fodder Strips (2mx50m) x 8 strips	SSM				
	B/WCC relay				
SSM: PAN4A128 / SC701	SSM				
	Lespedeza				
	SSM				
	Tall Fescue				
	SSM				
	B/WCC relay				

FENCED
TRIALS -500m²
(10mx10m)x5
Compared to
normal blocks

To keep all stover
-zero grazing



REMEDIAL
TRIALS –
1000m²

Limed and
ploughed
contours and
swales
Dense planting
of cover crops

To correct 'bad'
soils that are not
improving



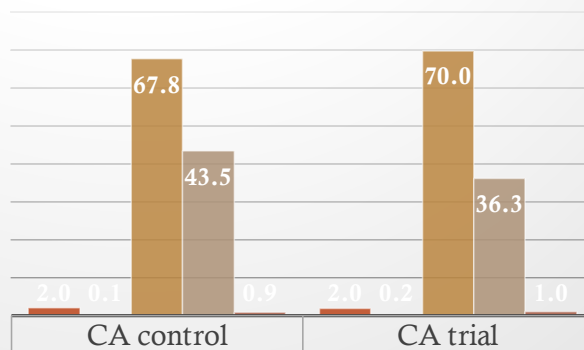




Measurements

Soil fertility analysis (25 participants – December 2022)

Bergville 2022 N=25 Soil fertility results for CA control and CA trial samples across 7 villages



	CA control	CA trial
■ Average of Org. C %	2.0	2.0
■ Average of N %	0.1	0.2
■ Average of N Required (kg/ha)	67.8	70.0
■ Average of P required (kg/ha)	43.5	36.3
■ Average of Lime req t/ha	0.9	1.0

- ◆ Average % Org C for CA control plots are 1,5% and CA trial plots 1,9%.
- ◆ Average % N for Ca control plots is 0,15% and for CA trial plots is 0,19%
- ◆ The P requirement for the CA trial plots is substantially lower than for the CA control plots

Soil conditions are not significantly different for the CA trial and control plots.

Notable difference where CA trial plots fare better are in %N and in fertilizer P requirements. These do indicate an improvement through judicious fertilizer use, multi cropping and crop roataiton.

Measurements

Bulk density

Bergville ρ_b (g/cm ³)	2018/19	2019/20	2020/21	2021/22	2022/23
CA multi cropped plots combined	1,26	1,29	1,12	1,14	1,91
CA control (M)	1,36	1,40	1,23	1,26	1,95
Conventional control (M)	1,30	-	1,24	-	2,04



Above: Taking bulk density samples at Phumelele Hlongwane in Ezibomvini Bergville

- Bulk density for multi-cropped plots are lower than the mono-cropped maize for all 5 seasons measured.
- Bulk density for the conventionally tilled maize only plots are higher than the CA maize only control plots for the 3 seasons of measurement

Results for 2022/23 are substantially higher than for the 4 previous seasons. Errors during analysis are assumed as the reason.

Measurements and results Water productivity field cropping

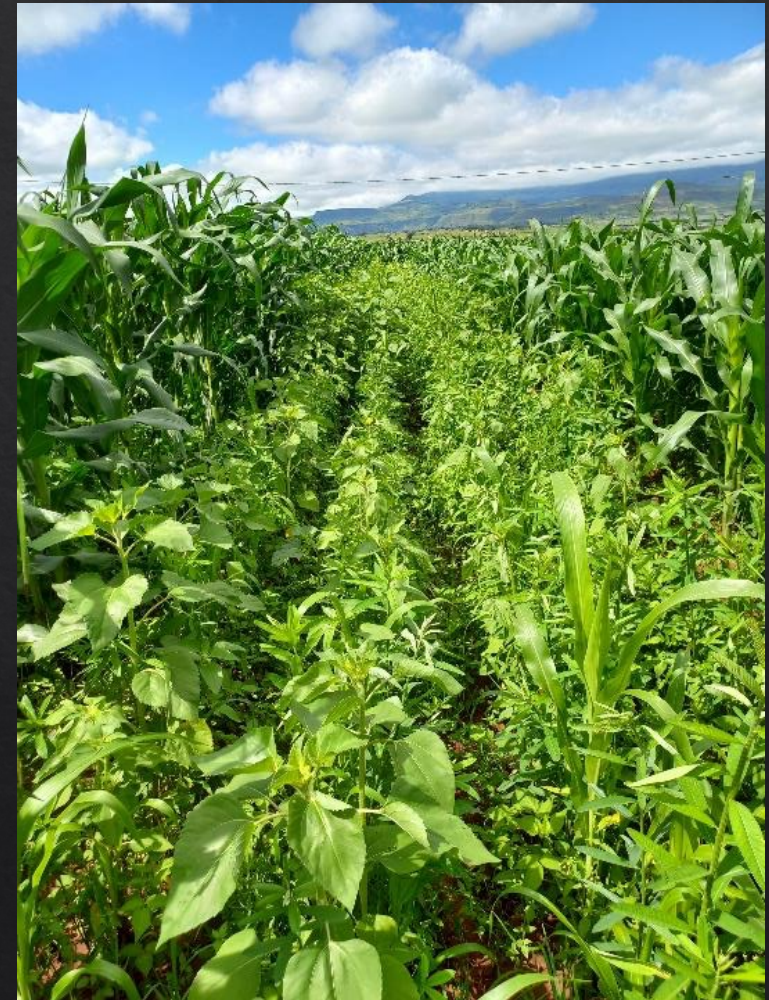
- Water productivity for CA maize grown as an intercrop with beans or cowpeas is higher than single cropped CA maize and
- Water productivity for CA plots is significantly higher than conventionally tilled plots.
- Despite annual differences in water productivity, these trends remained the same across three to four seasons for all three areas within KZN.
- The annual increase in WP for the CA plots (both control plots and trial plots) is also evident.

Cropping options (BERGVILLE)	WP (kg/m ³)				Ave WP (4 seasons)
	2022/23 (n=8)	2021/22 (n=8)	2020/21 (n=11)	2019/20 (n=9)	4yr Ave
CA – Maize (M)	2,09	2,64	2,28	1,11	2,03
CA- Maize, bean intercrop (M+B)	3,38	3,07	2,50	1,21	2,54
CA- Maize control (M-CA control)	1,54	1,42	1,10	0,80	1,22
Conventionally tilled maize (M-Conv Control)	2,1		0,75	0,36	1,07

WP for maize grown in a multi-cropping rotation CA system is much higher (x2) than CA mono-cropped maize or conventionally tilled maize

Measurements and results Volumetric water benefit field cropping

	CA trial (inter cropping)	CA control (mono cropped M)	Conv control (mono cropped M)
kg/m ³ (WP)	2,54	1,22	1,07
Difference (CA trial-CA control- Conv control)	1,32	0,15	
Volumetric water difference (l/kg)	1 320	150	
Yield (t/ha)	5,30	1,8	
VWB(l/ha) 2022/23	6 996 000	270 000	
VWB (l/ha) 2021/22	8 840 300	344 400	

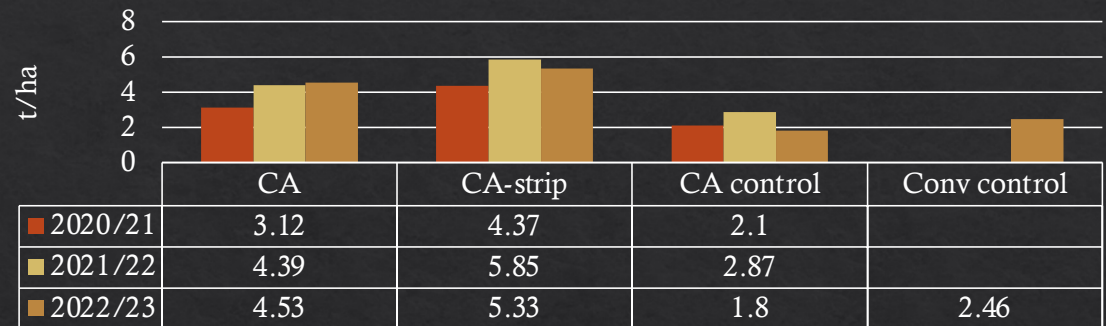


Volumetric water benefit for intercropped and rotated CA plots is ~7 million litres/ha more than conventional tillage and for mono-cropped CA plots is ~0,3 million litres/ha more than conventionally tilled plots.

