BUILDING CLIMATE RESILIENCE THROUGH PROTECTION OF WATER SUPPLY SOURCES:
Case of Rulindo and Gicumbi Districts

Water For People, the Ministry of Infrastructure and districts of Rulindo and Gicumbi developed district water supply sources management plans to ensure sustainability of water supply services. This paper will discuss the key findings and recommendations of the studies.

METHODOLOGY & KEY FINDINGS

During both studies, water supply sources recharge catchments were delineated using GIS and management measures for each recharge catchments were developed based on land husbandry technologies.

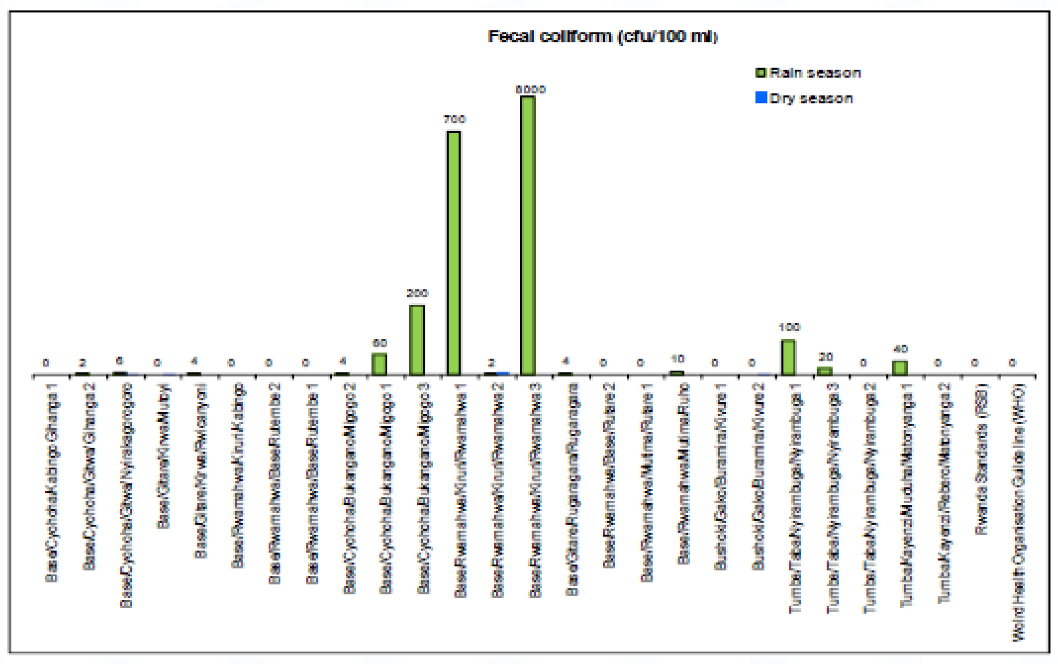
Both studies showed a perceived unbalance between water demand and supply in some sectors (administrative entities) in the near future, also water quality results showed that among the 7 parameters tested, total coliforms were observed in most of the springs and lower values of pH.

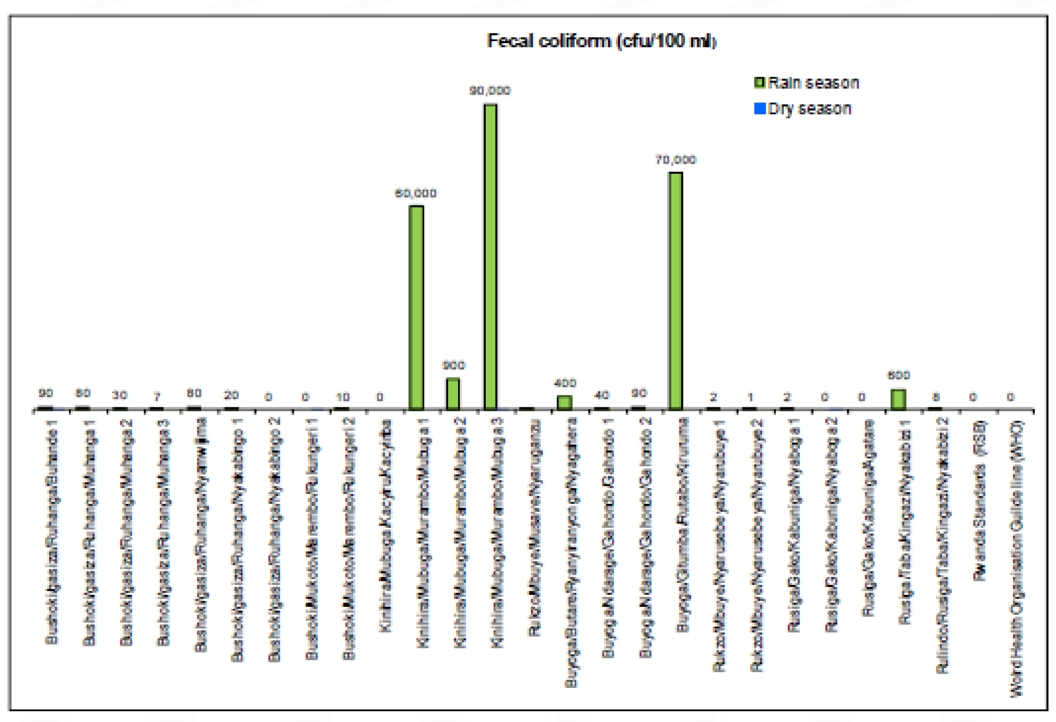
As a result Agroforestry with progressive terraces/cutoff drains, Agroforestry with cutoff drains/horizontal trenches, Agroforestry with radical terraces/gully treatment, Forest plantation, and Natural forest were recommend as collective measures at catchment level, while diversion ditches, fences, planting, removal eucalyptus, and progressive terraces were recommended at immediate sources catchment level.

To deal with the water quality aspect the studies recommended installation of chlorination units (as disinfection facilities) and pH regulators.

