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Victoria Water Management Zone



Rwizi Catchment Management Plan

March 2020

Acknowledgement

Guided by the Victoria Water Management Zone (VWMZ) of the Directorate of Water Resources Management (DWRM) in the Uganda Ministry of Water and Environment (MWE), stakeholders in the Rwizi catchment drafted the Rwizi Catchment Management Plan (CMP) in 2015.

The VWMZ and the Rwizi Catchment Management Committee (CMC) reviewed and finalized the draft CMP in 2020 with financial support from Advocates Coalition for Development and Environment (ACODE). The Minister of State for Environment, Hon. Beatrice Anywar launched the final Rwizi CMP on 19th March 2020, during a Symposium on the Restoration of River Rwizi and enhancing the transition to a green economy in Uganda.

Executive Summary

The Ministry of Water and Environment (MWE), through its Directorate of Water Resource Management (DWRM), is implementing Catchment-based Integrated Water Resources Management (CbIWRM) as part of its water resources management reforms completed in 2005. CbIWRM places stakeholders at the centre of developing and managing water and related resources in their area; it allows stakeholders to jointly plan and manage water and related resources (e.g., land, ecosystems, and socio-economic systems) considering the needs and interests of all.

To operationalise CbIWRM, the MWE divided Uganda into four Water Management Zones (WMZs): Upper Nile, Albert, Victoria, and Kyoga. Within each WMZ are smaller hydrological units called catchments, further delineated into sub- and micro-catchments. Rwizi catchment is one of the six catchments in VWMZ. In each Catchment, stakeholders develop Catchment Management Plans, Sub Catchment Management Plans, and Micro Catchment Management Plans in a participatory process following the Guidelines for Catchment Management Planning. The Plans guide stakeholders on the critical issues in the respective catchments that need an immediate, medium-term, and long-term response. The Plans provide priority measures required to manage water and related resources in a manner that considers, among other aspects, the needs and aspirations of relevant stakeholders.

Guided by the Victoria Water Management Zone (VWMZ), stakeholders in the Rwizi catchment drafted the Rwizi Catchment Management Plan (CMP), this document, in 2015. The VWMZ and the Rwizi Catchment Management Committee (CMC) reviewed and finalized the draft CMP in 2020. The Minister of State for Environment, Hon. Beatrice Anywar launched the final Rwizi CMP on 19th March 2020, during a Symposium on the Restoration of River Rwizi and enhancing the transition to a green economy in Uganda.

Rwizi catchment covers approximately 8,554 square kilometers in the following districts: Buhweju, Bushenyi, Sheema, Ntungamo, Mbarara, Rwampara, Isingiro, Kiruhura, Lyantonde, Lwengo, Rakai, and Kyotera. River Rwizi is the main river in the Catchment. The river forms a complex system of wetlands and streams originating from the hills in Buhweju district, flowing in a southerly direction, turning eastwards for about 57 kilometres until the gauge at Mbarara waterworks discharging its water into Lake Victoria. Rwizi catchment is partly flat and sloping. The upper reaches of the Catchment are predominantly hilly, while the middle is generally flat and lies within the cattle corridor (dryland). The lower parts, towards Lake Victoria, are mainly marshland. Altitude in the Catchment ranges from 1,262 metres above sea level (m.a.s.l.) at the outlet to 2,168 m.a.s.l. at the very northern part of the Catchment, with an average of 1,517 m.a.s.l.

The Catchment experiences two rainy seasons (March to May, September to November, and sometimes up to December) and two dry seasons (December to February, and June to August). Rwizi Catchment receives rainfall in the range of 700mm/year to 1,300mm/year. The rainfall received is influenced by topography, wetlands, and open water. The average daily temperature for the Catchment is a minimum of 13.7°C and a maximum of 26.6°C. Available data suggest that the temperature has increased by about 2°C from 1960 to 1993. Future climate scenarios suggest a 10% to 12% increase in rainfall extremes in the 2050s and 16% to 19% in the 2090s. However, the monthly mean maximum and minimum temperature change are more optimistic: the dry season could become cooler while the wet season could become warmer. The increase in maximum temperatures during the wet season could increase evaporation and water loss from the system.

Soils in Rwizi catchment are dominantly clay loam, sand clay loam, sandy loam, and peaty loam soils. The geology of the Catchment is composed of metamorphic rocks overlain by alluvial deposits in some places. Within the upper parts of the Catchment, the rock system is complex and therefore not easily eroded. In contrast, the rock system in the middle and lower parts of the Catchment suggests that the soil is easily erodible. Rwizi catchment has many wetlands and the major ones include: Nyarubungo, Katerera, Nyaruhandagazi, Kizimbi, Kasaana, Kibaare, Katukuru, Rwemigina, Nyabikungu, Bujaga, Kicwamba, Rugaaga, Nyamuyanja, Nyakabaare, Mirama, Rukindo, Nakisharara, Kooga, Rucece, Kyarutengura, Kalunyiga, Mazinga, Katara, Kanyabukanja, Rushanje, Kibingo, and Nyakambu. The lakes include Nakivale, Kachera, Mburo, and Kijanibalora; they provide livelihoods to communities and contribute to the national economy through fisheries, water transport, and marine tourism. Lakes and wetlands have a significant effect on the flow regime in the Catchment. There is increasing pressure on wetlands and lakes, affecting their extent, biodiversity, and water levels recovery.

Groundwater potential in the Catchment is highly variable but is generally poor. Trends indicate declining groundwater levels, possibly due to increased abstraction levels in the face of reduced recharge from rainfall. Groundwater depletion could be a possible risk where the low permeability basement aquifers are exploited by high-yielding electric pumps, which is the case with areas abstracting water for industrial use in the urban centres. A water balance analysis revealed that the water available in the Catchment could meet all current (2020) and projected (2040) consumptive water needs in the Catchment if the water would be distributed evenly in time and space. Generally, surface water in the Catchment shows significant levels of turbidity. In contrast, groundwater shows high levels of hardness and high contents of calcium, magnesium, iron, fluoride, manganese, and other elements, making it unpotable.

The Catchment faces increased pressures due to the increasing human and animal population, seasonal migrations by pastoralists, land reclamation for farming and construction, clearing of hill slopes for agriculture, and sand mining from the river bed. There is an increase in the individualization of land ownership, resulting in an easy change of land use in fragile areas, such as wetlands, riverbanks, and woodlands. Further, there is pressure to de-gazette more forest reserves and encroachment on wetlands. Analysis of land-use changes indicates that bushland, forest, grassland, and wetland have reduced by 64%, 634%, 48%, and 46%, respectively, between 2005 and 2019. On the other hand, the area under built-up area and farmland increased by 77% and 85%, respectively, in the same period. Generally, Rwizi catchment is degraded by runoff, deforestation, encroachment on wetlands, sand mining, brick making, overgrazing, and poor agricultural practices.

Based on the critical issues identified, their causes, and impacts, Catchment stakeholders agreed on a vision for the Catchment:

“A sustainable, beautiful Rwizi Catchment environment for better livelihoods.”

To achieve this shared vision, the CMP addresses four strategic objectives, which the stakeholders formulated:

1. To ensure sustainable access to water of adequate quality and quantity for domestic use and production
2. To ensure that farming, animal husbandry systems, and industrial establishments are productive, drought and climate-resilient, and improve household income.
3. To restore degraded natural resources.
4. To strengthen natural resources management systems and structures.

The Rwizi Catchment Management Plan aims at implementing interventions that will showcase the benefits of Integrated Water Resources Management (IWRM) and development at the Catchment level. These interventions include (i) Strengthening the Catchment Management Organization, (ii) investing in ecosystem restoration, (iii) investing in water and sanitation (and related infrastructure), (iv) investing in economic development, including investments in income-generating activities for livelihood improvement, infrastructure development and green economy investments aimed at achieving sustainable development while combating poverty. Implementing these interventions will address concerns by catchment stakeholders, including high drought conditions, increased water demand for different uses, water pollution, impacts of climate change and variability, and critical dependency on natural resources and wetlands encroachment for increased agricultural production. In addition, the interventions will resolve threats, pressure, and impacts associated with loss of vegetation cover, soil erosion and siltation of lakes and rivers, reduction in water levels impacting on water availability, nutrient enrichment and eutrophication, disease risks through poor waste disposal, loss of current livelihoods due to water stress and increased conflicts from limited water access.

Investments in institutional strengthening of the catchment management organization will require UGX 3.98 Billion, ecosystem protection and restoration will require UGX 35.5 Billion, investments in water and sanitation will require UGX 73.1 Billion. In contrast, investments in agriculture, livelihood improvement, and economic development will require approximately UGX 3.1 Billion. The overall investment to deliver this plan is roughly UGX 115.7 Billion, requiring an additional UGX 6.4 Billion per year for operation and maintenance over ten years.

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Acronyms and Abbreviations

ACODE	Advocates Coalition for Development and Environment
ACORD	Agency for Cooperation and Research in Development
Asl	Above Sea Level
ASM	Artisanal and small-scale mining
BOD	Biochemical Oxygen Demand
CAO	Chief Administrative Officer
CBO	Community Based Organization
CbWRM	Catchment Based Water Resources Management
CCU	Climate Change Unit
CFM	Collaborative Forest Management
Cm	Centimetre
CMO	Catchment Management Organization
CMP	Catchment Management Plan
CMS	Catchment Management Secretariat
CSF	Catchment Stakeholder Forum
CSO	Civil Society Organisation
CTC	Catchment Technical Committee
DDP	District Development Plans
DEA	Directorate of Environmental Affairs
DfiD	Department for International Development
DPO	District Production Officer
DRAW	District Rapid Appraisal of Wetlands
DWD	Directorate of Water Development
DWO	District Water Officer
DWRM	Directorate of Water Resources Management
DWSSC	District Water and Sanitation Coordination Committee
FAO	Food and Agricultural Organisation
FEWS	Flood Early Warning System
FSSD	Forestry Sector Support Department
GFS	Gravity Flow Scheme
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoU	Government of Uganda
GW	Ground Water
ha	Hectare
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management
km ²	Square Kilometre
l	Litre
LC	Local Council
LLG	Lower Local Government
LVEMP	Lake Victoria Environmental Management Project
M&E	Monitoring and Evaluation
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
m.a.s.l	Metres Above Sea Level
MCM	Million Cubic Metre
MEMD	Ministry of Energy and Mineral Development
MLG	Ministry of Local Government
Mm	Millimetre
MM ³	Million cubic meters
MOFED	Ministry of Finance, Planning and Economic Development
MOH	Ministry of Health

MoU	Memorandum of Understanding
Mt	Metric ton
MTTI	Ministry of Tourism, Trade and Industry
MWE	Ministry of Water and Environment
MWLE	Ministry of Water and Environment
MWT	Ministry of Works and Transport
NAADS	National Agricultural Advisory Services
NaFORRI	National Forestry Resources Research Institute
NEMA	National Environmental Management Authority
NFA	National Forest Authority
NGO	Non-Governmental Organization
NWRA	National Water Resources Assessment
NWSC	National Water and Sewerage Corporation
O&M	Operation & Maintenance
OPM	Office of the Prime Minister
PPP	Public Private Partnership
PRA	Participatory Rural Appraisals
RDC	Resident District Commissioner
RUG	Resource User Groups
SME	Small and Medium Enterprises
SSEA	Strategic Social and Environmental Assessment
SW	Surface Water
SWOT	Strength, Weaknesses, Opportunities and Threats
TLU	Tropical Livestock Unit
TOR	Terms of Reference
TSU	Technical Support Unit
UBOS	Uganda Bureau of Statistics
UGX	Ugandan Shilling
UNMA	Uganda National Meteorological Authority
UNRA	Uganda National Roads Authority
UOs	Umbrella Organisation
UWA	Ugandan Wildlife Authority
UWASNET	Uganda Water and Sanitation NGO Network
VSLA	Village Saving and Loan Association
VWMZ	Victoria Water Management Zone
WAP	Water Action Plan
WASH	Water, Sanitation and Hygiene
WfP	Water for Production
WMD	Wetlands Management Department
WMZ	Water Management Zone
WRA	Water Resources Assessment
WRSA	Water Risk and Sustainability Assessment
WSDF	Water Sector Development Facility
WSS	Water Supply Scheme
WSSB	Water Supply and Sanitation Board
WUC	Water Users Committee
WWF	World Wide Fund for Nature
yr	Year

1 INTRODUCTION

1.1 This document

Guided by the Victoria Water Management Zone (VWMZ), stakeholders in the Rwizi catchment drafted the Rwizi Catchment Management Plan (CMP), this document, in 2015. The VWMZ and the Rwizi Catchment Management Committee (CMC) reviewed and finalized the draft CMP in 2020. The Minister of State for Environment, Hon. Beatrice Anywar launched the final Rwizi CMP on 19th March 2020, during a Symposium on the Restoration of River Rwizi and enhancing the transition to a green economy in Uganda.

The Rwizi CMP will guide stakeholders in protecting, conserving, and managing the natural systems while considering the social and economic system. It specifies interventions that will showcase the benefits of integrated water resources management and development at the catchment level. Broadly, the interventions include initiatives for ecosystem restoration, infrastructure investments (e.g., for urban and rural water supply and sanitation, irrigation development, livestock watering, hydropower production, among others), and green economy investments.

Successful implementation of the Rwizi CMP will deliver four essential water uses to stakeholders in the catchment, namely:

- a) Water for people - addressing water supply and wastewater treatment and disposal;
- b) Water for food - through the development of irrigation infrastructure, livestock watering, post-harvest processing, industrial processing, among others;
- c) Water for nature - aiming for a demonstrated increase in quality, quantity, and distribution of healthy ecosystems in the catchment supporting all forms of life; and,
- d) Water for other uses - including energy through hydropower production, tourism, fisheries, drainage, and flood management.

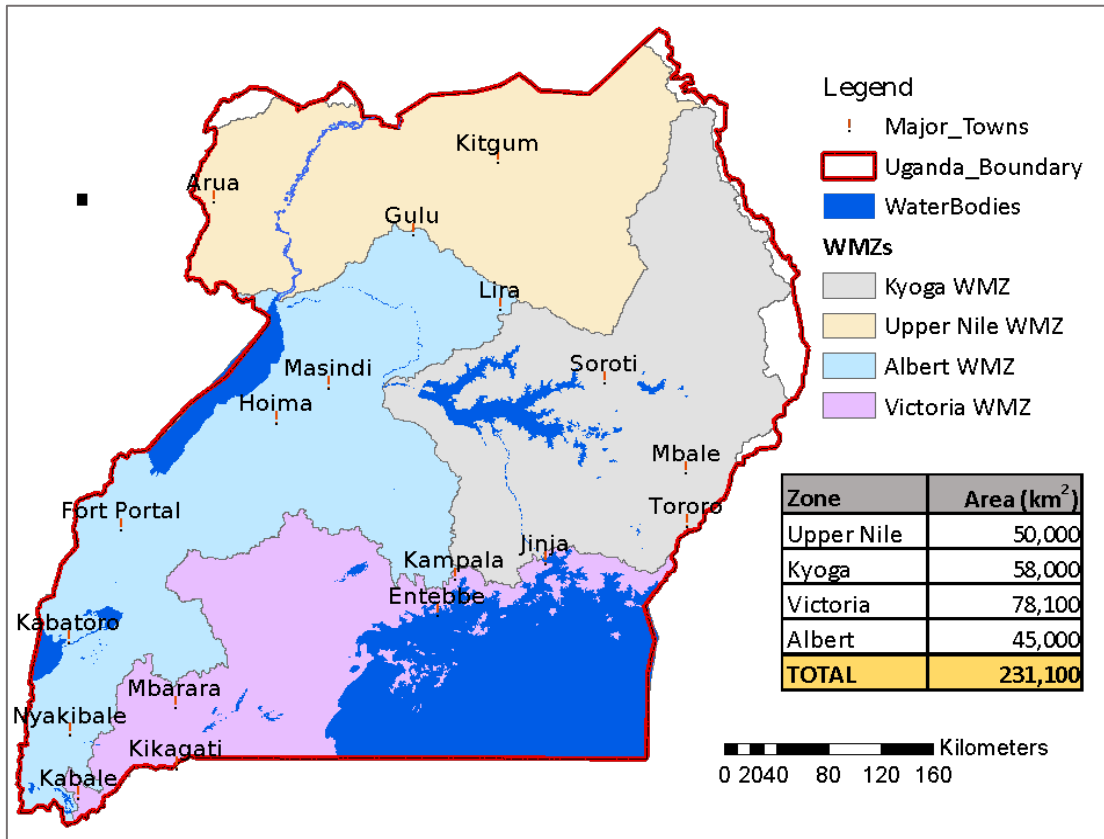
The Rwizi Catchment Management Plan comprises four chapters. Chapter One provides a contextual background and highlights the relevant Policy and institutional framework for Water Resources Management in Uganda. Chapter Two describes the status of Rwizi Catchment, focusing on the biophysical context, water resources, a stakeholder inventory, a social and environmental context, and ongoing and planned activities in the catchment. The Chapter ends with a prognosis of the strengths, weaknesses, opportunities, and threats to water resources management in the catchment. Chapter Three presents the stakeholders' vision for Rwizi catchment, their objectives in pursuit of the shared vision, the management interventions needed to achieve the objectives, and analyses the likely outcomes of implementing the options. Then Chapter Four presents the funding requirements for implementing the CMP, highlights possible funding sources, and suggests the roles and responsibilities of different stakeholders in the implementation of the CMP.

1.2 Water Resources Management in Uganda

The Ministry of Water and Environment (MWE), through its Directorate of Water Resource Management (DWRM), is implementing Catchment-based Integrated Water Resources Management (CbIWRM) as part of its water resources management reforms completed in 2005. CbIWRM places stakeholders at the centre of developing and managing water and related resources in their area; it allows stakeholders to jointly plan and manage water and related resources (e.g., land, ecosystems, and socio-economic systems) considering the needs and interests of all.

To operationalise CbIWRM, the MWE divided Uganda into four Water Management Zones (WMZs), namely: Upper Nile, Albert, Victoria, and Kyoga (Figure 1). Within each WMZ are smaller hydrological units called catchments, further delineated into sub- and micro-catchments. Rwizi catchment is one of the six catchments in Victoria Water Management Zone (VWMZ).

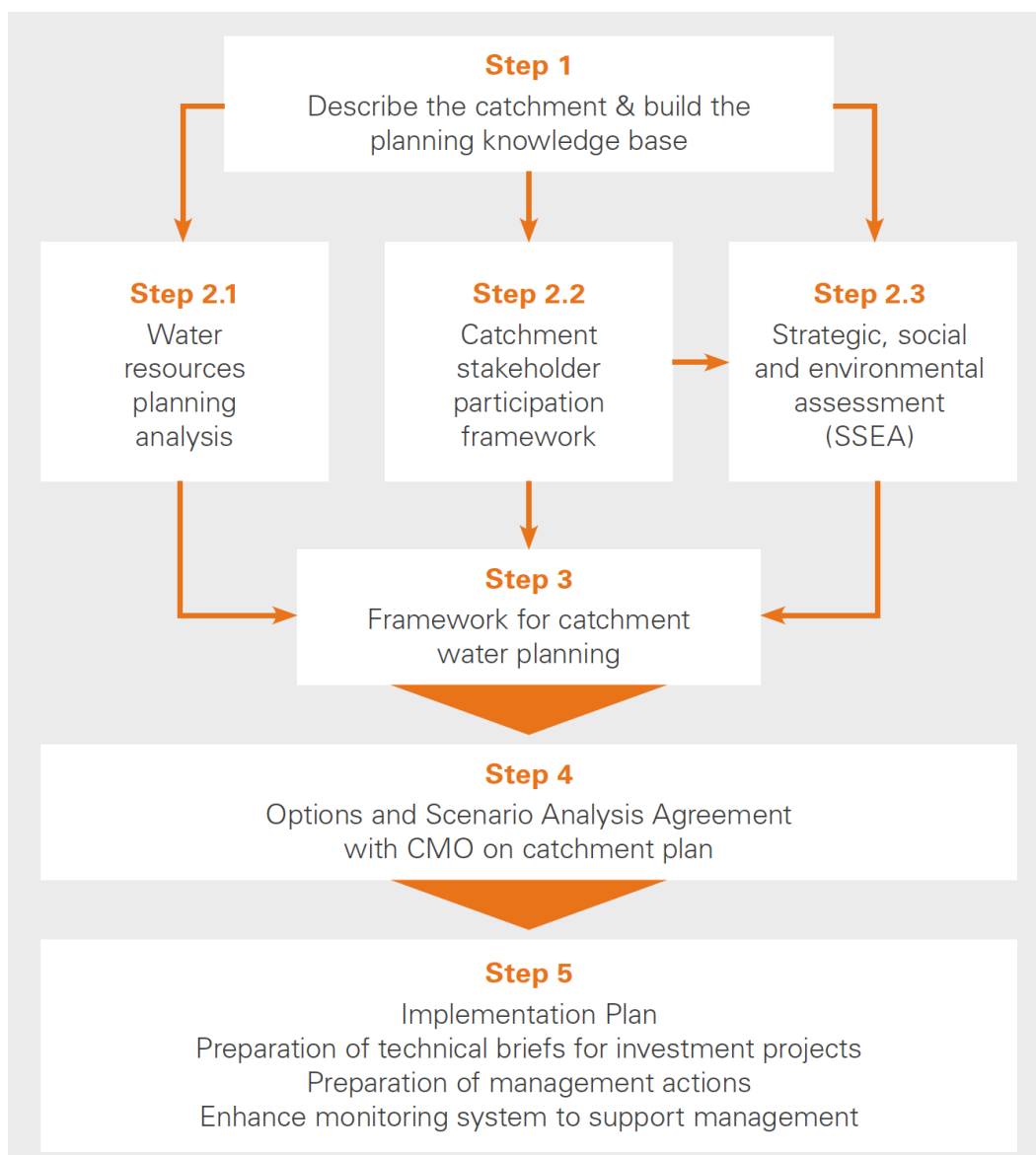
Figure 1: Water Management Zones in Uganda



Source: MWE (2019) Uganda Catchment Management Planning Guidelines 2019

In each catchment, stakeholders develop Catchment Management Plans, Sub Catchment Management Plans, and Micro Catchment Management Plans in a participatory process following the Guidelines for Catchment Management Planning (Figure 2). The Plans guide stakeholders on the critical issues in the respective catchments that need an immediate, medium-term, and long-term response. The Plans provide priority measures required to manage water and related resources in a manner that considers, among other aspects, the needs and aspirations of relevant stakeholders.

Figure 2: The Catchment Management Planning Process



Source: MWE (2019) Uganda Catchment Management Planning Guidelines 2019

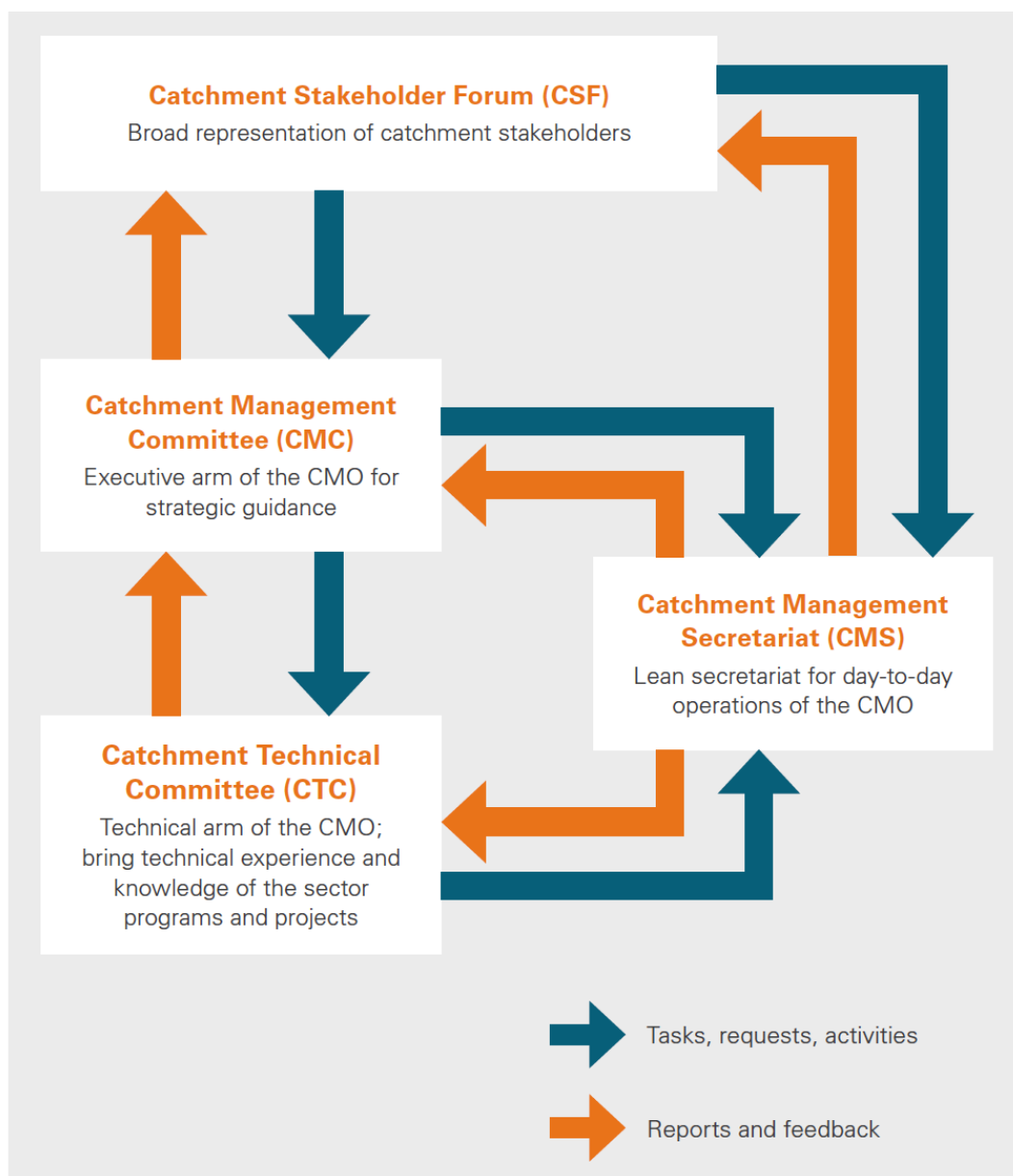
Further, a multistakeholder coordination structure called a Catchment Management Organisation (CMO) is established following the CMO Procedures Manual¹ to facilitate collaborative water resources management. A CMO comprises several bodies (Figure 3):

- a Catchment Stakeholder Forum (CSF) brings together all actors on catchment management. The CSF defines critical issues related to water resources in the catchment that require consideration to protect, manage, and develop water resources effectively. It provides input to the CMP for coordinated, integrated, and sustainable development and management of water and related resources in the catchment, including their implementation status.
- a Catchment Management Committee (CMC) is an executive board for the CMO. It is composed of representatives of all relevant stakeholder groups (Government, politicians, and community-based organisations, NGOs, water users, media, academic institutions, and private sector) and collaborates with the WMZ during the formulation of a CMP and plays a steering role during its implementation. It endorses the CMP and presents it to the CSF for information purposes.

¹ MWE (2019) Catchment Management Organisations Procedure Manual 2019

- a Catchment Technical Committee (CTC) forms the technical arm of the CMO and supports the CMC in their tasks. The CTC brings technical expertise and knowledge during the formulation of the CMP, puts into operation and sometimes implements programmes and projects from the Plan, and generally ensures that the different districts collaborate to implement the Plan. It comprises technical people from Government, NGOs, the private sector, development agencies, and other relevant organisations.
- a Catchment Management Secretariat (CMS) is an administrative secretariat for the CMC and the CTC. It supports the CMC in coordinating the planning and implementation of activities in the catchment and following up on recommended actions by the stakeholders.
- Sub Catchment Management Committees (SCMCs) and Micro Catchment Management Committees (MCMCs) are composed of representatives of all relevant stakeholder groups at Sub Catchment and Micro Catchment levels. The SCMCs and MCMCs are responsible for stakeholder coordination and implementation of the plans at their respective levels.

Figure 3: Composition of the Catchment Management Organisation (CMO)



Source: MWE (2019) Catchment Management Organisations Procedures Manual 2019

1.2.1 Key messages and conclusions on water resources management in Uganda

1. As part of its water resources management reforms completed in 2005, the Ministry of Water and Environment (MWE), through its Directorate of Water Resources Management (DWRM), is implementing stake-holder driven management of water resources.
2. Catchment-based Integrated Water Resources Management (CbiWRM) allows stakeholders to jointly plan and manage water and related resources (e.g., land, ecosystems, and socio-economic systems) based on hydrological, instead of administrative, boundaries, at the lowest appropriate level, considering the needs and interests of all.
3. To operationalise CbiWRM, the MWE divided Uganda into four Water Management Zones (WMZs), namely: Upper Nile, Albert, Victoria, and Kyoga. Within each WMZ are smaller hydrological units called catchments, further delineated into sub- and micro-catchments.
4. In each catchment, stakeholders develop Catchment Management Plans, Sub Catchment Management Plans, and Micro Catchment Management Plans in a participatory process following the Guidelines for Catchment Management Planning. Further, a multistakeholder coordination structure called a Catchment Management Organisation (CMO) is established following the CMO Procedures Manual to facilitate collaborative water resources management.

1.3 Policy, Legal and Institutional Framework for Water Resources Management in Uganda

The implementation of Water Resources Management in Uganda has its legal basis from international and transboundary conventions and obligations and national legislation, policies, and regulations. Also, several strategies at the national and regional level promote Integrated Water Resources Management.

1.3.1 International and regional obligations

Internationally- and regionally-agreed principles, conventions, agreements, treaties, and protocols relevant to the management of water resources include:

The Sustainable Development Goals (SDGs) framework is a plan for people, the planet, and prosperity that all stakeholders and countries should implement in collaboration and partnership. SDG 6, which seeks to "ensure availability and sustainable management of water and sanitation for all, covers the entire water cycle in addition to management of water and wastewater and ecosystem resources." Other SDGs relevant to IWRM include SDG 2 (Zero Hunger), SDG 5 (Gender Equality), SDG 7 (affordable and clean energy), SDG 8 (Decent work and economic growth), SDG 11 (Sustainable cities and communities), SDG 12 (Responsible consumption and production), SDG 13 (Climate Action), SDG 14 (Life below water), SDG 15 (Life on Earth) and SDG 17 (Partnerships for the Goals). Annex 2 gives the SDG targets linked to the environment or WRM in general.

The Ramsar Convention (1971) on wetlands is an intergovernmental treaty for which member states must commit to maintaining the ecological character of wetlands of international importance and Plan for sustainable use of wetlands in their territories. The Convention's mission is "*the conservation and wise use of all wetlands through local and national actions and international cooperation as a contribution towards achieving sustainable development throughout the world.*" Uganda became a signatory to this Convention on the 4th of July 1988 and currently has about 12 Ramsar registered wetland systems covering approximately 454,303 hectares. In terms of this Convention, the wise use of wetlands is "*the maintenance of their ecological character, achieved through the implementation of ecosystem approaches within the context of sustainable development.*"

In 1997, Uganda ratified the **UN Convention on combating desertification (UNCCD)**. The Climate Change Department of the Ministry of Water and Environment is the focal point for UNCCD. In 2000, Uganda launched a National Action Programme to combat drought and desertification following a national report to UNCCD in Uganda in 1999.

In 1993, Uganda ratified the **UN Framework Convention on climate change and the Kyoto protocol (UNFCCC)**. It launched the climate change policy in 201 with related prioritisation of outputs under short (1-5 years), medium (6-10 years), and long term (11-15 years) time frames.

The Africa Agenda 2063. Goal 7 (environmentally sustainable and climate-resilient economies and communities) of Africa Agenda 2063 calls for putting measures to sustainably manage the continent's rich biodiversity, forests, land, and waters and using adaptive measures to address climate change risks. The priority areas for Goal 7 are sustainable natural resource management and biodiversity conservation, sustainable consumption and production patterns, water security, climate resilience and natural disasters preparedness and prevention, and renewable energy.

The African Convention on the Conservation of Nature and Natural Resources (2003), adopted in Maputo, Mozambique on 11/07/2003, came into force on 23/07/2016. On 18/12/2003, Uganda signed the Convention but was yet to ratify it as of the most recent status update² on 06/02/ 2019. Article VI requires Parties to "take effective measures to prevent land degradation" through developing "long-term integrated strategies for the conservation and sustainable management of land resources, including soil, vegetation, and related hydrological processes." Article VII requires parties to, among others, take appropriate measures towards "the integrated management of water resources, and the conservation of forested and other catchment areas and the coordination and planning of water resources development projects."

The East African Community (EAC) Vision 2050: Pillar 3.4 of the EAC Vision 2050 targets sustainable utilisation of natural resources, environmental management, and conservation with enhanced value addition, with 92.9% of the population having access to safe water

The East African Community (EAC) Protocol on environment and natural resources management (2006): In April 2006, the EAC's Council of Ministers adopted the Protocol to promote "cooperation (among the Partner States) in the management of the environment and natural resources within their jurisdiction. Article 13 (water resources management) requires the EAC partner states to, among others, "take all necessary measures to promote river and lake basin management to protect water resources," "improve water catchment management," and "(...) promote the participation of the private sector, civil society, and women in the management of water resources."

The Nile basin cooperative framework agreement: Uganda signed the Nile Basin cooperative framework agreement (CFA) in 2010 and ratified it in 2019. The CFA aims to establish a framework to promote integrated management, sustainable development, and harmonious utilization of water resources of the basin and their conservation and protection to benefit the present and future generations. The Cooperative framework agreement (CFA) outlines the principles, rights, and obligations for cooperative management and development of the Nile Basin water resources.

The **Convention on the Protection of World and Cultural Heritage (1972)** guides the preservation of artifacts of cultural importance. Similarly, The **Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)** guides the protection of endangered species such as those found in National Parks like Lake Mburo. Further, the **Convention on Biological Diversity (1992)** provides for the management of biodiversity while protecting catchments from which rivers draw water.

The **Vienna Convention for the protection of the Ozone Layer (1985)** is essential in the climate change debate and the management of greenhouse gas emissions from cities such as Mbarara. Similarly, the

² https://au.int/sites/default/files/treaties/7782-sl-revised_african_convention_on_the_conservation_of_nature_and_natural_resources.pdf

Montreal Protocol on Substances that deplete the Ozone layer (1987) guides local dialogue on impacts of climate change.

1.3.2 National legislative framework

The **Constitution of the Republic of Uganda (1995)** requires the State to adopt an integrated and coordinated planning approach to ensure balanced development between different regions of Uganda and the rural and urban areas, protect essential natural resources, and endeavour to fulfil the fundamental rights of social justice and economic development Ugandans. The State is also required to promote sustainable development and public awareness of the need to manage land, air, water resources, and natural resources in a balanced and sustainable manner for both current and future generations. Through this, the Constitution provides the legal basis for Integrated Water Resource Management in Uganda.

Further, The Constitution paved the way for decentralization and devolution by clarifying Central and Local Governments' roles. Central Government's mandate is to set policy standards, supervise, inspect, coordinate, and monitor the Local Governments, while Local Governments are responsible for providing a broad range of services³.

Article 178 of The Constitution provides for the cooperation of two or more districts to form a regional government that shall be a corporate body (with powers to sue or be sued) having political, legislative, executive, administrative, and cultural functions. Among others, such a government would:

- develop and manage regional infrastructure, for instance, roads and hospitals but not those operated by national institutions;
- coordinate, monitor, and supervise activities related to agriculture, forests (but not in national parks and wildlife reserves managed by the Central Government), cultural and traditional lands;
- promote water and sanitation; and
- perform functions and services surrendered voluntarily by district councils; however, such a government can impose tax only with Central Government's approval.

Therefore, Article 178 of The Constitution provides the basis for establishing multi-district coordination structures such as CMOs.

The **Water Act Cap 152 (1997)**: Uganda's Water Act Cap 152 provides for the use, protection, and management of water resources and supply; and facilitates the devolution of water supply and sewerage undertakings. Its objectives are to:

- promote the rational management and use of the water resources of Uganda;
- promote the provision of a clean, safe and sufficient supply of water for domestic purposes;
- ensure appropriate development and use of water resources other than for domestic use, e.g., watering of stock, irrigation, and agriculture, industrial, commercial, and mining uses, generation of energy, navigation, fishing, preservation of flora and fauna, and recreation in ways which minimize damage to the environment; and
- control pollution and promote the safe storage, treatment, discharge, and disposal of waste, which may pollute water or otherwise harm the environment and human health.

The Act promotes the principles of IWRM and advocates for the involvement of all stakeholders in planning for the utilization, development, and management of water resources. It addresses cross-sectoral interests in water resources and the (financial and technical) shared roles among stakeholders. The Act is currently under review to provide for the de-concentration of water resources management from the centre to regional entities.

³ Ministry of Local Government (2014). Decentralization and local development in Uganda. Accessed on 12/03/2020 at <https://www.ug.undp.org/content/dam/uganda/docs/UNDPUG2014%20-LOCAL%20GOVERNMENT%20HANDBOOK%202014.pdf>

The **National Environment Act (2019)**: Section 3, subsection 2, places on every person the duty to create, maintain, and enhance the environment and prevent pollution. Section 5 provides principles of environmental management:

- i. encouraging the participation by the people of Uganda in the development of policies, plans, and programmes for managing the environment
- ii. providing for equitable, gender-responsive, and sustainable use of the environment and natural resources, including cultural and natural heritage, to benefit both present and future generations
- iii. maintaining stable functioning relations between the living and non-living parts of the environment through conserving biological diversity and by use of prudent environment management measures
- iv. ensuring an optimum sustainable yield in the use of renewable natural resources
- v. ensuring that activities relating to extractive processes of renewable and non-renewable natural resources are sustainable
- vi. restoring lost or damaged ecosystems where possible and reversing the degradation of the environment and natural resources,
- vii. ensuring the establishment of adequate environmental protection standards and implementation of effective monitoring of change in environmental quality.

Several Environmental Regulations supplement this Act; they include:

- The National Environment (Standards for Discharge of Effluents into Water or on Land) Regulations, SI 153-3
- The National Environment (Waste Management) Regulations, S 153-2
- The National Environment (Wetlands, Riverbanks and Lake Shores Management) Regulations, SI 153-5
- The National Environment (Hilly and Mountainous Areas Management) Regulations, SI 153-6

The **Local Government Act (1997, revised 2015)**: The Act gives local authorities the mandate to plan and implement development interventions according to local needs in water and sanitation. Section 8 of the Local Government Act provides that two or more district councils may cooperate (per article 178 of The Constitution) in areas of culture and development. The cooperating districts can establish joint institutions (e.g., councils, secretariats), trust funds and appoint joint committees on matters of mutual interest. Like Article 178 of The Constitution, this provision of the Local Government Act provides the foundation for structures such as CMOs and the resultant collaboration between District Local Governments.

Other laws relevant to water resources development and management include:

- The Land Act Cap 227
- The Mining Act, 2003
- The Physical Planning Act, 2010
- The National Forestry and Tree Planting Act, 2003
- The Roads Act, Cap 358
- The Fish Act, Cap 197
- The Rivers Act Cap 357
- The Uganda Wildlife Act, Cap 200
- The Public Health Act, Cap 281
- The Occupational Safety and Health Act, 2006
- The Inland Water Transport (Control) Act Cap 356
- The Investment Code Act, Cap 92
- The Civil Aviation (Aerodromes) Regulations, 2007

1.3.3 National Policies

The **National Water Policy (1999)**: The National Water Policy defines the Government's policy objective as managing and developing the water resources in an integrated and sustainable manner to secure and provide water of adequate quantity and quality, with the full participation of all stakeholders. This Policy, currently under review, is based on an IWRM framework. The role of the central Government's agencies is to guide and support the local governments as required, while the responsibility to provide water services and maintain facilities lies with local councils in districts and urban centres. Thus, the Act emphasizes the

shared responsibility among stakeholders, including the private sector and Non-Governmental Organisations (NGOs), in the development and management of water resources and the regulation of human activities that pose potential risks to land and water resources.

The National Environment Management Policy (1994): The National Environment Management Policy provides for environmental management in the country and provisions for regulating developments assumed to impact the environment (including effects on water resources).

National Policy for the Conservation and Management of Wetland Resources (1995): This Policy aims to restrict the continued loss of wetlands and their associated resources and ensure the equitable and sustainable distribution of the benefits derived from wetlands. It guides the protection and conservation of wetlands as important catchments for water.

Uganda National Land Policy (2013): The Policy provides a framework for articulating the role of land in national development, land ownership, distribution, utilisation, alienability, management, and control. The Land Policy has a specific objective that seeks to ensure sustainable utilisation, protection, and management of environmental, and natural, and cultural resources on land for national socio-economic development. It aims to ensure that all land-use practices and plans conform to principles of sound environmental management. Therefore, it promotes sustainable land management approaches that do not compromise land's ability to provide ecological services.

National Forestry Policy (2001): It provides for establishing, rehabilitation, and conservation of watershed protection forests. It aims at promoting sustainable management of forests that protect the soil and water in critical watersheds and river systems.

Decentralisation Policy Strategic Framework (DPSF) 2013-2023: The Decentralisation Policy Strategic Framework (DPSF) 2013-2023 replaces the earlier one formulated in 2006. While re-affirming democratic decentralisation as Uganda's decentralisation policy, the DPSF (2013-2023) takes account of several significant developments since 2006, including changes in Uganda's national development planning framework and the emergence of Local Governments as agents of local development.

National Environmental Management Policy (1994): This Policy has provisions to control land degradation in the country and has specific objectives to integrate environmental concerns in all development policies, planning, and activities at national, district, and local levels, with the full participation of the people.

The Uganda Wildlife Policy (2014): Features of this Policy relevant to IWRM include sustainable management of wildlife to grant benefits for the present and future generations and promote public/private partnership in wildlife management. It has provisions requiring sustainable water resources for life in the wild.

Energy Policy for Uganda (2002): Among others, the Policy aims at meeting the energy needs of Uganda's population for social and economic development in an environmentally sustainable manner. It guides the non-consumptive use of water for hydropower production and biomass energy delivered from fuelwood.

National Climate Change Policy (2015): The Policy intends to guide all climate change activities and interventions in the country and ensure that all stakeholders address climate change impacts and their causes through appropriate measures while providing sustainable development and a green economy. The Policy lays out specific strategies relevant to the water sector, including promotion and encouragement of water harvesting and efficient water utilization, (ii) ensuring availability of water for production in water-dependent sectors, (iii) promotion and strengthening of the conservation and protection against degradation of watershed and catchment areas, (iv) promotion of integrated water resources management (including underground water resources), and (v) improving and strengthening trans-boundary cooperation.

National Gender Policy (2007): This Policy aims to guide all levels (including in the water sector) of planning, resource allocation, and implementation of programmes with a gender perspective. The emphasis on gender follows from the recognition of "gender" as a development concept helpful in identifying and

understanding the social roles and relations of women and men of all ages, and it affects development. The Policy recognises women and children as key stakeholders in water provision, use, and resource sustainability.

Other relevant policies include the following:

- i. *The Mining and Mineral Policy for Uganda (2018)* guards against unsustainable use of heavy metals such as cyanide and mercury in mineral resource exploitation. This Policy, therefore, cushions water resources from pollution by such heavy metals.
- ii. *The National Fisheries Policy (2004)* observes that the fisheries industry depends on quality water resources.
- iii. *The National Irrigation Policy (2017)* regulates the abstraction and use of water for commercial irrigation activities.
- iv. *The Policy Framework for Industry Sector (2008)* promotes sustainable abstraction and use of water resources without compromising future requirements.

1.3.4 National plans and strategies

The Uganda Vision 2040: The Vision provides for the development of a 30-year plan implemented through (i) three 10-year plans, (ii) six 5-year National Development Plans (NDP), (iii) sector-specific master and investment plans (SIPs), (iv) local government development plans, and (v) annual plans and budgets.

National Development Plan III (NDP - III): The theme of the Third National Development Plan (2020-2025) is "*Sustainable Industrialization for inclusive growth.*" The Plan recognises the effects of climate change caused by deforestation, land degradation, wetland degradation, and encroachment⁴. Program number five (5) of the NDP 3; Climate Change, Natural Resources, Environment, and Water Management, aims at 1) assuring availability of adequate and reliable quality freshwater resources for all uses; 2) increasing forest, tree, and wetland coverage, restoring bare hills and protecting mountainous areas and rangelands; 3) maintaining or restoring a clean, healthy, and productive environment; 4) reducing climate change vulnerability and carbon footprint; 5) reducing human and economic loss from natural hazards and disasters; and 6) increasing incomes and employment through sustainable use and value addition to water, forests and other natural resources.

Climate Change Adaptation Strategy for the Water Sector (2011): The overall objective of the strategy is to reduce vulnerability to climate change, build adaptive capacity and resilience to climate hazards, and use a policy-based approach to implement development programmes that are climate proofed.

Water for Production Strategy and Investment Plan (2009): This strategy and investment plan aims at promoting the development of cost-effective and sustainable water for production supply and management for increased production and contribution to the modernisation of the agricultural sector in Uganda with a focus on poverty reduction and minimal environmental impacts.

National Irrigation Master Plan for Uganda (2010 – 2035): The main objectives of the master plan are to achieve economic growth and poverty alleviation by improving the country's irrigation potential sustainably, thereby mitigating the potential impacts of climate change. The Irrigation Master Plan also promotes the improvement of existing schemes and crop yields, and livelihood differentiation.

National Water Quality Management Strategy (2006) Water quality management plays a crucial role in WRM and is one of the pillars and main objectives of any global WRM strategy. The main objectives of the NWQMS are the reduction of poverty through effective water quality management and the improvement of water quality standards to meet socio-economic and environmental needs. It identifies ten strategic targets for the aquatic environment and monitoring of water quality at the consumer level.

The National Forest Plan (2011/12-2021/22): Deforestation and encroachment of forests for cultivation are significant threats to forests in Uganda. The existence and conservation of wet forests and riverine

⁴ NPA (2020) National Development Plan (2020/2021-2024/2025), National Planning Authority, 2020.

forest ecosystems depend on sound WRM and the adoption of strategies to alleviate the existing pressures on forest resources.

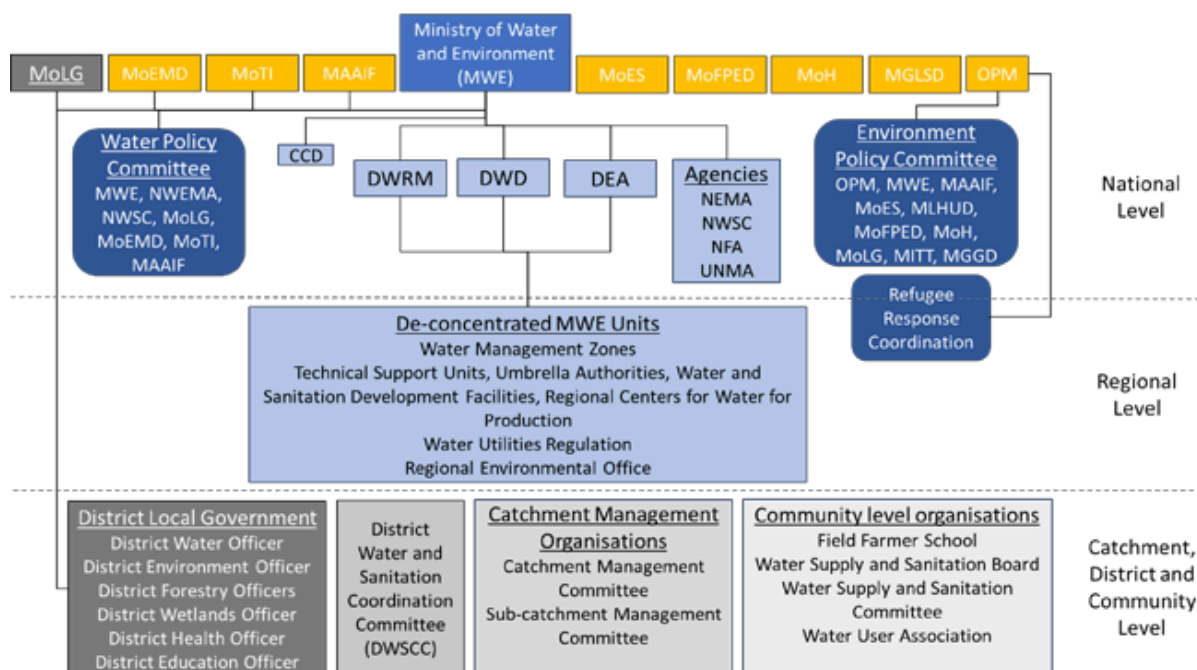
Uganda Green Growth Development Strategy (2017/18-2030/31): Aims to ensure that Uganda attains the goals of Vision 2040 and the NDPII 2015/16-2019/20 sustainably. One of the five focus areas of the UGGDS is natural capital management and development, which focuses on tourism development, sustainable forestry, wetlands, and optimal water resources management

The Uganda Country Refugee Response plan (Jan 2019-December 2020): The recently approved Uganda Country Refugee Response plan (Jan 2019-December 2020) emphasizes using a catchment-based approach in planning and implementing environment and natural resource protection and restoration while promoting green livelihoods. It further highlights the collaboration between District Local Governments (DLGs) and Water Management Zones in developing environmental impact assessments, action plans, and forest resource management plans for each refugee-hosting sub or micro-catchment.

1.3.5 Institutions and coordination structures

The overarching structure for implementing Water Resources Management in Uganda cascades from the national level, the regional level, the catchment level, and the district level (Figure 4).

Figure 4: Water and Environment Sector Institutional framework



Source: MWE (2019) Water and Environment Sector Performance Report 2019

National level

The **Ministry of Water and Environment** is mandated to plan, manage, maintain, develop and coordinate all water and environmental sector activities in Uganda. The ministry is the ultimate authority responsible for water resources and environmental management in Uganda. It is mandated to manage and regulate all water resources, determine water development and management priorities, and set national policies and standards.

MWE operates through three directorates:

- The **Directorate of Water Resources Management (DWRM)** is responsible for developing and maintaining water resources and supports the enforcement of national water legislation, policies, and regulations. It also monitors, assesses, and regulates the country's water resources through issuing water abstraction and wastewater discharge permits. DWRM is the lead in agenda development for CbiWRM. It is responsible for coordinating the Water Management Zones, mobilising resources, and building stakeholders' capacity in CbiWRM.
- The **Directorate of Water Development (DWD)** is responsible for developing large-scale water infrastructure. Its mandate is to promote and ensure the rational and sustainable development, utilisation, and safeguarding of water infrastructure and providing overall technical oversight for the planning, implementation, and supervision of urban and rural water and sanitation services.
- The **Directorate of Environmental Affairs (DEA)** is the lead agency for environmental policy, regulation, coordination, inspection, and supervision, monitoring of the environment and natural resources, restoration of degraded ecosystems, and the mitigation of and adaptation to climate change.

The **Climate Change Department (CCD)** of MWE is responsible for strengthening the country's implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol (KP).

The MWE collaborates with affiliated semi-autonomous bodies such as:

- The **National Forestry Authority (NFA)** is responsible for managing central forest reserves sustainably and supplying high-quality forestry-related products and services to Government, local communities, and the private sector.
- The **National Environment Management Authority (NEMA)** is mandated to coordinate, monitor, regulate, and supervise environmental management in Uganda. It is the lead agency in developing environmental policies, laws, regulations, standards, and guidelines. NEMA guides the Government on sound environmental management in the country. It is the apex body for environmental law enforcement in Uganda; however, some of its functions are delegated to other institutions as lead agencies in their respective fields. The responsibility of compliance control is placed on gazetted environmental inspectors⁵ distributed in several institutions and agencies of Government at the central, regional, and district levels. According to the National Environment Act 2019, the board of NEMA is responsible for the administration of a National Environment Fund aimed to support, among other activities: management of sensitive and fragile ecosystems; critical environmental restoration activities; research intended to further the requirements of environmental management, capacity building, environmental publications and scholarships; and innovations for environmental conservation and management. An Environmental Police has been formed at NEMA, trained explicitly in environmental issues; their functions include sensitization against and prosecution of environment-related cases. NEMA works closely with relevant offices at the district level, such as those responsible for the environment, forest resources, wetlands resources, agriculture, and fisheries resources.
- The **Uganda National Meteorological Authority (UNMA)** has the mandate to offer weather and climate services, analyze scientific research findings, and provide guidance on climate change.
- The **National Water and Sewerage Corporation (NWSC)** is responsible for the operation of sewerage services and the provision of water in urban centers. It uses generated revenue to develop and improve relevant infrastructure and, recently, implement water source protection interventions.

Other ministries that have direct relevance for water resources management due to their mandates and operations are:

- The **Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)**; mandated to lead on water use and management of on-farm agricultural water facilities, while MWE is responsible for off-farm activities

⁵ <https://nema.go.ug/sites/all/themes/nema/docs/DESGINAYED%20ENVIRONMENTAL%20INSPECTORS.pdf>

- The **Ministry of Tourism, Wildlife and Antiquities (MTWA)**; covers the water use and management of industries, commerce, wildlife, and tourism
- The **Ministry of Trade Industry and Cooperatives (MTIC)** covers water use and management for industries and commerce
- The **Ministry of Energy and Mineral Development (MEMD)**; oversees the water use and management for hydropower generation and mining, including oil exploration and exploitation activities.
- The **Ministry of Health (MOH)**; has the role of ensuring that everyone in Uganda has access to quality health services through primary health care, a process in which water plays a critical role.
- The **Ministry of Works and Transport (MWT)**; oversees water use for navigation and management of water resources during road and bridge construction.
- The **Ministry of Local Government (MLG)**; responsible for establishing structures and frameworks for the governance of districts.

Coordination is a necessary process for Integrated Water Resources Management (IWRM), which involves multiple stakeholders from different sectors, different scales, and different structures and interests. At the national level, the following committees are relevant to integrated water resources management:

- The **Policy Committee on Environment**, established under the National Environment Act, is responsible for strategic policy guidance on the environment. It consists of the Prime Minister (who chairs it) and Ministers responsible for water and environment; agriculture, animal industry, and fisheries; finance, planning and economic development; education, science, technology, and sports; health; lands, housing, and urban development; local Government; tourism, wildlife, and antiquities; trade, industry, and cooperatives; works and transport; energy and mineral development; internal affairs; defense and veterans' affairs; information, communications technology, and national guidance. Its functions include providing advice in the formulation and implementation of environmental and climate change policies, plans, and programmes; and providing guidance on harmonisation of Government policies on the environment, natural resources, water, and climate change.
- The **Water Policy Committee**: established under the Water Act Cap 152 and Water Resources Regulations (1998) of Uganda, the Water Policy Committee assists and advises the Minister of Water and Environment and promotes inter-Ministerial and inter-sectoral coordination over a wide range of water resources management and development issues. It provides an avenue for promoting IWRM at the national level and guiding the country's strategic management of water resources. The Permanent Secretary of the Ministry of Water and Environment chairs the Water Policy Committee.
- The **Water and Environment Sector Working Group (WESWG)** and **IWRM Working Group** enable stakeholder interaction and coordination at the national level on water and environmental matters.
- The **Inter-Ministerial Technical Committee** regarding Water for Production, comprising members from the MWE, Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF), Office of the Prime Minister, National Planning Authority, and Ministry of Finance. It meets quarterly to coordinate investments and works regarding water for production.
- The **Wetlands Advisory Group (WAG)** is a technical group dedicated to wetlands. The WAG improves coordination on wetlands issues.
- The MWE-DWRM has created **Water Net**, a network for building capacities of stakeholders connected to the water sector.

Regional level

Water Management Zones: As a result of the de-concentration of water resources management, DWRM created four Water Management Zones (WMZ) following hydrological boundaries. They operate on a regional level intending to bring the central services closer to the stakeholders. The WMZs provide an interactive interface between the central and the local government actors, coordinate partners' activities, and monitor and evaluate the performance of water resources management activities. The WMZs facilitate the establishment of CMOs and support them to implement activities relevant to DWRM's de-concentrated functions and services. The Ministry of Water and Environment appoints WMZ staff and delegates to them

defined DWRM functions. The four WMZs are Victoria WMZ (based in Mbarara), Albert WMZ (based in Fort Portal), Upper Nile WMZ (based in Lira), and Kyoga WMZ (based in Mbale).

The Directorate of Water Development (DWD) established the **Water and Sanitation Development Facility (WSDF)** to support water supply and sanitation facilities for rural growth centers and small towns to promote a demand-responsive approach. The WSDFs design and construct water supply and sanitation facilities, carry out related community mobilization activities and set up operation and maintenance structures. The government and other stakeholders fund investments for water and sanitation in small towns, town boards, and rural growth centers through WSDFs. Currently, WSDFs operate through four branch offices presently established in Mbarara (southwest), Lira (north), Mbale (east), and Wakiso (center).

Further, the DWD established **Rural Water Regional Centers (RWRCs)**, formerly Technical Support Units (TSUs), at the regional level to support the capacity building of district-based structures. This capacity-building involves training, technical advice, and support supervision of District Local Governments to implement their roles effectively; the mandate also covers water-for-production. The RWRCs currently operate through six branch offices in Lira, Moroto, Mbale, Mbarara, Fort Portal, and Wakiso districts.

Water for Production Regional Centers (WFPRCs) are responsible for promoting water-for-production development by constructing valley tanks, valley dams, and irrigation schemes. They currently operate through three branch offices presently established in Mbarara (west and center), Lira (north), and Mbale (east)

Umbrella Authorities (UA) of Water and Sanitation, formerly Umbrella Organisations (UO), are responsible for managing gazetted water and sanitation schemes. They operate through six branch offices in Lira (North), Moroto (Karamoja), Mbale (East), Wakiso (Central), Kyenjojo (Mid-West), and Kabale (South-West).

The Directorate of Environmental Affairs has established **offices for the wetland department on the regional level**.

Catchment level and Sub Catchment level

Water Management Zones of the Ministry of Water and Environment establish Catchment Management Organisations (CMOs) at the local level. A CMO comprises several bodies:

- i. **The Catchment Stakeholder Forum (CSF)** brings together all relevant actors in the catchment. The CSF defines critical issues related to water resources in the catchment that require consideration to protect, manage, and develop water resources effectively. It provides input to the Catchment Management Plan (CMP) for coordinated, integrated, and sustainable development and management of water and related resources in the catchment.
- ii. **The Catchment Management Committee (CMC)** is composed of representatives of all relevant stakeholder groups (Government, politicians, and community-based organisations, NGOs, water users, media, academic institutions, and private sector) and collaborates with the WMZ during the formulation of a Catchment Management Plan and plays a steering role during its implementation. It endorses the CMP and presents it to the Catchment Stakeholder Forum for information purposes. The CMC acts as an executive board for the Catchment Management Organisation.
- iii. **The Catchment Technical Committee (CTC)** forms the technical arm of the CMO and supports the CMC in their tasks. The CTC brings technical expertise and knowledge during the formulation of the Catchment Management Plan. The CTC operationalises the CMP and generally ensures that the different districts collaborate to implement the Plan. It comprises technical people from Government, NGOs, the private sector, development agencies, and other relevant organisations.
- iv. **The Catchment Management Secretariat (CMS)** supports the Catchment Management Committee in coordinating the planning and implementation of activities in the catchment and following up on recommended actions by the stakeholders. The CMS acts as an administrative secretariat for the Catchment Management Committee and the Catchment Technical Committee.

At the sub-catchment level, a **Sub Catchment Management Committee (SCMC)** comprises political leaders, administrators, and other stakeholders at the Sub-county level. At the micro-catchment level, a **Micro Catchment Management Committee (MCMC)** is a mirror image of the SCMC at the Parish or Village level. These committees are responsible for coordinating and supervising the implementation of water resources management activities at their respective levels of operation.

The CMO Procedures Manual ⁶ elaborates the composition of the CMO, roles of the different structures, their establishment process, and linkages with stakeholders at different levels.

District Local Government level

In consultation with MWE, **District Local Governments (DLGs)** appoint and manage private operators for urban piped water schemes outside of NWSC jurisdiction. The District Water Offices manage water and sanitation development and oversee the operation and maintenance of existing water supplies. As described under the legislative framework, DLGs may cooperate to form and support joint institutions for managing, among others, water and related resources, which is very important for the formation and functioning of CMOs.

At the DLG level, several offices and departments are relevant to water resources management:

- The District Environment Office, the District Forestry Office, and District Wetlands Office under the **District Natural Resources Department** are responsible for natural resources management, capacity building, sensitization, and environmental law enforcement.
- The **District Water Office** is responsible for developing water infrastructure for domestic use and production
- The **District Production Department** including Agriculture, Livestock, and Fisheries Offices.
- The **Department of Community Based Services** coordinates all activities related to community development, including activities of CSOs, NGOs, and other community-based institutions. The department works directly with communities and mobilizes and sensitizes them for poverty eradication, gender, probation, social welfare, and community development.
- The **Department of Planning** is mandated to provide planning services within the District by working with other district departments, as well as the lower local governments to ensure timely production of up-to-date and high-quality medium-term operational plans
- The **District Communication Office** is the official government communication platform at the district level. It has free airtime in private and Government media and a budget for community mobilization and sensitization.
- The **District Health Office** is responsible for ensuring that the district population has access to quality health services through primary health care.

District Environment and Natural Resources Committees responsible for, among other functions: coordinating the activities of Urban or District councils relating to the management of the environment and natural resources; ensuring the integration of environmental concerns in all plans and projects approved by the Urban or District council; assisting in the formulation and enforcement of ordinances and monitoring all activities within the District to ensure that such activities do not have any significant impact on the environment.

District Water and Sanitation Coordination Committees (DWSCCs) are present in all districts and provide a coordinating platform that oversees the DLGs water and sanitation sector activities. DWSCCs aim to strengthen cross-sector collaboration and are composed of political leaders, relevant district departments, NGOs, and development partners.

⁶ MWE (2019) Catchment Management Organisation Procedures Manual

Community-level

The NGOs involved in water sector activities have formed a network of over 170 members, called the Uganda Water and Sanitation Network (UWASNET), for improved coordination of their actions in the water sector. The UWASNET provides a platform for constructive engagement with Government and donors in the water sector and promotes experience-sharing among its members.

The Water Act provides for the formation of Water and Sanitation Committees, Water User Groups, and Water User Associations, as local community-level organisations, to ensure the sustainability of the water supply and sanitation facilities through proper management, operation, and maintenance by the user communities.

The NGOs and CBOs play a critical role in CbiWRM implementation. They promote natural resources management interventions, implement water supply infrastructure, and mobilise and sensitise communities towards environmental protection.

The private sector plays a significant role in the water and environment sector by providing the following contributions: private sector contractors and consultants undertaking design and construction work in water supply and sanitation; hand pump mechanics and scheme attendants providing maintenance services; operators managing piped water services in small towns and rural growth centres; and private forest owners with registered forests and processing of forest products in the forestry sub-sector.

1.3.6 Key messages and conclusions on the policy, legal and institutional framework

1. The implementation of Water Resources Management in Uganda has its legal basis from international and transboundary conventions and obligations, national legislation, policies, regulations, and several strategies at both national and regional levels.
2. The existing policy and legal framework promote water resources management from the lowest possible level while considering and specifying the roles of different stakeholders, providing the basis for CbiWRM.
3. The overarching structure for implementing Water Resources Management in Uganda cascades from the national level, regional level, catchment level, and district level. No single institution has the full mandate (and, ultimately, resources) to implement CbiWRM; hence, collaboration, coordination, and communication among the mandated institutions are critical to the effective implementation of CbiWRM.

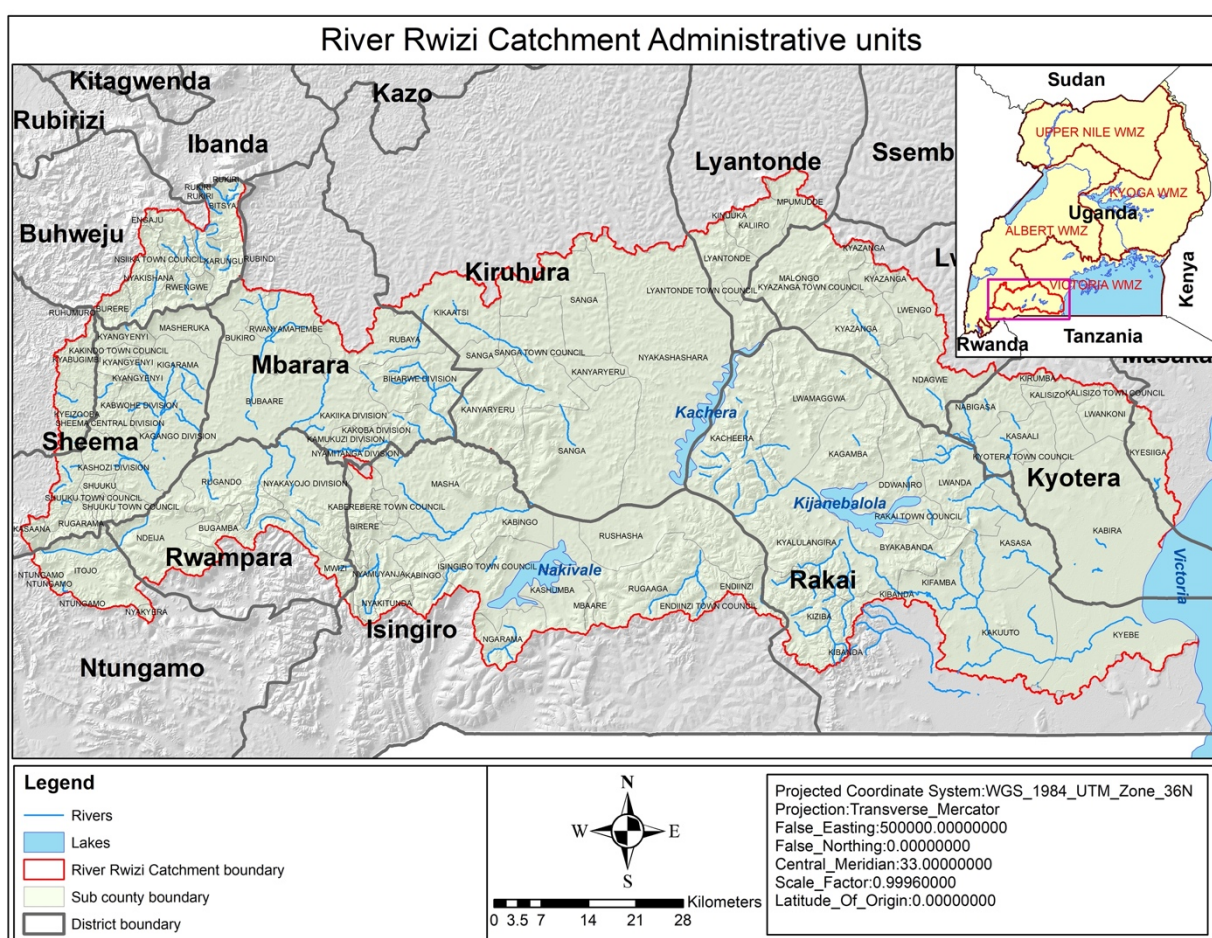
2 STATUS OF RWIZI CATCHMENT

2.1 Biophysical context

2.1.1 Location and extent

Rwizi catchment covers approximately 8,554 square kilometers in Buhweju, Bushenyi, Sheema, Ntungamo, Mbarara, Rwampara, Isingiro, Kiruhura, Lyantonde, Lwengo, Rakai, and Kyotera districts (Figure 5). River Rwizi is the main river in the Catchment. The river forms a complex system of wetlands and streams originating from the hills in Buhweju district, flowing in a southerly direction, turning eastwards for about 57 kilometers until the gauge at Mbarara waterworks, discharging its water into Lake Victoria.

Figure 5: Administrative Units in Rwizi Catchment



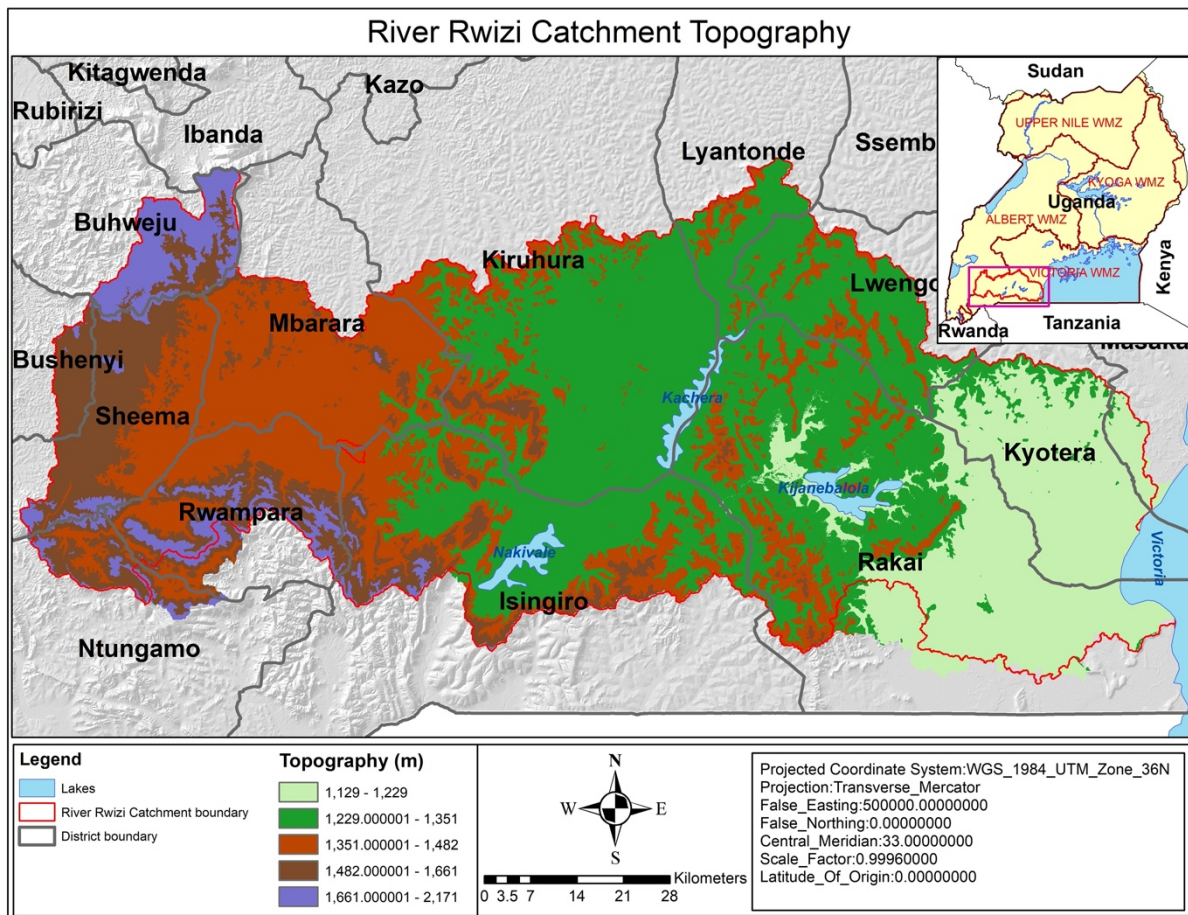
2.1.2 Topography

Rwizi catchment is partly flat and sloping (Figure 6). The upper reaches of the Catchment are predominantly hilly, while the middle is generally flat and lies within the cattle corridor (dryland). The lower parts, towards Lake Victoria, are mainly marshland.

Altitude in the Catchment ranges from 1,262 metres above sea level (m.a.s.l) at the outlet and 2,168 m.a.s.l. at the very northern part of the Catchment, with an average of 1,517 m.a.s.l. The upper part of the

Catchment has an altitude of 1,600 m.a.s.l. to 2,168 m.a.s.l., Buhweju district having the highest altitude. Areas around Lake Mbuho, Kashara river, and Lake Kachera (i.e., mid-Rwizi Catchment) in the southern parts of Kiruhura and Rakai districts have an altitude of 1,200 m.a.s.l. to 1,300 m.a.s.l. Lower Rwizi (towards Lake Victoria's shores) has an altitude of 1,100 m.a.s.l. to 1,150 m.a.s.l.

Figure 6: Topography of Rwizi Catchment



2.1.3 Weather and Climate

2.1.3.1 Rainfall

The Catchment experiences two rainy seasons (March to May, September to November, and sometimes up to December) and two dry seasons (December to February, and June to August) - Figure 7. November and April are the wettest months, whereas July is the driest month. Rwizi Catchment receives rainfall in the range of 700mm/year (in Isingiro, Mbarara, Kiruhura, and Lyantonde) to 1,300m m/year (in Buhweju, Sheema, Bushenyi, Rakai, and Kyotera). The rainfall received is influenced by topography, wetlands, and open water.

The spatial variation exhibits a trough or 'U' shape, i.e., minimum values in the middle of the Catchment and higher values at the headwaters and near the outlet into Lake Victoria. This variation corresponds to the cattle corridor areas stretching from Isingiro through Mbarara, Lyantonde, and Kiruhura. Figure 8 shows the mean monthly rainfall as measured at different stations within the Rwizi catchment. Historical rainfall data for the Catchment is scanty. However, an analysis of available data reveals that total annual rainfall in

the Catchment was generally stable, with a slight decrease, over the 45 years from 1957 to 2002 (Figure 9 and Figure 10).

Figure 7: Biannual Pattern of rainfall in Rwizi Catchment

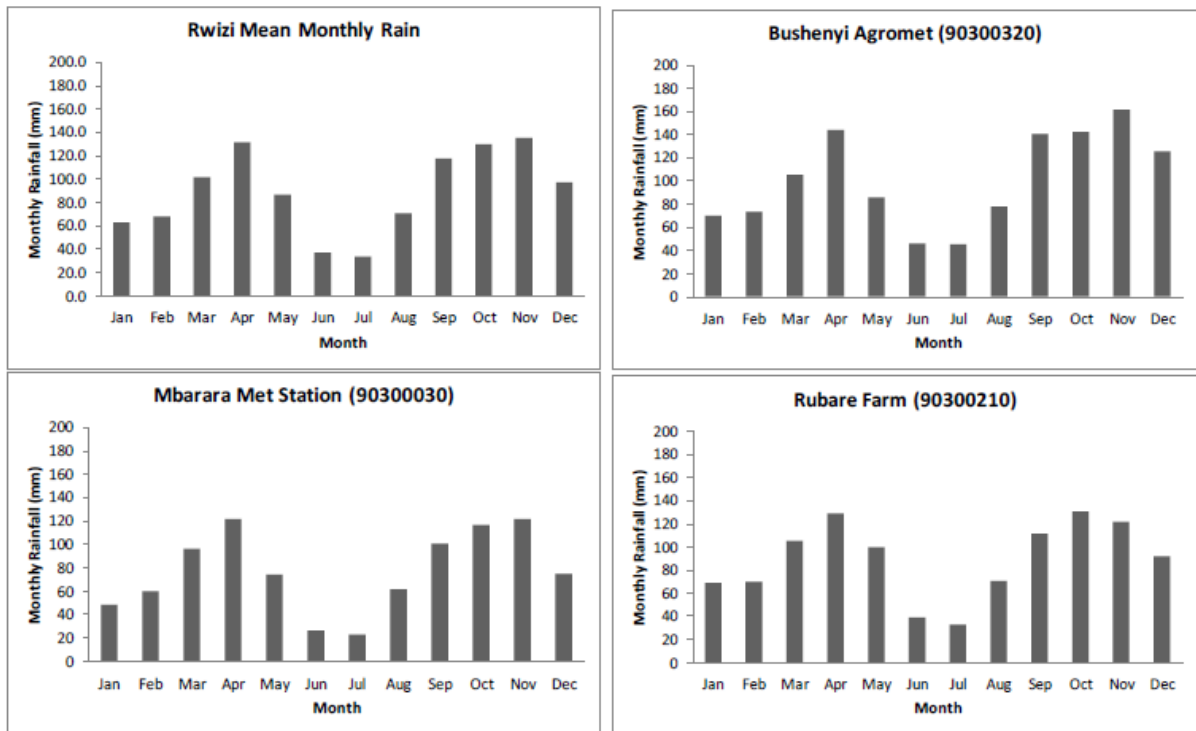


Figure 8: Rainfall Distribution in Rwizi Catchment

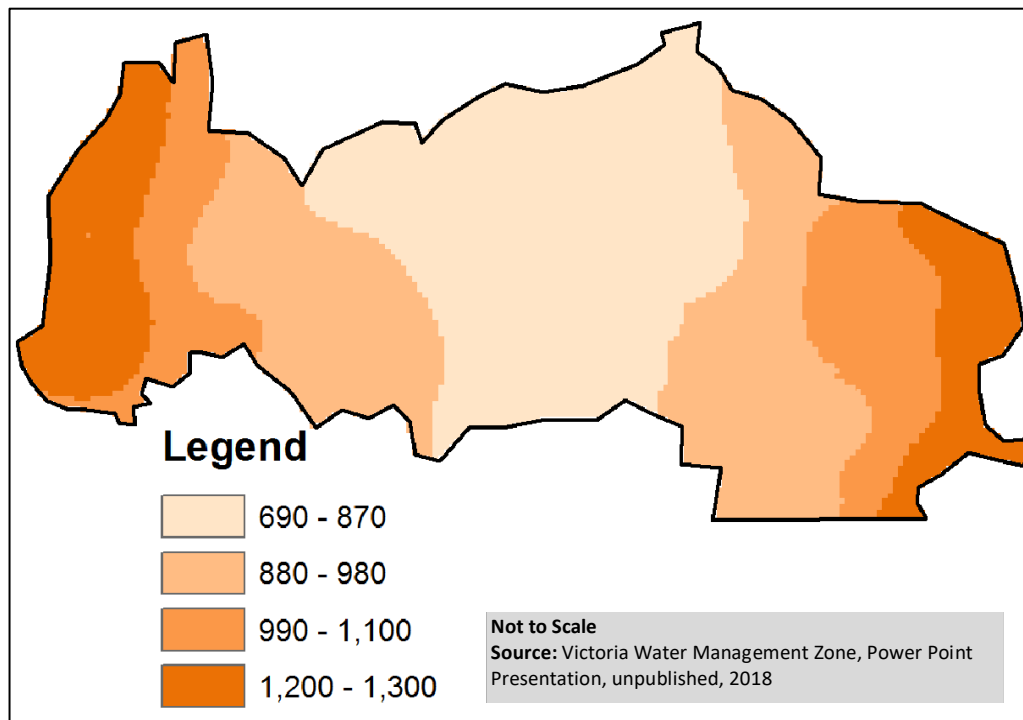


Figure 9: Long term precipitation records for Mbarara Stock Farm

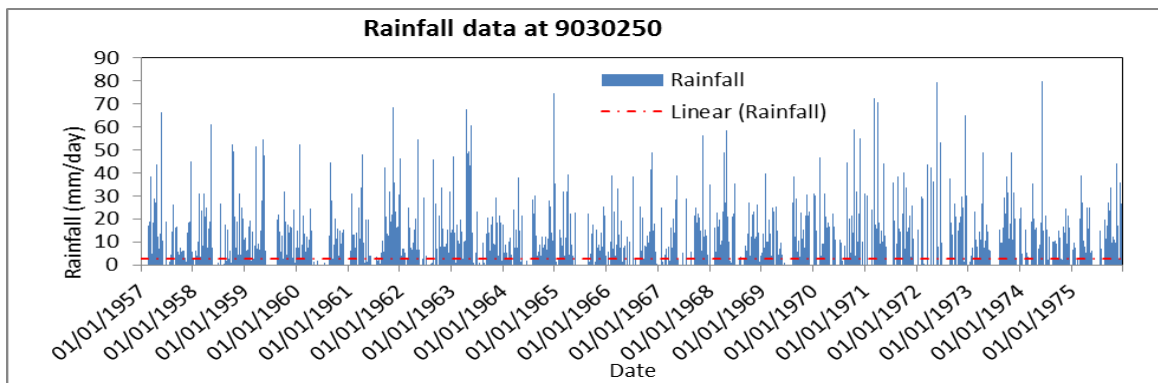
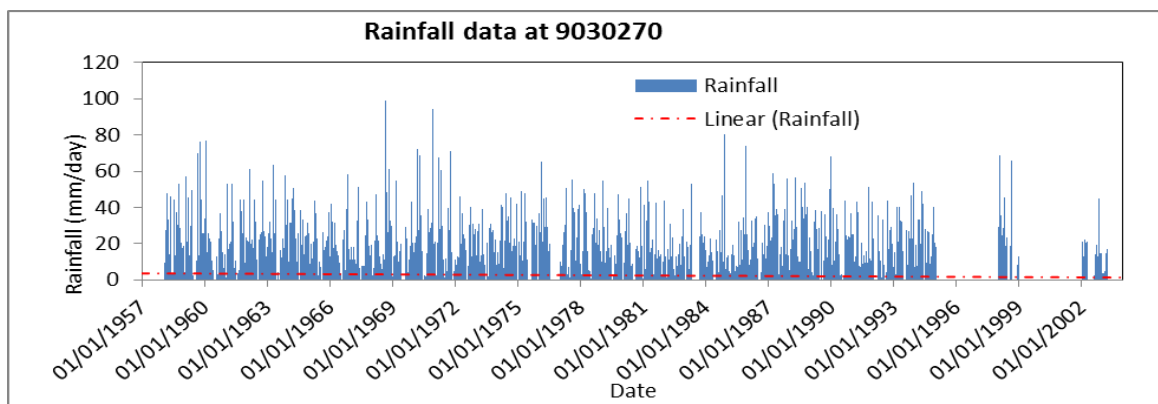


Figure 10: Long term precipitation records for Bugamba, Mbarara

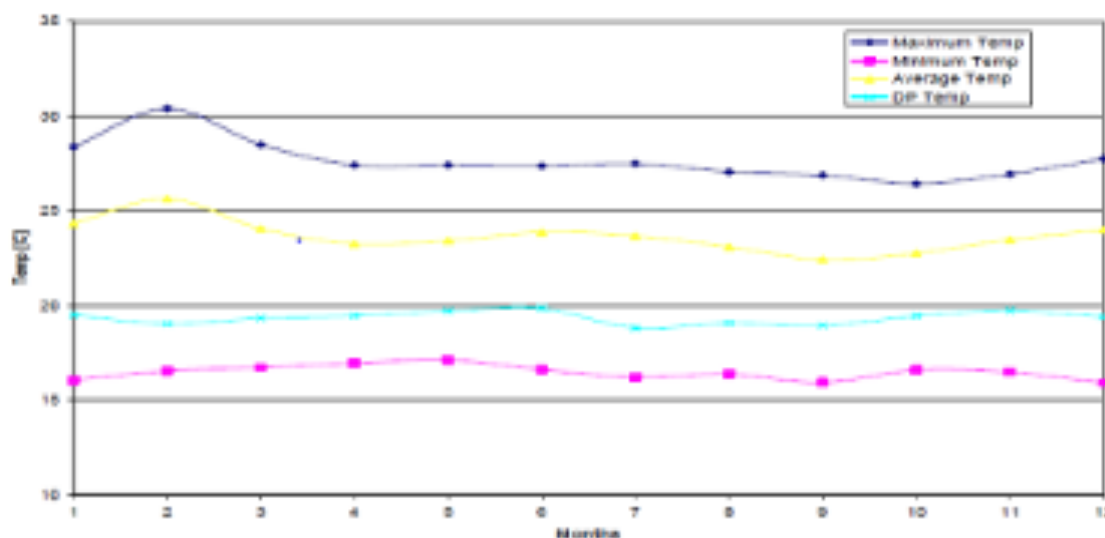


2.1.3.2 Temperature

The average daily temperature for the Catchment, based on data from Mbarara Meteorological Station for the period 1960-1993, is a minimum of 13.7°C and a maximum of 26.6°C. Analysis of the trend shows an increase of about 2°C over this period. The average dew-point temperature for the area is 19°C, and the long-term average temperature is 24°C. January, February, and March are the hottest months of the year.⁷ Figure 11 presents a general overview of the temperature variation for an average year; the range is 17 – 30°C.

⁷ ARUP (2014) Water Risk and Sustainability Assessment for RWIZI Catchment

Figure 11: Average Monthly Temperatures, Mbarara



2.1.3.3 Impacts of climate change on rainfall and temperature

Future climate scenarios suggest a possible increase in rainfall extremes in different parts of the Lake Victoria basin.⁸ Western parts of Uganda, of which most of the Rwizi catchment is part, are likely to experience a 10% to 12% increase in rainfall extremes in the 2050s and 16% to 19% in the 2090s. The South-Western part of the basin is likely to experience a 25% decrease in extremes in the 2050s and 2090s.

The change in monthly mean maximum and minimum temperature is likely to be more optimistic. The range of projected change in Tmax is -4°C to 8°C, and that for Tmin is -4°C to 10°C. While the Tmin is likely to decrease in the drier months, Tmax could increase in the wetter months. Therefore, the dry season could become cooler while the wet season could become warmer. The increase in maximum temperatures during the wet season could increase evaporation and water loss from the system.

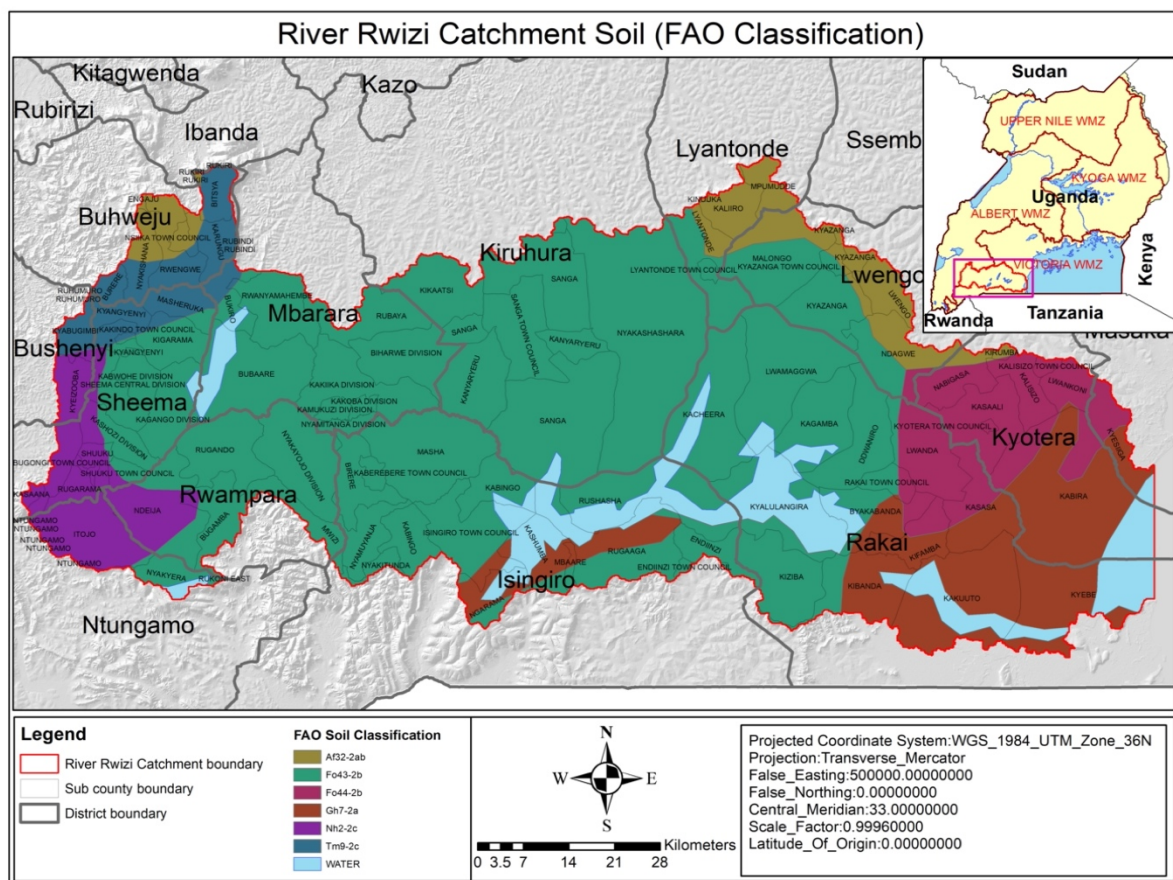
2.1.4 Soils

Soils in Rwizi catchment are dominantly clay loam, sand clay loam, sandy loam, and peaty loam soils. Generally, the soils in the Catchment, especially in Mbarara, Bushenyi, and Kiruhura districts, are sandy loams, clay loams, and slightly lateritic loams. Sandy loam is found in the long and shallow valleys, which are seasonally or permanently flooded, favoring aquatic flora and fauna. The soils in the wetlands contain peat derived from accumulated residual litter of the swamp flora, mainly papyrus, sedges, and typha. Soils are generally black clays with sandy soils along the river line of river Rwizi.

Figure 12 shows soil classification in the Rwizi catchment. Acric ferralsols (mainly in Buhweju, Sheema, and between Lake Kachera, Kijanebarola, and Mburo) and luvisols (covering most of Mbarara, some part of Sheema, Isingiro, Kiruhura, and parts of Rakai) are the dominant class of soils in Rwizi Catchment. Others classes include leptosols, arenosols, gleysols, and planasols. According to FAO classification, the predominant soil types are categorized as "alisols"; they have extremely low base saturation.

⁸ Nimusiima et al. (2014) Analysis of Future Climate Scenarios over Central Uganda Cattle Corridor, Journal of Earth Science and Climate Change, 2014, 5:10:

Figure 12: Soil textural classes for Rwizi catchment



2.1.5 Geology

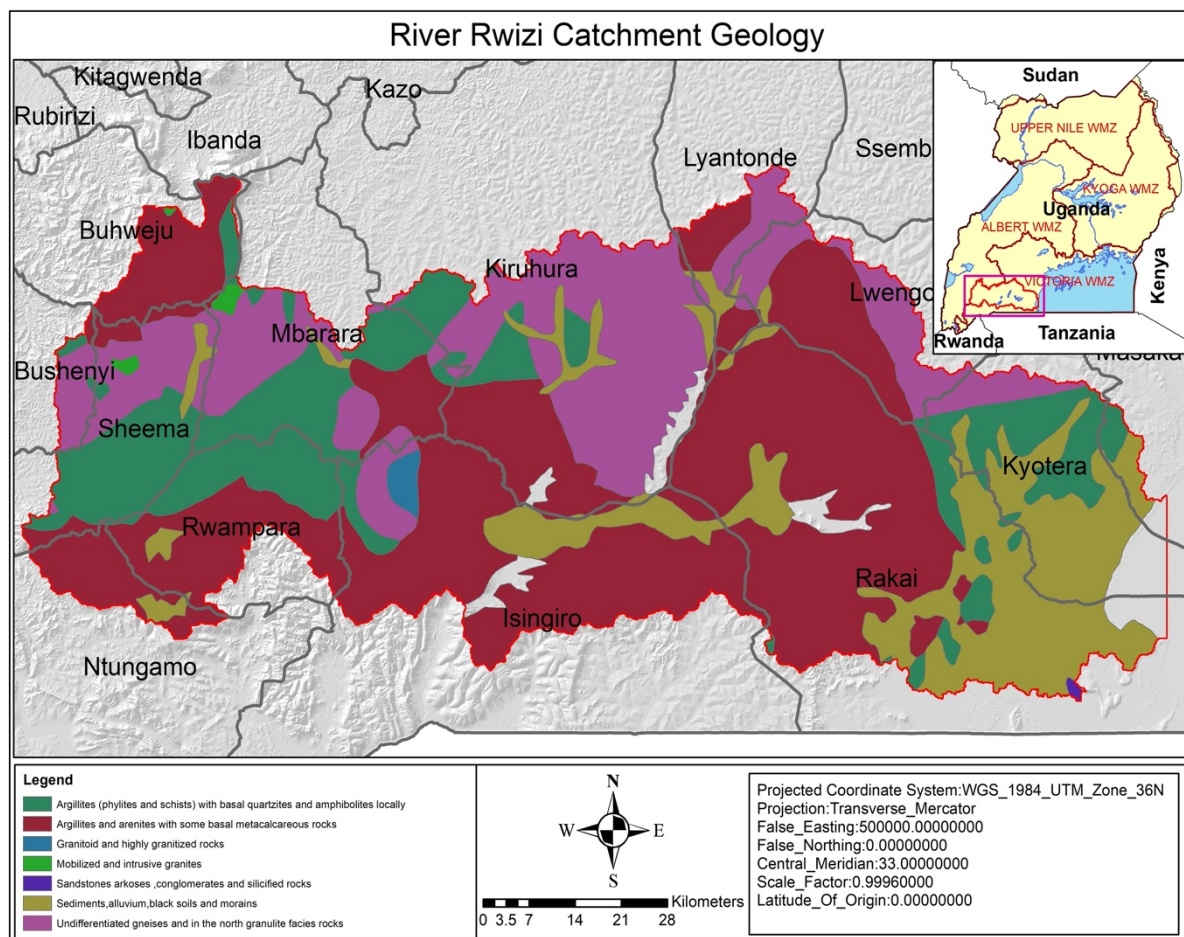
Figure 13 shows the geology of the Catchment as described by Geological Surveys and Mines in 2012. The geology of the Catchment is composed of metamorphic rocks overlain by alluvial deposits in some places. The eastern, north-western, and south-western parts of the Catchment are composed of the Buganda -Toro system (Argillites, arenites with some basal metacalcareous rocks). The lower central part and north-eastern part of the Catchment comprises the Karagwe series (phyllites and schists, basal quartzites, and amphibolites). The upper central part and some parts in the eastern region consist of undifferentiated gneisses. Intrusive granites and highly granitized rocks are also present in the Catchment as pockets. Highly mineralized rocks occur in some parts of the Buganda -Toro system. The phyllites in the Catchment are associated with high iron content, which makes the groundwater unpalatable.

Buhweju district has predominantly quartzitic sandstone and pelites with minor quartzite beds. Mbarara, Bushenyi, Sheema, Ntungamo, Isingiro, and Kiruhura are composed of mudstone, shale, slate, phyllite, aluminium sand, mica schist with quartzite interbeds, sandstone, quartzite, grit intercalated shale, alluvium, swamp lacustrine deposits, and porphyritic granite gneiss. Other districts like Kiruhura, Rakai, and Lyantonde have granite and beach terrace, especially near Lake Victoria.

The significance of the geology relates to the erosivity factor, a measure of the rainfall's kinetic energy and intensity to describe the effect of rain on erosion. Within the Upper Rwizi, the rock system is complex and therefore not easily eroded. The middle Rwizi is an area characterized by rock systems that are easily erodible (highly susceptible to detachment and transport by runoff). The downstream end of the Catchment

has rock systems arising from deposition and sedimentation. Therefore, the rock system in the middle and lower parts of the Catchment suggests that the soil is easily erodible.

Figure 13: Geology of Rwizi catchment



2.1.6 Key messages and conclusions on the biophysical context

1. Rwizi catchment is defined by the river Rwizi, which forms a system of lakes, wetlands, and streams. River Rwizi originates from the hills in Buhweju district and flows in a southerly direction, turning eastwards for about 57 kilometres until the gauge at Mbarara waterworks, discharging its water into Lake Victoria.
2. Rwizi Catchment is partly flat and sloping. The upper reaches of the Catchment are predominantly hilly, while the middle is generally flat and lies within the cattle corridor (dryland). The lower parts, towards Lake Victoria, are mainly marshland.
3. Altitude in the Catchment ranges from 1,262 metres above sea level (m.a.s.l) at the outlet to 2,168 m.a.s.l. at the very northern part of the Catchment, with an average of 1,517 m.a.s.l.
4. The Catchment experiences two wet seasons: March to May, September to November, and sometimes up to December. Rainfall varies significantly across the Catchment, ranging from 700mm/yr in Isingiro, Mbarara, Rwampara, Kiruhura, and Lyantonde to 1300 mm/yr in Buhweju, Sheema, Bushenyi, Rakai, and Kyotera. The data gaps notwithstanding, available historical data suggests that rainfall has been relatively stable, with only a slight decrease that does not affect

water availability in Catchment significantly. Future climate scenarios indicate that rainfall extremes are likely to increase in Western Uganda by 10% to 12% in the 2050s and 16% to 19% in the 2090s. In South-Western Uganda, rainfall extremes are likely to decrease by 25% in the 2050s and 2090s.

5. The average temperature for the Catchment is a minimum of 13.7°C and a maximum of 26.6°C. Data shows a 2°C increase from 1960 – 1993. January, February, and March are the hottest months of the year. Future climate scenarios suggest that the dry season could become cooler while the wet season could become warmer. The increase in maximum temperatures during the wet season could increase evaporation and increase water loss from the system.
6. Soils in Rwizi catchment are dominantly clay loam, sand clay loam, sandy loam, and peaty loam soils. The geology of the Catchment is composed of metamorphic rocks overlain by alluvial deposits in some places. Within the upper parts of the Catchment, the rock system is complex and therefore not easily eroded. In contrast, the rock system in the middle and lower parts of the Catchment suggests that the soil is easily erodible.

2.2 Water resources

2.2.1 Surface water

2.2.1.1 *Lakes, rivers, streams, wetlands*

Rwizi catchment has many wetlands and the major ones include: Nyarubungo, