

## **Wetland Restoration as Part of an IWRM Approach to Ensuring Sustainable Supply of Water Resources: A Case of Kamwenge District in Uganda**

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### **Background**

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 (Ministry of Natural Resources, 1995). Wetlands are also considered to have a back and forth relationship with groundwater, whereby some wetlands depend on outward flow of aquifers for water, and, reversely, the downstream flow of water from a wetland can be a source of replenishment for a groundwater aquifer (Ramsar Convention Secretariat, 2010). Importantly, in arid and semi-arid environments and areas with limited surface water supplies, groundwater is a major life, health, and livelihood supporting factor; it is considered vital for domestic and production-related water functions. Therefore, it is of paramount importance to ensure that all environmental resources that contribute to the conservation of groundwater resources are managed in an integrated way to sustain the multiple and multisector functions of groundwater. Related ecosystems should be safeguarded from degradation and restored whenever degraded (Ramsar Convention Secretariat, 2010).

Water For People is implementing the Everyone Forever model in Kamwenge District in Western Uganda to support attainment of sustainable, universal access to safe water supply and appropriate sanitation and hygiene services. The program is highly dependent on groundwater, and the district has wetlands spread over all 15 Sub Counties. Water For People mobilizes collaborative efforts of government, private sector, community, non-government stakeholders, and other partners to ensure that the water supply services last a life time both in quantity and quality. This implies that the success of both the service provision and sustainability will highly depend on how well the wetlands are managed. As such, conservation of local water resources has been a key component that Water For People, Kamwenge District, and Sub County Local Governments have pursued as a major priority.

### **Introduction**

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 as shown in Figure 1.

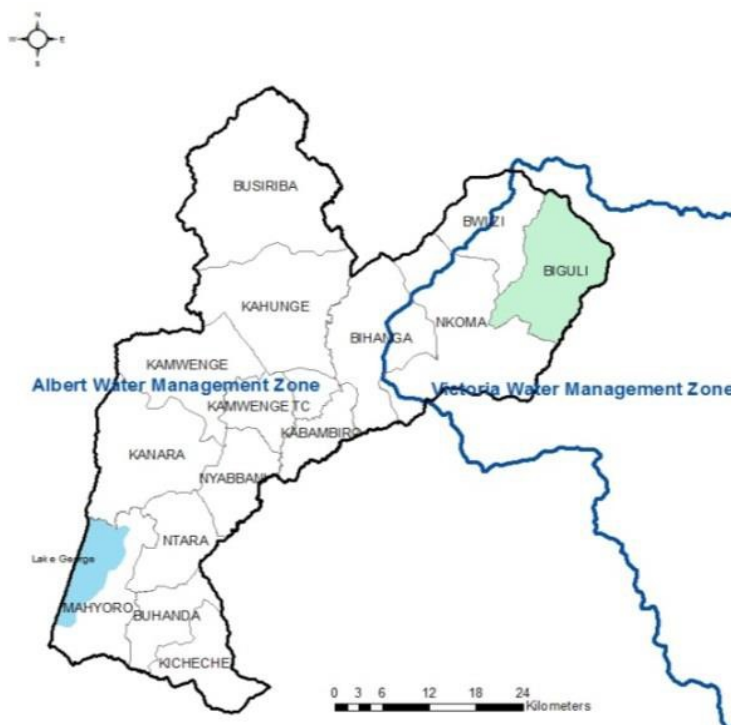
**Figure 1: Map of Uganda showing the 4 major basins on whose hydrological flow the Albert, Victoria, Upper Nile, and Kyoga Water Management Zones (WMZs) delineation is based**



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. Figure 2 shows the Kamwenge District and Biguli Sub County within the WMZ delineation. 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 (Government of Uganda, 2016). Under the catchment-based management of water resources in Uganda, Biguli Sub County in Kamwenge is upstream of the Katonga Catchment in the Victoria Water Management Zone while the 14 remaining Sub Counties are downstream of the Mpanga Catchment in the Albert Water Management Zone. Steering Committees and Water For People subscribe to the implementation of the Mpanga and Katonga Catchment Management Plans.

In this regard, 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. While interventions have been district wide, there has been more focus and concentration on Biguli given the urgency to restore the vital wetland ecosystems perceived to be a buffer zone with positive impact on the groundwater recharge and intake for the 8 piped water supply systems serving over 40,000 people given the low groundwater potential in the sub county.