These measures if fully implemented will help to ensure continuous water supply services, address the issues of poor water quality and will prevent some of the climate change effects like landslides and water pollution during heavy rain.

Rulindo District





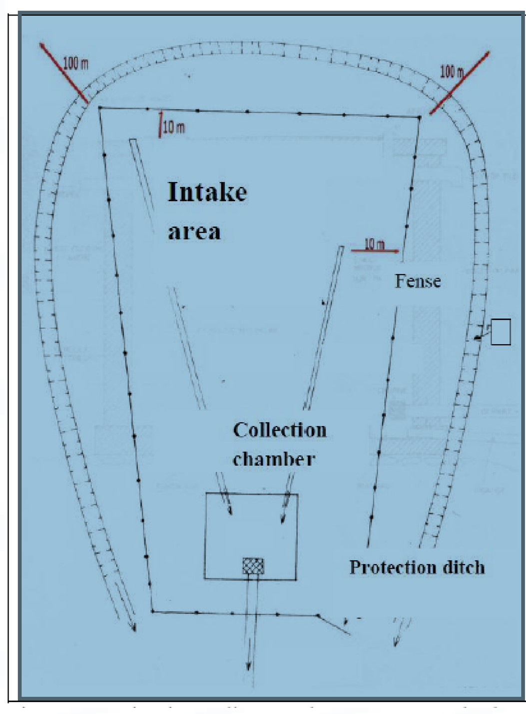
To identify the land resilience units in the project area, a comprehensive approach consisting of combining the slope classes and soil depth classes spatially in the project area based on the land unit matrix was applied. Fifteen classes were identified representing land husbandry land units in increasing order of care requirement (this classification also incorporate limitation for production per land units). In other words, the classification obtained indicates the level of technical and financial investment required to treat the different classes of land units identified.

Soil depth	Slope Categories				
	0-6%	6-16%	16-40%	40-60%	>60%
0-50 cm	9	10	11	12	15
50-100 cm	4	5	6	8	14
>100 cm	1	2	3	7	13

Land resilience Unit matrix

#	Code	Level of care requirement	Land Resilience Unit
1		Low	Croplands
2		Medium	Forest plantation
3		High	Rangelands/Croplands
4		Very High	Natural forest

Land resilience Unit



Upstream protection zone:
- 45^0 Arc radius of 100 meters upstream outside the protection ditch,
- No potential pollution source is allowed (latrines, life stock grazing), nor roots of trees in that zone

Direct protection area:
- Radius of 10 meters around the surface of catchment area within the fence,
- Should be fenced,
- No farming activities allowed (no plants, no animals within the fence.

Protection ditch:
- Circle the catchment area,
- Drain surface waters downstream,
- Limit direct infiltration into the capture.

Collection chamber / departure:
- Should be securely locked.

Spring immediate catchment area standard management measures
Source: WASAC Ltd

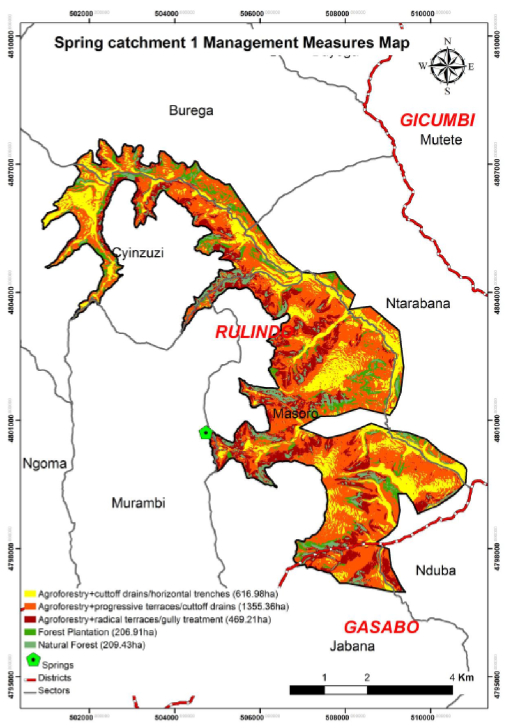
Budget estimated for short intervention for the protection of the springs already captured by WFP and others in pipeline

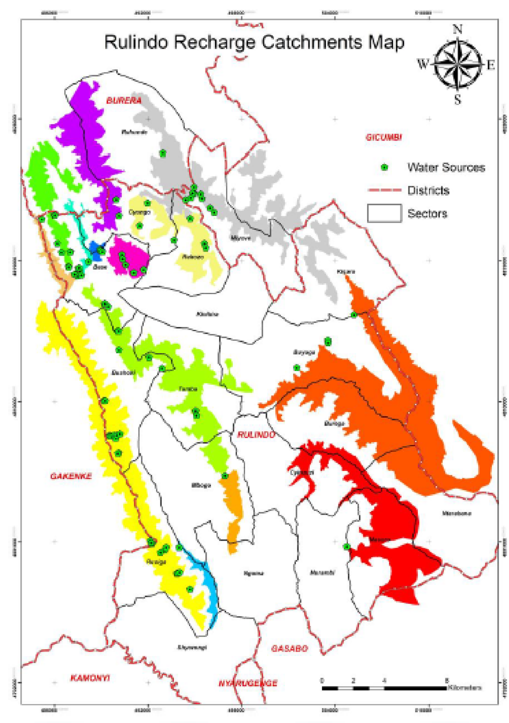
SN	Description of the intervention	Concerned water sources	Cost per source (Rwf)	Total budget (Rwf)
1	Provision of water diversion ditch at the catchment area	23	500,000	11,500,000
2	Provision of fences for spring catchment protection	25	300,000	7,500,000
3	Passparum plantation in the direct spring catchment area	15	100,000	1,500,000
4	Clean up the eucalyptus up to 20 m from the catchment	5	100,000	500,000
5	Establishment of immediate spring catchment	20	500,000	10,000,000
6	Proper water capturing	10	400,000	4,000,000
7	Progressive terraces in upstream part of the spring catchment	6	100,000	600,000
8	Maintain/establish trenches in upstream part	13	800,000	10,400,000
9	Total rehabilitation of the intake structure	18	5,000,000	90,000,000
10	Manhole covers	15	40,000	600,000
11	Marking the pipelines	all	-	5,000,000
12	Training of water users association for springs management and protection	All sectors once every 5 years	-	10,000,0000
	Total budget for the intervention	-		**151,600,000**