Productivity: Yields (Bergville)



Comparison of maize yield per treatment; 2020/21 to 2022/23 (n=50 for 5 villages)



Comparison of yield pairs: Tukey-Kramer	Mean difference	p-value
Strip - CA control	3,531	<0,0001
Strip - Conv control	2,868	<0,0001
CA - CA control	2,734	<0,0001
CA - Conv control	2,070	0,0028
Strip - CA	0,797	0,1762
Conv control - CA control	0,663	0,8258

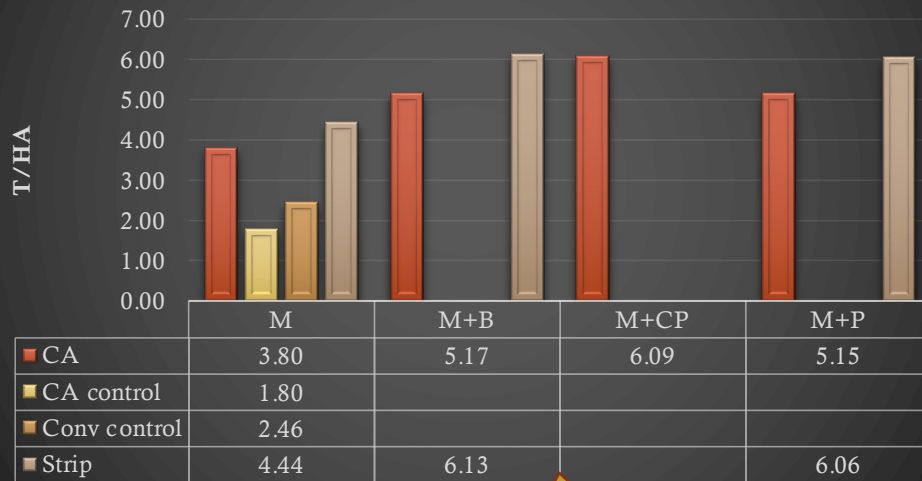
On average the CA block trial plots produce 2t/ha more maize than the control plots (CA and conventional)

and the CA strip trial plots produce 3t/ha more. ha

Maximum yields have increased from 6,7 t/ha to 13,6 t/ha between 2014 and 2023.

Bergville yields continued

Maize yields for monocropping and intercropping after a 3 year period



Now it is possible to more clearly see the impact of intercropping on yield improvement of maize



Measurements

Fodder nutrient analysis for veld, and stover (beans, SCC and Lespedeza)
April 2023

Sample ID	Species	Name	Location	Moisture %	NDF %	ADF %	Protein %	Fat %
NN beans	Beans	Nomavila Ndaba	Eqeleni	75,21	58,72	46,63	12,19	3,20
LD Beans	Beans	Lungile Dladla	Eqeleni	41,32	34,08	26,34	21,26	2,04
KD-Fodder	Lespedeza	Khulekani Dladla	Stulwane	38,56	65,18	54,88	8,95	2,96
NZ Fodder	Lespedeza	Nothile Zondi	Stulwane	39,48	69,07	54,30	11,67	2,97
NZ Veld	Veld	Nothile Zondi	Stulwane	49,25	78,59	44,51	5,53	2,51
TDS Veld	Veld	Thulani Dlamini_Stulwane	Stulwane	48,48	80,65	47,03	4,80	2,65
TD Veld	Veld	Thulani Dlamini_Eqeleni	Eqeleni	57,91	77,04	44,96	4,91	2,66
SM SCC	SCC	Sthabiso Manyathi	Eqeleni	59,74	59,68	36,23	7,35	2,72
NZ SCC	SCC	Ntombakhe Zikode	Eqeleni	48,81	54,35	32,91	10,46	2,96
NM SCC	SCC	Nelisiwe Msele	Stulwane	53,66	63,25	40,54	13,67	2,47

Veld nutrient and protein availability is too low for maintenance of condition in livestock

SCC nutrient and protein availability is good for both growing and lactating animals