**Figure 2: Map showing Kamwenge District and Biguli Sub County in the Albert and Victoria Water Management Zone**



Source: Biguli Water Resources Assessment Report (Water For People, 2017)

## Problem Statement

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. The wetlands were degraded through human activities, mainly crop agriculture, brick making, sand mining, and forestry with water draining tree species, such as eucalyptus, that were planted and thriving in the fragile ecosystems. Prior to Water For People’s intervention in Biguli, safe wafer coverage was at 23% because handpumps installed by the district had failed; they required better technologies since the water table was too low to support shallow wells.

The degradation was feared to not only affect groundwater potential and related failure of the water systems’ ability to last up to their design period, but also other human and environmental benefits of such ecosystems with diversity of flora and fauna like fish, which was of key value to the population in the vicinity. In addition, the wetlands and fragile ecosystems are meant to be a public good that provides a diversity of uses to different users and stakeholders, yet they were being personalized by the degraders (Ministry of Natural Resources, 1995). Water draining trenches and alien plant species, mainly crops (photo 1) and trees, were introduced to the sensitive ecosystems thus reducing the wetlands’ ability to perform their natural functions of filtration, flood control, aquifer replenishment, and providing habitat to wetland adapted flora and fauna. Intensive sand mining which left deep pond like holes (photo 2), in mainly the Rwakasirabo Wetland, punctuated the fragile ecosystems exposing them to drying up through evaporation. Restoration of the wetland became an immediate need for the sustainability of the piped water supply infrastructure.



Photos 1 & 2: Rice and sorghum growing (left) and sand mining (right) in Rwakasirabo Wetland before restoration

## Scope of Work

Water For People, in fulfillment of the Forever component of its model that is aimed at ensuring the sustainability of the water supply infrastructure, conducted a water resources assessment in Biguli, an upstream Sub County of the Katonga Catchment in the Victoria Water Management Zone (VWMZ) in 2014. The assessment was aimed at establishing the status of the water resources in a Sub County that is not only a source of the transboundary Katonga Catchment but also a host of the 8 piped water supply systems that Water For People has constructed with the district local government to serve the population for the next 20+ years. The assessment established key hot spot areas constituted of the 5 wetlands that were highly degraded, including Kizikibi, Rwakasirabo, Nyakatooma, Kabale, and Keishunga wetlands. These wetlands are characterized in Table 1.

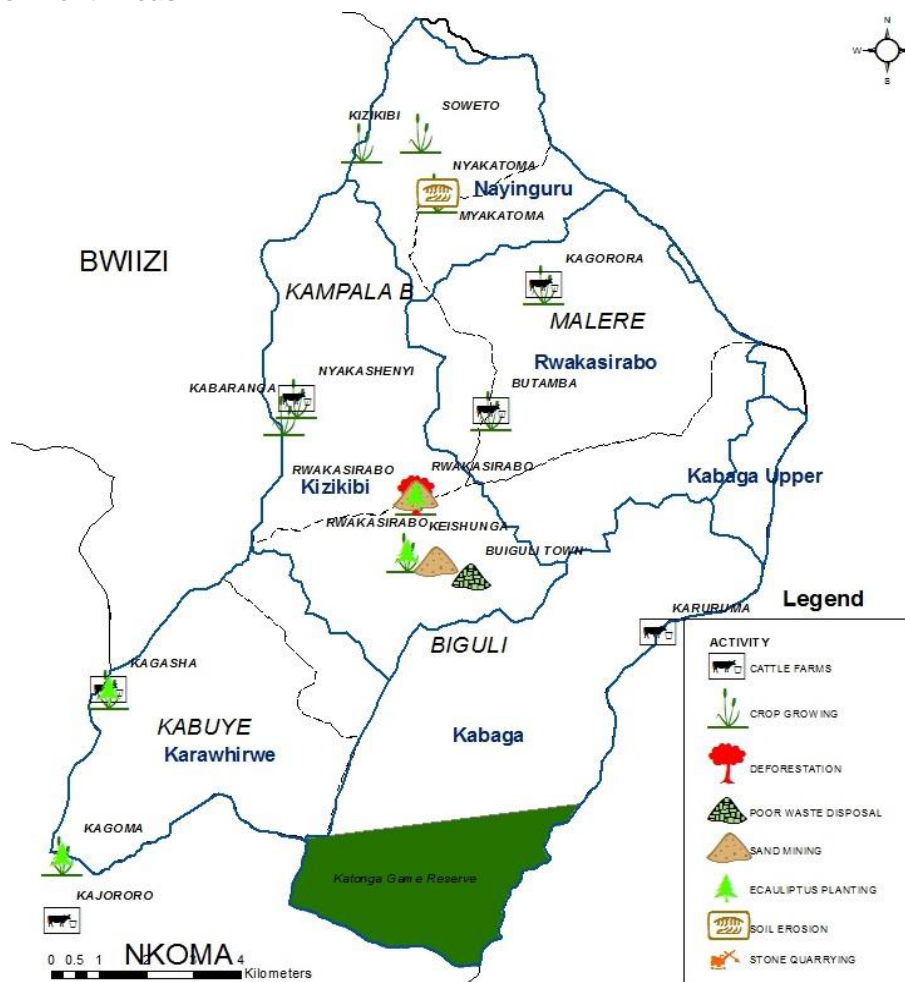
Table 1: Wetlands and Degraded/Restored Area Size in Biguli Sub County, Kamwenge District