*The total rehabilitation cost do not include the supply cost

		Land Resilience Units			
		Croplands	Rangelands	Forest plantation	Natural forest
Agro climatic zones	M. L. L	Agro forestry + simple management	Agroforestry + average management (Progressive terraces)	Forest plantation	Natural forest
	M. M. H. L	Agroforestry + average management (Progressive terraces)	Agroforestry + advanced management (Radical terraces)	Forest plantation	Natural forest
	W. M. L	Agroforestry + advanced management (Radical terraces)	Agroforestry + advanced management (Radical terraces)	Forest plantation	Natural forest
	W. H. L	Natural forest	Natural forest	Natural forest	Natural forest

Recharge catchment management measures





The study reveals that the annual rainfall in Rulindo is good and ranges between 651mm to 1,550mm. A big part of Rulindo has annual rainfall above 1,200mm. The analysis of the water quality revealed that iron (Fe) concentration in both rainy and dry seasons is in the recommended range of RSB and WHO limits.

The study revealed that sources are prone to contamination and fecal coliforms. It was also revealed that the number of fecal coliforms increases in rainy seasons and drops in dry seasons. The increased concentration of fecal coliforms during the rainy season should be associated with the ground water contamination by the pit latrines in the area and the runoff of water in the water catchment, which in many places is not well protected and/or captured.

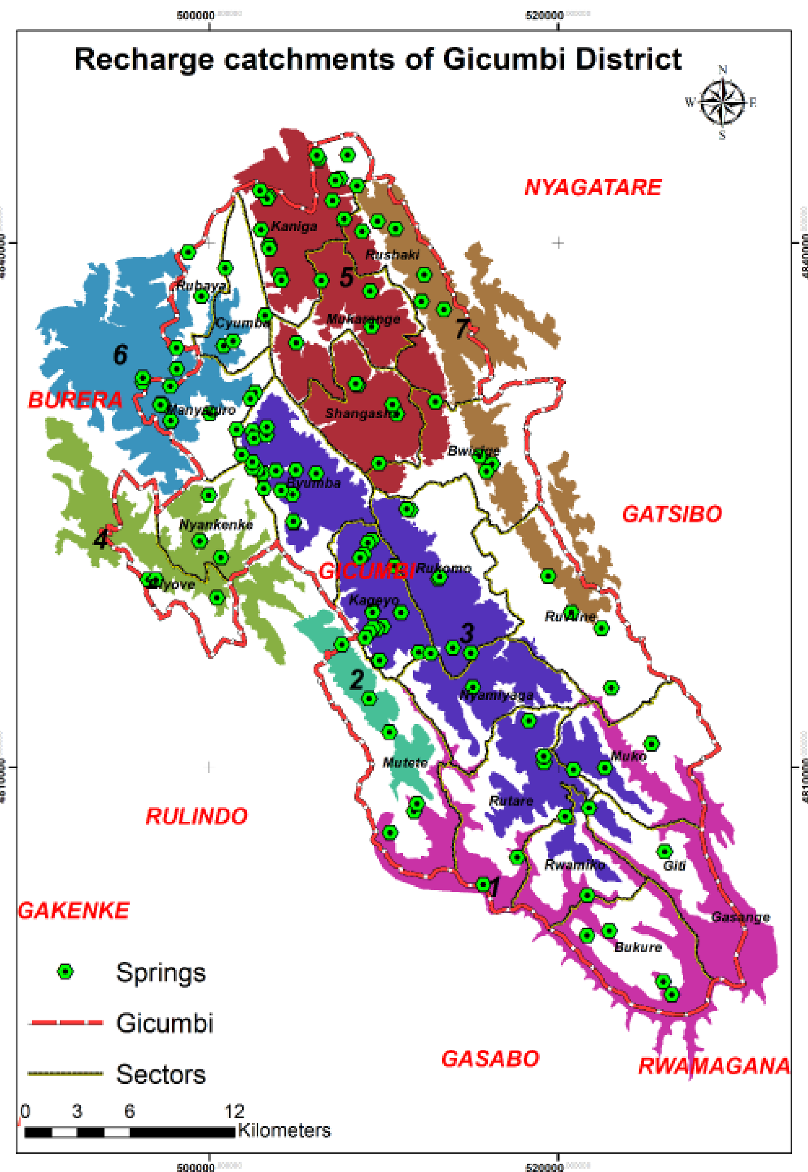
The measured concentration of total nitrogen and total phosphorous indicates a general increasing concentration in rainy season.

the study revealed that water demand is higher than water production from sources, and water from sources is not enough to meet the demand over the 25-year horizon. If the district continues to rely on water from springs, water demand will not be met, and water service will not be sustainable. Graph 1 illustrates findings from the water demand and balance analysis for each sector of Rulindo District. The water demand and balance analysis were based on daily use with quantities expressed in liters/unit. The deficit and surplus of water were calculated as the difference of water available (from existing spring sources) and water demand. The major driver of the water deficit was observed to be population growth.

Gicumbi District

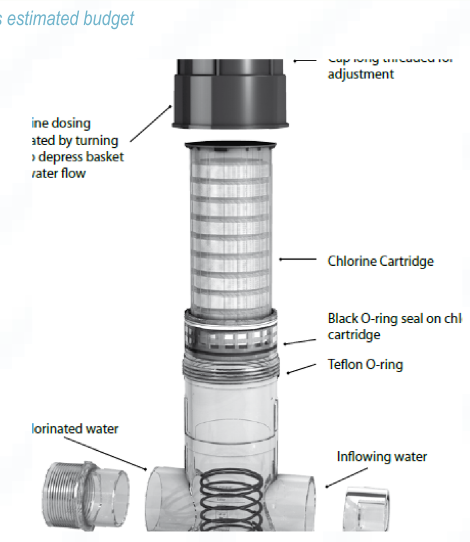
The annual rainfall variation in Gicumbi, based on the Rwanda Meteorological Agency (RMA) database, ranges approximately between 903mm to1,349mm. The water quality analysis revealed the main issues as pH, total nitrogen, total phosphorus and total coliforms.