Lespedeza provides high protein but is not that palatable

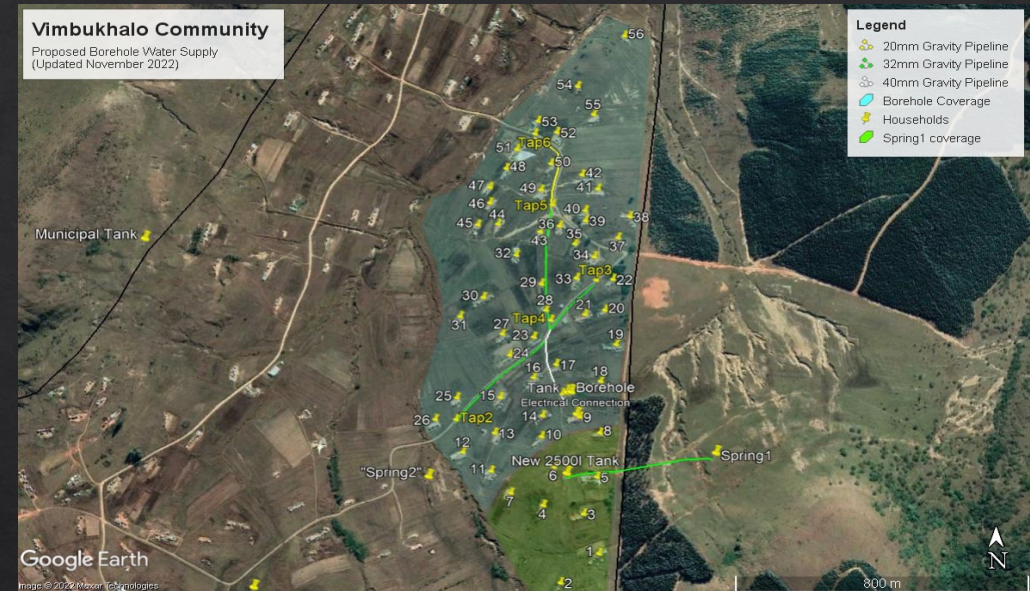
Bean stover has the best protein content and potential nutrient availability

Further analysis and community level workshops to follow in June-July 2023

Water access

Vimbukhalo borehole refurbishment and reticulation

Tank(L)	No of HH	L/hh/day	Monthly water use (L/mth)	Annual water use (L/yr)
2500	13	96	37 440	
5000	40	62,5	75 000	
TOTALS	53		112 440	1 349 280
Averaging	53	100	159 000	1 908 000



- ◆ 53 HH receive ~100l of water per day from 6 taps within 200m of their homesteads
- ◆ Annual water access is 1908Kl
- ◆ Management includes
 - ◆ Not pumping for more than 8 hours/day
 - ◆ Payment of R10/month by each household for pumping costs- managed by two small sub committees
 - ◆ Payment of R200/hh for maintenance costs

Water access

Stulwane spring protection and reticulation upgrade

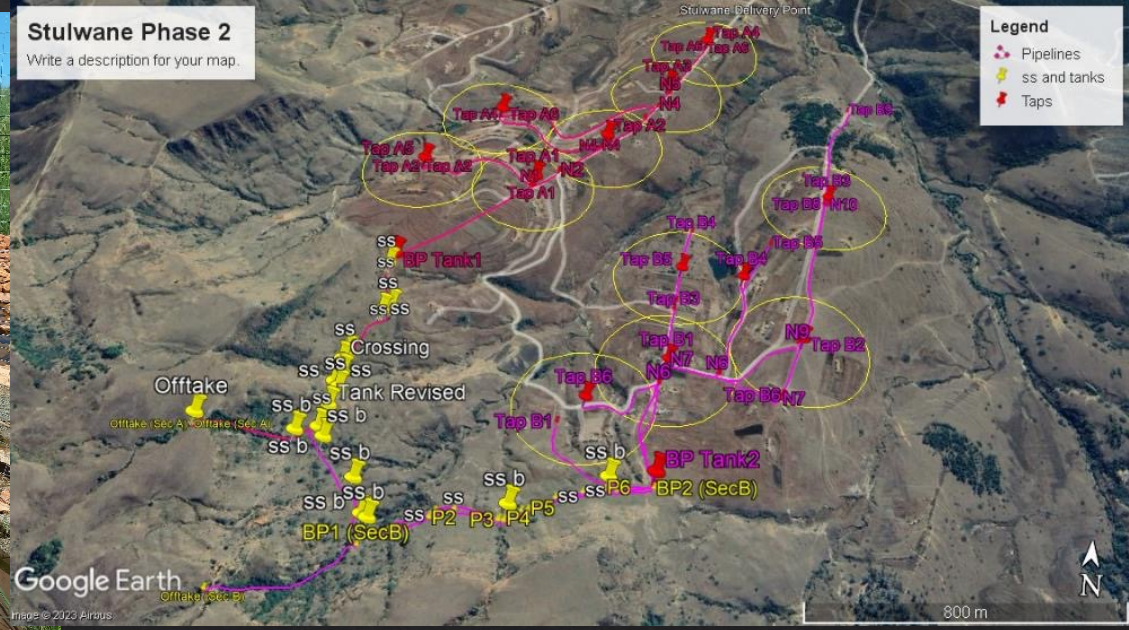


- ◆ 17HH originally another 11 now added through inclusion of 3 extra taps - all gravity fed.
- ◆ Each HH can collect between 200-380l per day
- ◆ Further 792Kl of water access per annum provided.
- ◆ Water committee elected to manage process and liaise with ward committee and Local Municipality

Work on further local water sources to start in May 2023

Water access

Stulwane 2x in stream abstraction and reticulation



- ◆ 75HH originally: Final possible, included and paid 69 HH
- ◆ Each HH can collect between 144l per day
- ◆ Further 1000 Kl of water access per annum provided.
- ◆ 2 sub committees elected to manage process and liaise with overall water committee, ward committee and Local Municipality. Also 12 tap groups to manage water for their sub area.