No.	Wetland Name	Degraded/Restored Area (Acres)	Nature of Degradation
1	Keishunga	3.69	Area planted with eucalyptus both uphill and downhill, old and new gardens with surface drains in place.
2	Kabale	22.22	The first 12 acres nearest to the intakes have maize gardens and eucalyptus trees uphill. The lower 10 acres are majorly maize gardens.
3	Rwakasirabo	56.67	Activities include gardens, eucalyptus trees, and sand mining. Fire was found destroying the swamp vegetation cover and trees. Might be bigger than this in a few weeks to come.
4	Nyakatooma	4.11	Largely gardens and a few eucalyptus trees.
5	Kizikibi	11.66	Area planted with eucalyptus both uphill and downhill, old and new gardens with surface drains in place.
<b>TOTAL</b>		<b>98.34</b>	

Additionally, verification of the hotspots was done in a participatory field visit to the wetlands by a multidisciplinary team of VWMZ staff of the Ministry of Water and Environment (MWE), District

Line Departments of Community Based Services, Natural Resources, Water, Education, Production, and Biguli Sub County staff. The spatial distribution of hotspots is shown in Figure 3. It shows the location of the 5 key hot spot areas and major degrading activities that were taking place in the respective wetland areas in Biguli Sub County.

**Figure 3: Map of Biguli Showing Spatial Distribution of Potential Water Resources Threats in Wetland Catchment Areas**



Source: Biguli Water Resources Assessment Report (Water For People, 2017)

## Approach

### 1. Delineation of wetlands

Water For People partnered with the VWMZ of MWE, and Kamwenge District Local Government for all steps of the process. The first step was to delineate the wetlands using GPS and temporary live marks. This was done on the 5 priority wetlands in Table 1. This first step was also done in 21 other wetland systems across the entire district in the sub counties of Kahunge, Kabambiro, Kamwenge Town Council, Nyabbanji, Buhanda, Kicheche, Busiriba, Mahyoro, and Bwiizi, which represent the larger area where the process of delineation with reinforced concrete pillars and restoration activities can be replicated.

### 2. Mobilization and sensitization of leaders and communities

The delineation and demarcation of the wetlands was preceded by community sensitization to raise awareness about the importance of the wetlands and the negative aspects of related degradation. The awareness creation has been an ongoing activity even after the demarcation was completed and is a continuous part of the process.

### 3. Demarcation of wetland boundaries with more permanent marks

The degraded area size of the 5 wetlands in Biguli was measured and established to be 98.34 acres. The next step was to back up the live marks with reinforced concrete pillars for permanent boundary marking. So far, 3 wetlands of Kizikibi, Nyakatooma, and Rwaksirabo have their boundaries fully demarcated with the permanent reinforced concrete pillars for frontline communities to know the buffer zones within which to avoid degrading activities or implement regulated activities. Placement of permanent reinforced concrete marks was done at an interval of about 100m from one pillar to another along the boundary line of the wetlands.