The potential hydrogen (pH) analysis revealed that water in Gicumbi is acidic, and pH is below the RSB and WHO standards for drinking water in both dry and rainy seasons. The total nitrogen and phosphorous were observed in samples taken, an indication that farming is affecting water sources in Gicumbi. This shows that agricultural practices in catchment areas of water sources will affect water services. As observed in Rulindo, the number of total coliforms increases in the rainy season compared to the dry season. Similar to Rulindo, the water demand analysis showed that the water demand is higher than water supply

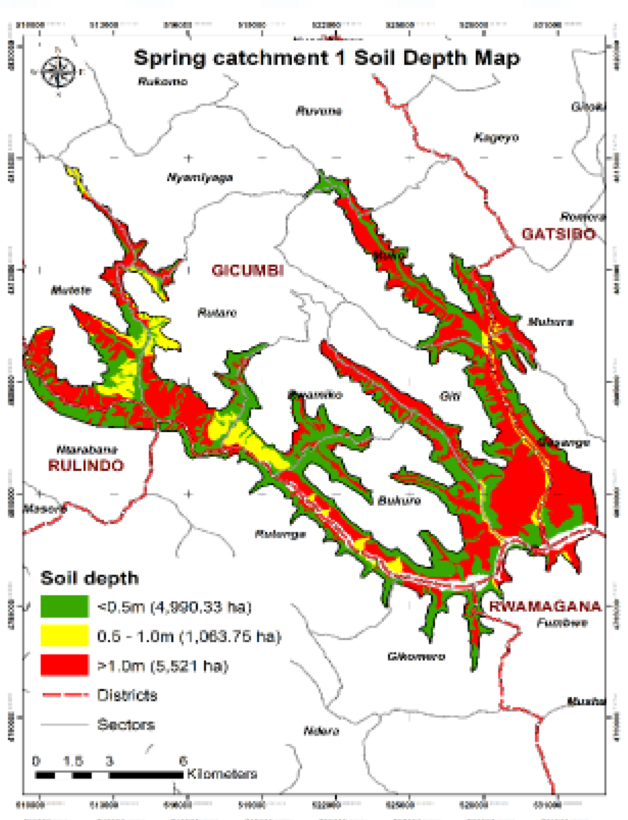


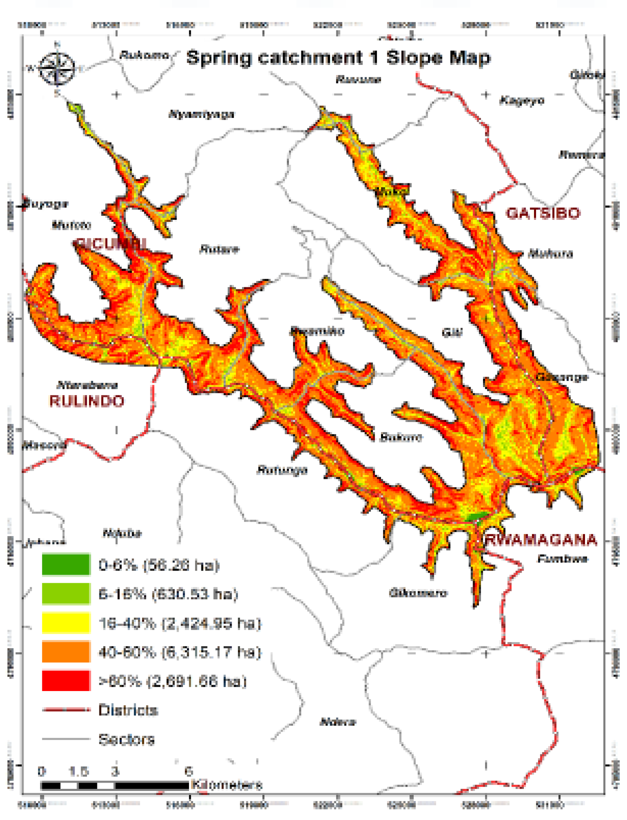
Spring recharge catchment 1			
Measures	Area Ha	unit cost FRW	Budget FRW
Agroforestry+progressive terraces/cuttoff drains	2,480.16	1,500,000	3,720,233,580.00
Agroforestry+cuttoff drains/horizontal trenches	3,001.79	250,000	750,446,273.50
Agroforestry+radical terraces/gully treatment	4,861.97	2,000,000	9,723,946,680.00
Forest Plantation	711.75	500,000	355,875,582.50
Natural Forest	522.22	1,200,000	626,663,820.00
Total			15,177,165,936.00

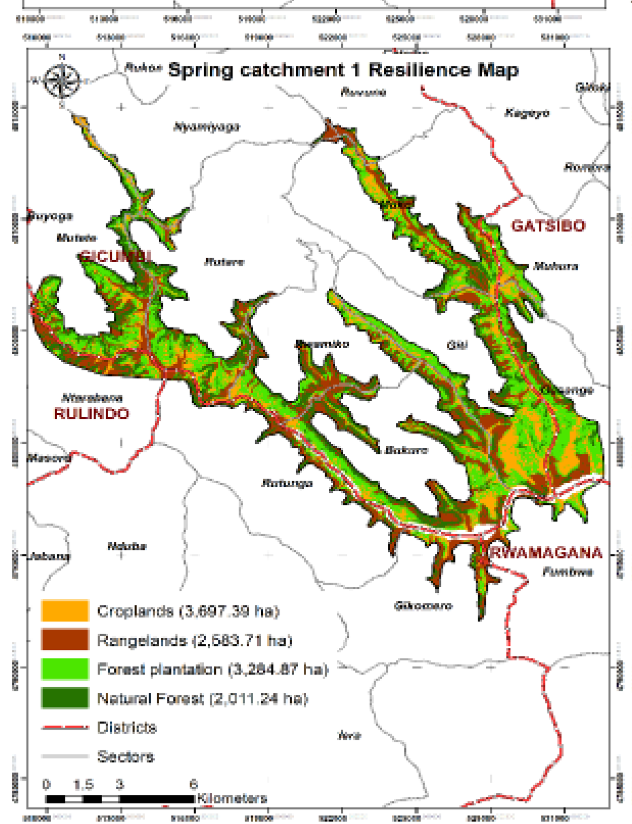
Sprinf recharde catchment management measures estimated budget