Many more participants, but lower overall water-as sources aren't that strong

Water access

Water quality testing

- ◆ Full laboratory analysis provided for the Vimbukhalo borehole, springs and streams– indicating an elevated level of fluoride.
- ◆ Springs have undergone quarterly tests for contamination using E Coli kits - which Eco champs have been trained to use and record. Until May2023

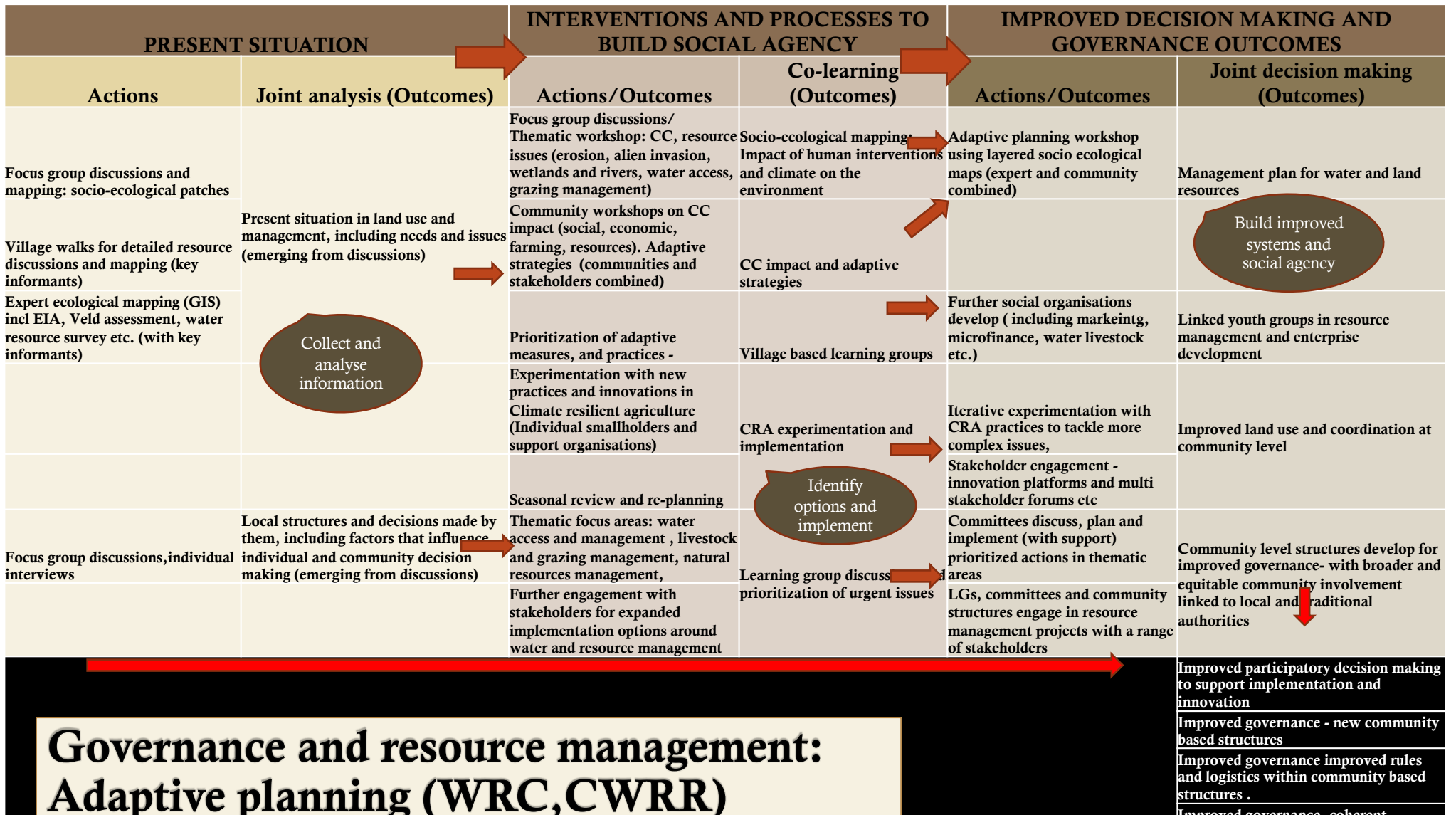



Test Report

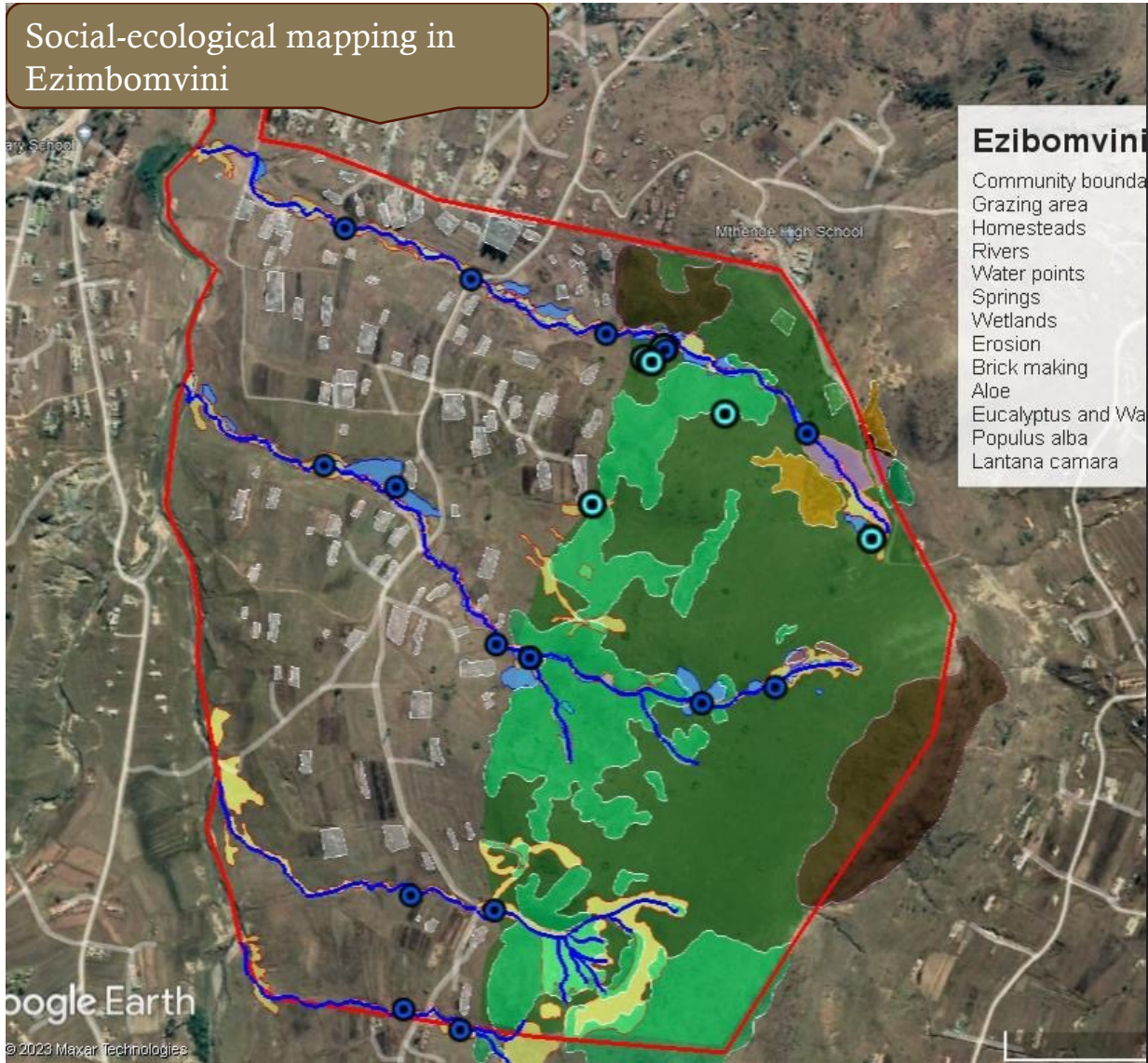
LABORATORY SERVICES DEPARTMENT

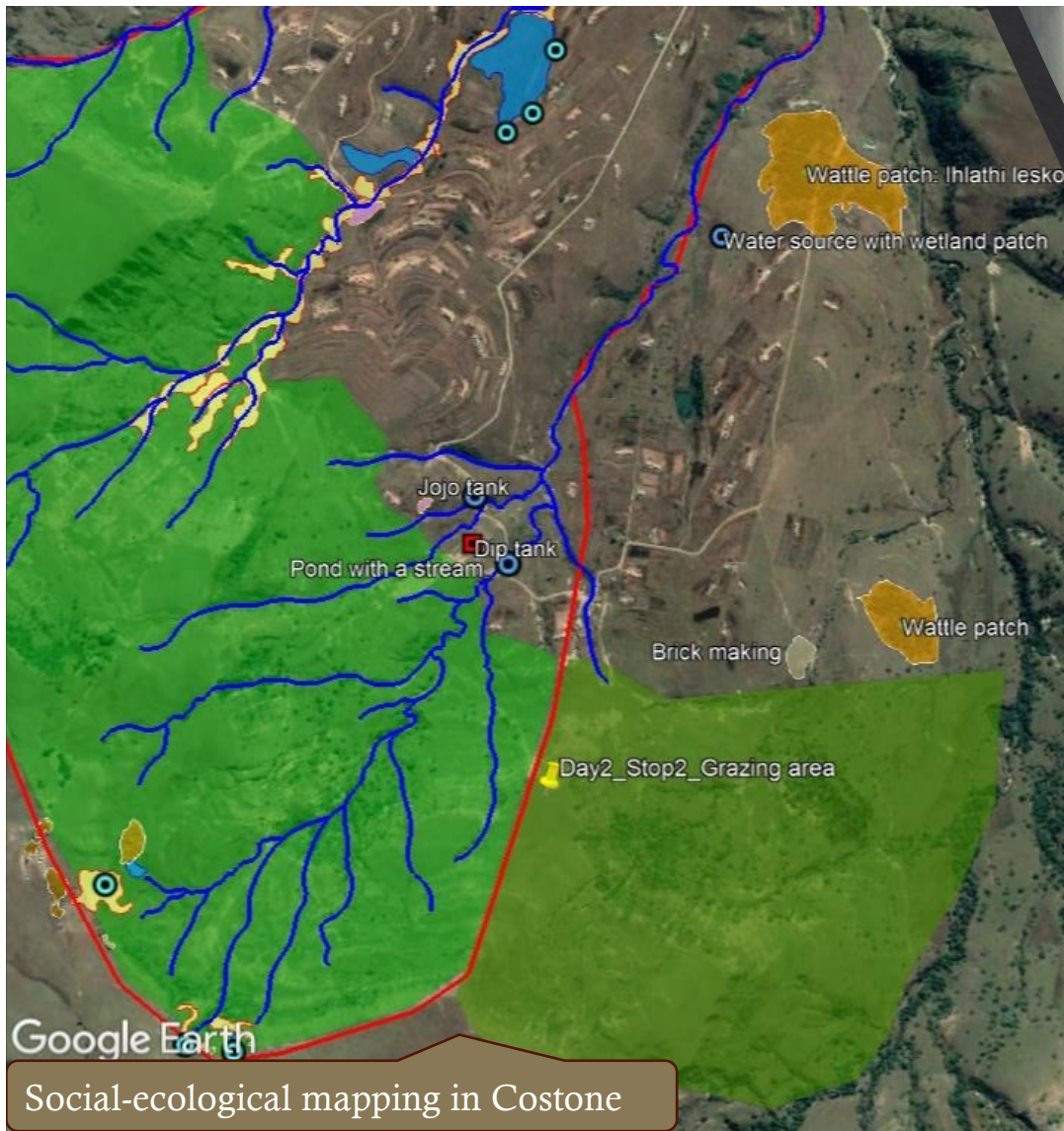
Test Report Number: 2004-0019 Page Number: 2 of 8