### 4. Promotion of community livelihood improvement initiatives

In addition to the benefits of the wetlands, community sensitization also included education of the communities in question about regulated activities within the wetlands and buffer zones by the district Senior Fisheries Officer and Biguli Sub County Agriculture Officer. This involved demonstration of water and soil conservation practices on farms upstream of the Kizikibi Wetland since communities testified to have used the wetland for crop gardening with a perception that it was more fertile and had enough soil moisture as compared to their gardens upstream. Thus, they learned that moisture and fertile soils perceived to be in the wetlands are deposited out of uncontrolled runoff and soil erosion from the gardens and can be preserved through better agronomic practices, such as diversion ditches and infiltration pits. Also, the communities within the catchment area of the wetlands were sensitized and trained on fish farming and construction and management of ponds. Up to this point, 6 farmers have constructed fishponds and are awaiting stocking with fish. The livelihood initiatives are expected to serve as an incentive for wetland conservation by the communities in the restored areas.

### 5. Enforcement

Additionally, it is within the mandate of the local governments to actively manage and coordinate the conservation efforts of the natural resources within their territories through planning, management, and enforcement, including eradication of illegal activities through policing (Government of Uganda, 2016). Following this mandate, in areas where noncompliance was noticed despite the sensitization, the District Natural Resources and Senior Environment Officers (SEO) served the culprits with restoration orders. For those that did not comply or cease illegal activities, joint enforcement was done by teams of staff from the offices of the Chief Administrative Officer (CAO), Resident District Commissioner (RDC), District Chairperson, District Police Commander (DPC), District Internal Security Officer (DISO), and the Biguli Sub County Chief and Chairperson. During the enforcement, eucalyptus trees were cut down, crops were cleared, and water draining channels were covered up to enable regeneration.



*Photos 3 & 4: 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)*

## 6. Groundwater level monitoring

The final step in the process was to set up a system to monitor groundwater levels of the drilled wells (abstraction points for the piped systems) in Biguli Sub County to better appreciate the impact of wetland restoration and better understand the sustainability of the wells. Water For People, in partnership with Desert Research Institute, organized a training in May 2018 on groundwater monitoring using the CTD diver technology to monitor groundwater levels, electrical conductivity, and temperature. The training was attended by experts in the field of groundwater planning and management from Kamwenge District Local Government, Mid-Western Umbrella of Water and Sanitation (the entity responsible for operation and maintenance of the piped systems), Albert WMZ, and the Directorate of Water Resources Management. During the training, 7 CTD divers were installed in 7 strategic boreholes in Biguli Sub County, including 5 monitoring wells and 2 motorized wells. In a monitoring well, this technology informs the fluctuation in the groundwater level which directly relates to the well aquifer type and factors that affect the well recharge. The diver also informs the well recovery and gives guidance on whether the well is being pumped at a safe yield or not. The CTD Divers were installed in May 2018, providing 1 year of data up to this point. Monitoring will continue for a period of about 10 years for long-term and continual understanding of the sustainability of these groundwater source areas.



*Photos 5 & 6: The team during the training (left) and installing the CTD diver in Bitojo well (right)*

## Results and Achievements

- Five wetlands have fully been restored.** These include Rwakasirabo, Kizikibi, Nyakatooma, Kabale, and Keishunga Wetlands in Biguli Sub County. The wetlands are fully flooded with water and overgrown with wetland vegetation. In Kizikibi, there are mud fish which had totally been extinct when the wetland was a hub of human activities. Neighboring communities are fishing and enjoying the fish protein from the restored wetland.



*Photos 7 & 8: Kizikibi Wetland before (left) and after restoration (right)*

2. **25 wetlands have been delineated and areas characterized.** Out of the 26 delineated wetlands (shown in Table 2), 3 have their territories marked with permanent reinforced concrete pillars, with plans for marking all the identified hot spots with permanent markers.

**Table 2: Wetlands whose Boundaries were Delineated**

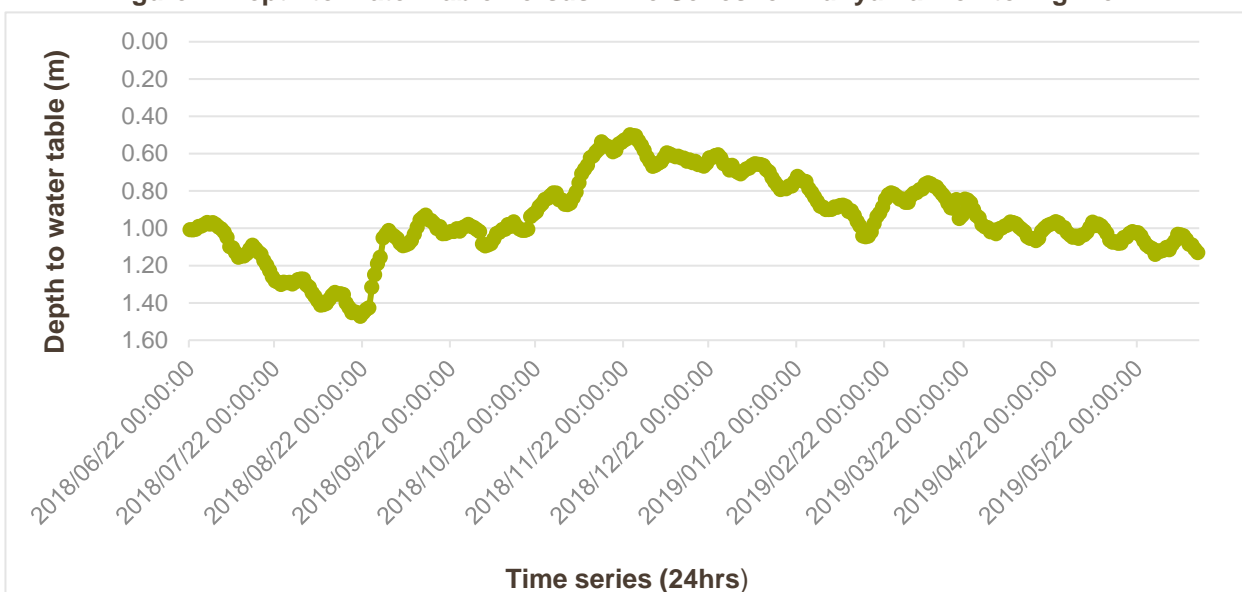
SN	Wetland System	Wetland Name	Sub County	Issues
1	Mpanga	1. Nyakahama	Kahunge	Change in land use through cultivation, planting of Eucalyptus, clearing of vegetation to establish farm land.
		2. Rushango	kabambiro	
		3. Karambi	Kamwenge T/C	
		4. Rwambu	Nyabbani	
		5. Kikoyo	Buhanda	
		6. Kigoto	Kicheche	
		7. Nyakabale	Kahunge	
		8. Byabasambu/Kyerima		
		9	Mpanga River (riverbanks)	
2	Lake George	10 Lyamugonera	Kahunge	
		11 Kanywambogo	Busiriba	
		12 Mahango	Busiriba	
		13 L. George (Lakeshores)	Mahyoro	
		14 Kaborogota	Busiriba	
		15 Magombe (Bigodi)		
		16 Kakoona	Bwizi	
		17 Lubaze		
		18 Kyakaitaba		
19 Kyehemba				
3	Lake Victoria Catchment Management Zone	20 Kagasha	Biguli	
		21 Kabale	Biguli	
		22 Keishunga	Biguli	
		23 Rwakasirabo	Biguli	
		24 Nyakatoma	Biguli	
		25 Naiyiguru	Biguli	
		26 Kizikibi	Biguli	