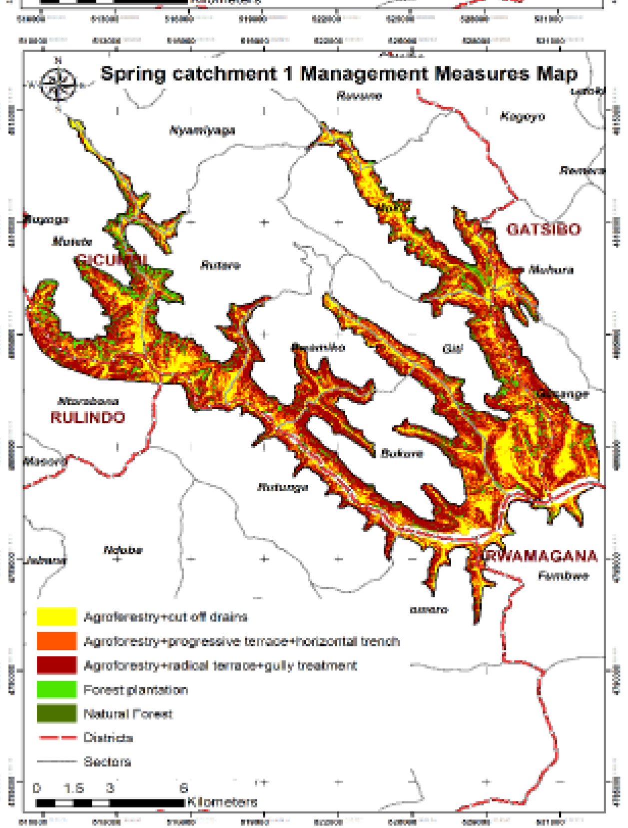


Chlorination unit, model Klorman









WETLAND RESTORATION AS PART OF AN IWRM APPROACH TO ENSURING SUSTAINABLE SUPPLY OF WATER RESOURCES:

A case of of Kamwenge District in Uganda

INTRODUCTION

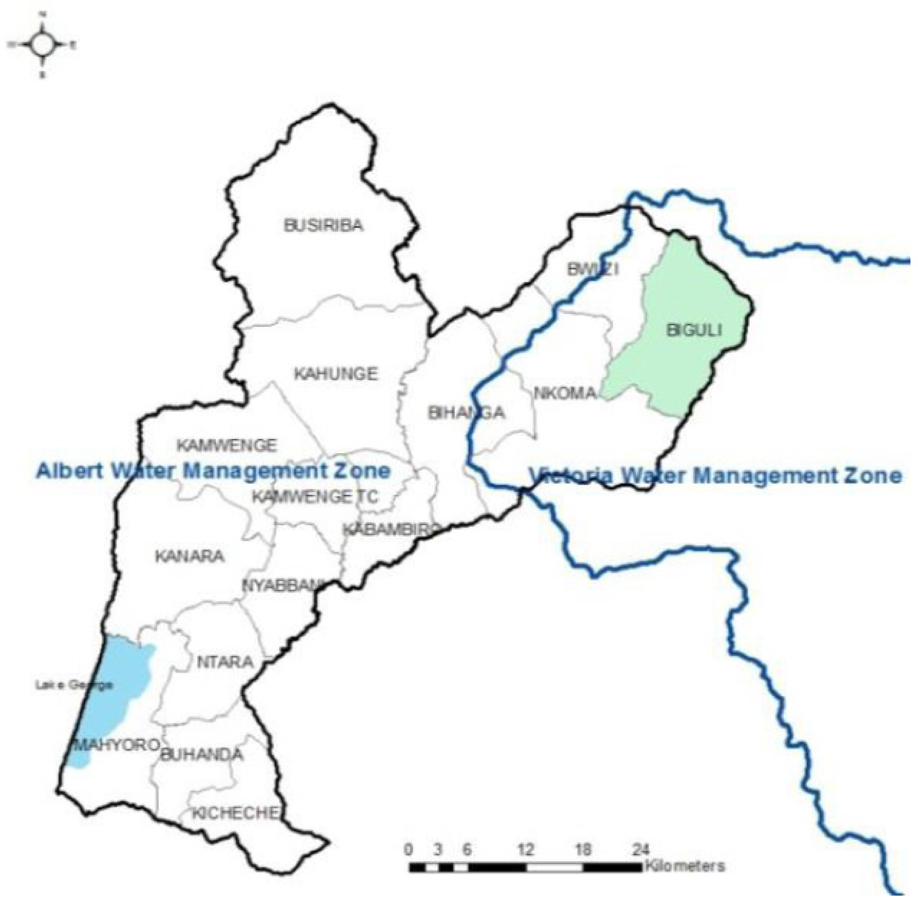
In Uganda, 11% of the total land area is covered by wetlands (Government of Uganda, 2016). Despite wetlands providing sources for construction materials, fishing, and domestic water supply, they have often been regarded as waste land and degraded through reclamation for human activities. Although there was a 0.03% increase in the Uganda wetland area in the year 2014, it is far less proportionate to the 30% reported decline between 1994 and 2008 (Government of Uganda, 2016). The extent of degradation or decline in wetland coverage varies across the four primary basins in Uganda: Lake Victoria, Lake Kyoga, Lake Albert, and Upper Nile

The extent of degradation or decline in wetland coverage in the two basins that overlay Kamwenge District is 53.8% in the Lake Victoria Basin and 14.7% in the Lake Albert Basin.