Sample ID	2190301		Uncertainty of Measurement (%)	SANS 241:2011 Drinking Water Standard Limits Required	SANS 241:2011 Drinking Water Classification	
Method Number	Sample Description	Source 1	Results			
1a	Alkalinity	mg CaCO ₃ L	18.2	±3.6%	no limit	-
1	Appearance	Appearance	Very Turbid Brown	not applicable	no limit	-
30	Calcium	mg CaL	<5.00	±4.3%	no limit	-
3a	Chloride (soluble)	mg ClL	1.38	±1.8%	4300	excellent
10	Colour	mg Pt.CoL	<1.00	±0.3%	400	excellent
Calculation	Condensed Nitrate + Nitrite Ratio	-	<0.12	not applicable	51	safe/health
21	Conductivity@ 25 °C	µS/cm	550	±1.8%	910	excellent
121	E.coli	MPN/100ml	88	±5%	0	safe/health
34	Fluoride	µg FL	>888	±5.3%	2100	chronic health
30	Iron	mg Fe/L	0.28	±3.2%	30.3	excellent
21	Water Hardness	mg CaCO ₃ L	>10.3	not applicable	no limit	-
80	Hardness/Total Dissolved Solids (TDS)	mg/L	>988	±20%	1000	occasional
30	Potassium	mg K/L	<5.00	±6.6%	no limit	-
30	Magnesium	mg Mg/L	<5.00	±0.2%	no limit	-
30	Manganese	mg Mn/L	0.18	±0.8%	40.0	excellent
30	Sodium	mg Na/L	<5.00	±0.3%	40.0	chronic health
3a	Nitrite (soluble)	mg N/L	<0.10	±0.4%	40.0	excellent
3a	Nitrate (soluble)	mg N/L	<0.10	±0.8%	411	safe/health
1	Odour	Appearance	0	not applicable	no reference	excellent
30	pH	not Limit	7.30	±0.5%	2.5 to 8.5	occasional
3a	Sulphate (soluble)	mg SO ₄ L	<1.00	±1.8%	400	excellent
81	Total Dissolved Carbon	mg C/L	1.08	±5%	50	chronic health
121	Total Coliforms	MPN/100ml	>848	±5%	50	occasional
80	Turbidity	NTU	40	±2%	51	occasional
					90	excellent



Social-ecological mapping in Ezimbomvini





Local resource management areas for improved eco system services- Community defined

Key Area	Management required	Notes
<p>Grazing areas (Amadlelo)</p> <p>-Livestock feed and water, firewood, medicinal plants,</p>	<p>Restoration and management.</p> <p>-Clear Lantana and use poison after cutting to stop regrowth</p> <p>-Rotational grazing</p> <p>-Control wildfires and make firebreaks. Storage drums for emergencies with fire one can use</p> <p>-Explore financial benefit – grant/incentive mechanisms</p> <p>-Monitor and manage nutrition of veld (erosion control, overgrazing control, removal of poisonous weeds, re-seed of palatable species)</p> <p>-Awareness raising in the community and for livestock owners.</p>	<p>-Eco-champs to do clearing</p> <p>-Dip tank committees and livestock associations</p> <p>-Better community collaboration with dip tank committee as well as TA and councillors</p> <p>-Community workdays</p>

- Clearing of Lantana in Ezibomvini and Costone.
 - Moving gates and fixing fences in Costone grazing area
 - Workshop presented by Working on Fire team in the uThukela area- re firebreaks and fire management



Local resource management areas for improved eco system services- Community defined

Key Area	Management required	Notes
<p>Erosion control</p> <p>-To ensure availability and quality of water and soil resources</p>	<p>Restoration</p> <ul style="list-style-type: none"> -Awareness raising and outline of responsible actions to enforce -Avoid expanding of minor erosion into dongas. -Prevent siltation and pollution. -Allow re-vegetation, naturally or through re-seeding -Prevent run-off -Check dams, brush packs, stone packs, -Prevent livestock from causing further damage -Control wildfire- make fire breaks <p>Storage drums for emergencies with fire one can use</p>	<ul style="list-style-type: none"> -TA and livestock committees to undertake some actions -Eco champs to assist -Some actions and contributions from community as a whole (e.g. loan of tractors, small financial contributions -External support -Continued support from UKZN and MDF in mapping, planning, proposal development, community structures and management
<p>Alien trees</p> <p>-Eucalyptus, poplar, and wattle plantations, and patches</p>	<p>Small changes</p> <ul style="list-style-type: none"> -Promote better management by 'owners' -Cut down and poison lantana and encroaching poplars -Ensure management of wattle patches -Remove trees from water sources and streams in all cases 	<p>-TA, Nkosi and 'owners" encouraged to undertake management activities as trees are useful in the community and cannot just be cleared.</p>

Stone packs and stone lines by eco champs in Ezibomvini and Community in Cosotone



Community based clearing of wattle in
Costone





Water quality testing in Ezibomvini and Costone, including mini SASS and E.coli. Cleaning of streambeds by community in Costone

Thank You
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