Source: Wetland Demarcation Report; Kamwenge Natural Resources Office, 2017



3. **Wetland conservation has increased prioritization by both the District and Sub County Local Governments as well as by community members.** Having caught wind of the enforcement, sub counties outside of Biguli are reporting that degraders of wetlands have cut down on water draining and are reclaiming eucalyptus plantations and woodlots that are in the wetlands. “The communities who were resistant to freeing the wetlands of the degrading activities, mainly eucalyptus, have since changed into partners in the campaign because they are doing it even before we reach their areas,” reflects Godfrey Mucunguzi, Resident District Commissioner, Kamwenge.
4. **The livelihood and socio-economic related benefits of the wetlands to the community have been restored.** These include the mud fish community members are catching for food and the wetland sages and other forms of vegetation used by the community to mulch their gardens for moisture retention and weed and soil erosion control. In Kizikibi, the mud fish, which had been extinct when the wetland was a hub of human activities, has since regenerated. Neighboring communities are currently fishing and enjoying the fish protein from the restored wetland ecosystem.
5. **Water Resources Assessment for Biguli Sub County led to identification and mapping of hot spot areas and created awareness.** The upstream Sub County of the Katonga Catchment was assessed, and key water resources issues were mapped out to inform all water resources conservation activities.
6. **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.** Monitoring results are available for 1 year, and the results are presented in Figure 4. Findings have been shared on various platforms, including Uganda Water and Environment Week in Entebbe and the bi-annual learning event in Kamwenge District. 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.

**Figure 4: Depth to Water Table Versus Time Series for Munyuma Monitoring Well**



With only 1 year of data and limited data from before the wetland work began, it is not possible to quantify the exact impact of the wetland restoration in terms of reduction in water level declines. However, the declines observed in the dry season in 2019 were slight, which could be attributed to the rejuvenating wetlands. Figure 4 presents a result of depth to water table below ground level (m) against a time series (24 hours) from the Munyuma monitoring well, indicating the gradual fluctuation in the level in accordance with the rainfall pattern in Biguli.

7. **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.
8. **Government institutions have been strengthened and are better equipped to sustain and expand wetland rehabilitation work in the district.** The overall focus of Water For People is on building and empowering government institutions to do their work better, thus putting Water For People in more of a facilitating role and letting the government be at the forefront of implementation. Water For People's membership on the Katonga and Mpanga Catchment Management Committees and role in supporting the water management on the bigger catchment related areas caused much appreciation of the restoration initiatives as they were considered not just a pocket of project activities but as addressing systemic issues affecting the bigger catchment of Katonga. This earned the initiative more support of the Water Management Zone Staff. Other bigger catchment areas supported by Water For People include providing financial support to the Albert Water Management Zone to conduct Mpanga Catchment Management Committee meetings, building capacity of AWMZ and VWMZ in groundwater monitoring using CTD divers, and providing the Zones with the devices for installation in areas they deem necessary.

### Drivers of Success

1. **The burning desire of the sub county and communities to conserve wetlands for sustainability of the water supply systems.** The link of the wetlands to groundwater recharge and sustainable yields of the water sources motivated both the sub county authorities and the resource users to embrace the wetland restoration initiative.
2. **Groundwater monitoring using CTD diver technology is scaling through the Ministry of Water and Environment.** Partners are implementing different strategies to scale up the technology in the whole country in the various water management zones. This was highly noted during the trainings conducted by Water For People during the Uganda Water and Environment Week in Entebbe and the bi-annual learning event in Kamwenge. Plans have been put in place to install the CTD divers distributed to the AWMZ in August 2019 and continue capacity building and follow up of their monitoring results on regular basis.
3. **A learning visit to the restored Nyakambu Wetland in the Rwiizi Catchment.** Water For People, working with the VWMZ team, organised a learning visit for the Kamwenge District and Biguli Sub County staff to the Rwiizi Catchment. The visit was aimed at supporting the district and sub county to appreciate that restoration of wetlands is possible, as well as to appreciate other livelihood activities that are vital to the success and sustainability of the restoration. One key inspiration that the visiting team got from the visit was the restored Nyakambu Wetland within the Rwiizi Catchment in Sheema District.



*Photos 9 & 10: Kamwenge District and Biguli Sub County Team at the restored Nyakambu Wetland (left) and the Secretary of the Rwiizi Catchment Management Committee addressing the visiting team about the Nyakambu Wetland restoration process during the learning visit to Rwiizi Catchment (right)*

4. **The involvement of multilevel and multisector stakeholders who brought diverse expertise and experience.** This involvement was key to the success of the restoration of the wetlands in Biguli Sub County in Kamwenge. The Community Development Officers were key in the community sensitizations, the Agricultural Officer for awareness creation on and demonstration of soil and water conservation measures on farms for the frontline communities of the wetland, the Fisheries Officer for supporting the community in development of fish farming skills and fish pond construction to enable the communities leaving the wetlands to have an alternative source of income, the Natural Resources Officer, Senior Environment Officer, and District Staff Surveyor in the provision of the technical guidance and delineation of the wetlands, and the area local leadership and Sub County Chiefs in providing ongoing mobilization. Additionally, the VWMZ Team Leader played a key role in providing the technical guidance during the Water Resources Assessment and identification of the key hotspot areas.
5. **Exemplary leadership and early response of the local leaders were key in ensuring compliance from the communities.** When the campaigns started, and even more so during enforcement, there was no discrimination between the leaders and local communities; they all received same treatment in advising them to remove degrading activities from the wetlands. Where the degraders were leaders, their degrading enterprises were removed first before those of the ordinary communities. A vivid case in point is Rwakasirabo Wetland whereby the main frontline landowner is a District Councilor, Mr. Karaki, who let go of all plans to utilize the wetland. The Sub County Chairperson, Mr. Komaho Simeon, never kept silent about telling the Biguli community, who are his voters, to free wetlands of degrading activities; he preached the gospel at every community gathering he attended. This equal treatment of the leaders and non-leaders was a major success factor as it was an exhibition of integrity throughout the process which helped in acquisition of the trust of the community.
6. **Starting with a Water Resources Assessment.** The assessment identified the hotspots that provided a way to prioritize the work and select the first 5 wetlands of focus. The wide dissemination of the report to the sub county and district officials was a key factor of success. It caused appreciation of water resource issues and triggered leaders to take action.



*Photos 11 & 12: District Councilor, Mr. Karaki, beside a pillar marking the boundary of Rwakasirabo Wetland to which he is a major frontline land owner (left) and a pillar standing out on the boundary of the restored Rwakasirabo Wetland (right)*

## Recommendations and Next Steps

Although this intervention has been successful, continued work is needed to sustain the protected areas and expand the work throughout the entire District. As the work expands, there is opportunity to improve the approach based on learnings from this first intervention.

1. **Continued capacity building of government institutions.** Ongoing support to government institutions will ensure that they have the human and financial capacity to carry on activities and strategies that will lead to restoration of more degraded wetland systems. Sustainable wetland restoration will need strong local and regional government leadership, as well as catchment organizations. Efforts to ensure regular meetings of the Katonga and Mpanga Catchment Management Committees, as well as establishment of learning and knowledge management mechanisms, will help keep track of the progress being made. Strong institutions are key in affecting wetland conservation, given the fact that with strong institutional establishments enforcement and implementation of existing policies is possible (Government of Uganda, 2016).
2. **Demarcation of more wetlands.** There is need to have the other delineated wetlands demarcated with permanent markers, preferably using the reinforced concrete pillars. Water levels and lines of the wetlands tend to shift over time along with the seasons, and this can often affect the sustainability of conservation and restoration achievements. Communities need to permanently know where the boundary of the wetland lies so that they can avoid degrading forever.
3. **More monitoring equipment.** There is need to install more monitoring equipment, such as a rainfall gauging station and a telemetric machine, in the designated area of Biguli Sub County to aid in the analysis of data and subsequently scale up these technologies in the whole country.
4. **Technical documentation of the entire restoration process.** This would be used for inter-catchment learning on restoration experience. It can also be used by the district local government to scale up to other major degraded wetland areas.
5. **Capacity building of the farmers and other upstream land users.** Upstream users of the wetlands could be sensitized on the implementation of regulated activities, such as fish farming and management and good agronomic farming practices that preserve soil fertility and retain water on farms by controlling runoff and related soil erosion.
6. **Supporting Mid-Western Umbrella of Water and Sanitation to obtain water abstraction permits.** Mid-Western Umbrella is the main water service provider in Biguli Sub County, and

Water For People will provide technical support to them to obtain groundwater abstraction permits for each of the piped water supply systems under their management. Piped water suppliers that abstract water from ground and surface sources are required to obtain water abstraction permits by the Ministry of Water and Environment (International Water Management Institute, 2017). Water abstraction permits are issued by the Directorate of Water Resources Management (DWRM) to bulk water abstractors aimed at mitigating over-abstraction and depletion of groundwater resources.

## Conclusions

The progress that has been made in last two years (from 2017 to date) is a demonstration that with the engagement of relevant stakeholders, wetland restoration is possible and can increase the sustainability of water supply sources.

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