The decline in wetland area across the country has been attributed to inadequate enforcement of existing laws and inadequate coordination amongst line government institutions and sectors

The 4 major basins on whose hydrological flow the Albert, Victoria, Upper Nile and Kyoga Water Management Zones (WMZs) delianation is based

Water For People has worked with the District and Sub County Local Governments, as well as the area Water Management Zone teams to contribute to reversing effects of decline in wetland area within the Mpanga and Katonga Catchments in the Albert and Victoria Water Management Zones. Interventions include institutional support and restoration of the wetlands.



Kamwenge District and Biguli Sub Country in the Albert and Victoria Water Management Zone

District Councilor, Mr. Karaki, beside a pillar marking the boundary of Rwakasirabo Wetland to which he is a major frontline land owner

Prior to Water For People 's intervention in 2013, there was severe degradation of wetlands in Biguli Sub County. The degraded ecosystems were within the recharge areas of the existing and planned piped water supply systems which posed a great threat to the reliability and sustainability of these systems that depend on groundwater.

Rice & sorghum growing (Top) and sand mining (down) in Rwakasirabo Wetland before restoration

INTERVENTIONS & RESULTS

Working with the Ministry of Water and Environment Water For People delineated the wetlands, demarcated wetlands with permanent reinforced concrete pillars, conducted intensive community mobilisation and education to raise awareness on the importance of wetlands on ecosystem health, and educated them on water and soil conservation practices on farm upstream. Enforcement mechanisms were also put in place snd started conducting regular groundwater level monitoring to monitor the impact in 25 wetlands

As a result, five wetands have fully been restored, 25 more have been delinated and characterized while communities are more involved in wetlands conservation.

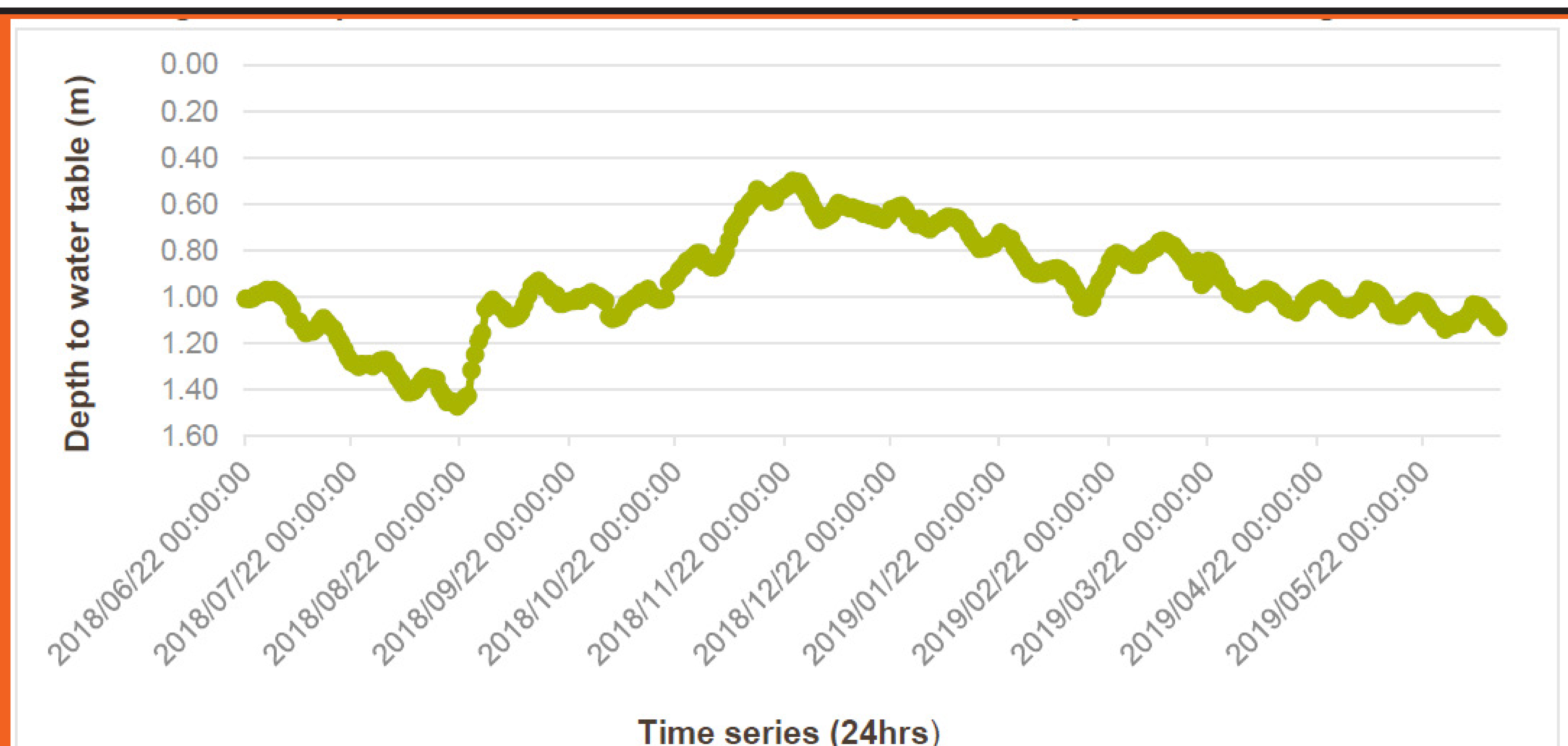
Groundwater monitoring has improved understanding of groundwater level fluctuations throughout the year and the importance of wetland restoration for improving recharge and subsequent system sustainability

There has been increase in the number of water sources that meet the adequate quantity requirement. According to Water For People's annual monitoring data, the percentage of water sources with adequate water quantity have progressively improved from 36.8% in 2017 to 68.4%% in 2019. There has also been an increase in the percentage of water sources whose water availability is not significantly affected by seasonal shortages, showing progressive improvement from 45% in 2017 to 64.3% in 2019. This improvement can partially be attributed to the wetland conservation campaign driven by the Kamwenge District Local Government and partners.

Government institutions have been strengthened and are better equipped to sustain and expand wetland rehabilitation work in the district.

The RDC addressing the SEO, DPC, and OC Biguli Police station during enforcement to remove illegal activities (left) and eucalyptus cleared by enforcement in Rwakasirabo Wetland (right)

Kizikibi Wetland before (left) and after restoration (right)



Depth to Water Table Versus Time Series for Munyuma Monitoring Well

From the findings, most of the drilled wells in Biguli Sub County consist of unconfined aquifer which highly depends on precipitation for recharge. This was observed from the variation in the groundwater level in relation to the rainfall seasons of the year with the water table level rising during rainy season and dropping slightly during rainfall off seasons. This implies that sustaining recharge throughout the year requires a system that holds the surface runoff that flows during rainy season to ensure constant recharge during the rainfall off seasons. Thus, this highlights the need to restore the wetlands, since it has the capacity to hold the surface runoff that ends up in it for a considerably long time to recharge the wells even during the rainfall off seasons.

BUILDING CLIMATE CHANGE RESILIENT WASH STRUCTURES:

A case of Chikwawa District in Malawi

WATER IN A CLIMATE CRISIS: CAPACITATING RESILIENT SOLUTIONS

Water For People's Everyone Forever model aims to bring permanent water service solutions to everyone in a district at both household level and public institutions. However, efforts to reach everyone with sustainable WASH services have been hampered by climate change effects, especially Chikwawa, Malawi, due to increased frequency and severity of water-related disasters.

Over the past five decades, Malawi has registered 19 major floods and seven droughts. In March 2019, Malawi experienced one of the worst tropical cyclones in its history, which brought heavy rains and strong winds. Severe flooding negatively affected people's lives, livelihoods and socio-economic infrastructure, pushing more people into poverty. 1 In Chikwawa alone where we have been working for the past decade, 12,755 households , translating to 53,765 people were displaced from their homes with at least 8 deaths recorded.

WASH infrastructures & CLIMATE CHANGE

$ 3, 800,000

WASH infrastructure damaged during Cyclone Idai that affected Malawi in March 2019

30 KMs

of water supply pipelines washed away during Cyclone Idai

396

boreholes washed away during Cyclone Idai

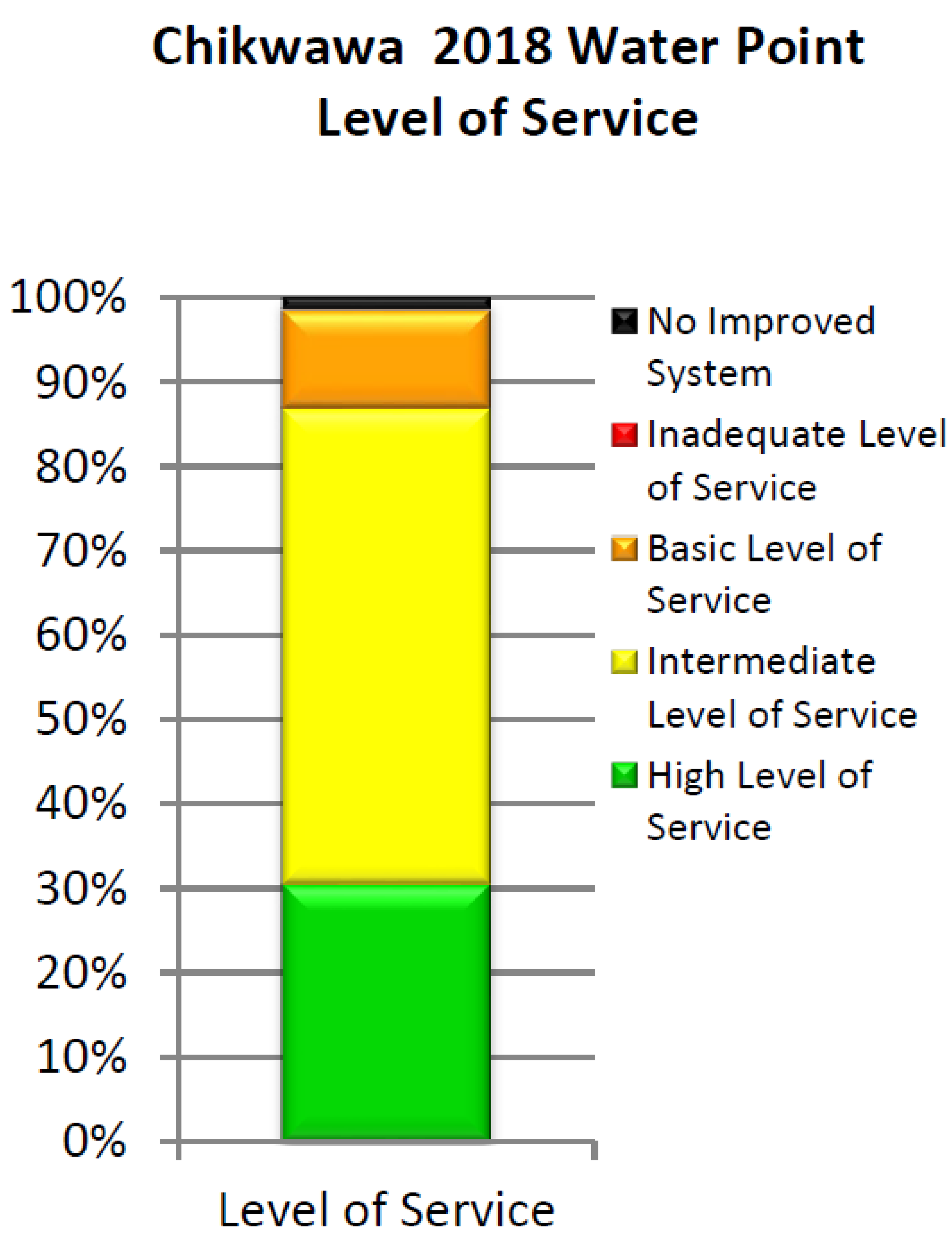
258

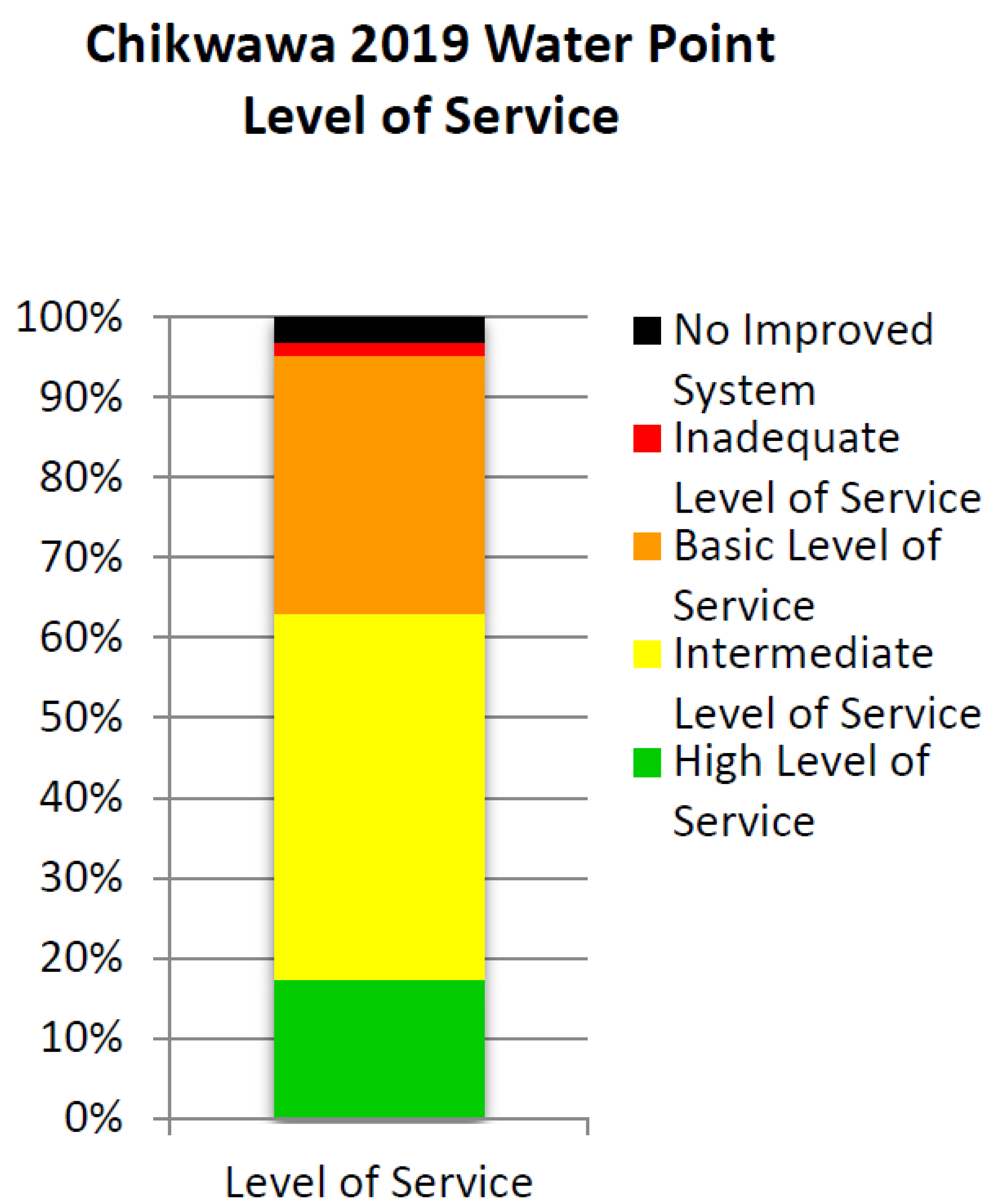
Household toilets that collapsed during Cyclone Idai

63%

Level of water service in 2019 in Chikwawa following Cyclone Idai. this is a significant drop from 86% in 2018

In Chikwawa, it is estimated that WASH (Water, Sanitation & Hygiene) infrastructure worth US$3.8M was damaged during Cyclone Idai that also resulted into a loss estimated at US$2.1 million. A total of 30 kms of water supply pipeline was washed away, 258 household latrines collapsed, and 396 boreholes were washed away3. This is evidenced by the drop in level of service of water supply from 86% in 2018 to 63% in 2019, as shown in the graphs below:





CONCLUSIONS & RECOMMENDATIONS

Based on the increasing variability in Malawi's climate and its effects on livelihoods, stronger focus is needed on ensuring resiliency in WASH infrastructure. Emphasizing the protection of drinking water sources and incorporating simple changes to latrine design to reduce the risks of flooding represent first steps towards adaptation and require relatively low-cost changes in design or practice. At the minimum, this paper proposes to have a sector wide discussion and deliberate effort on the following key issues that have been highlighted during the data collection of this write-up.

1. Technical guidelines in matters of borehole depths, catchment protection for gravity fed systems and flood protection for sanitation. These aspects may have been developed, but they are not widely known or used. The technical guidelines must also be disseminated to service providers (drillers, contractors) and indicate sanctions if the guidelines are breached

2. Design and Implementation – Most of the low-cost design technologies do not take adequate account of climate risks. Consideration must be given to design modifications that could increase resilience to increased droughts and floods and ensuring that the local communities are trained on monitoring of the same

3. Capacity development of local District Council – one field observation is that implementation of WASH infrastructure is left to financiers and contractors. The local councils do not play a major role to ensure adherence to standards yet the infrastructure is theirs. I believe the councils have a mandate to make sure that bullets I and II are adhered to.

4. Linkage of WASH sector with other sectors to help identify, understand and quantify disaster related risks. This will also help to provide quick warning signs to communities that may be perceived to be in danger as one way of mitigating the risks where resilience cannot be achieved.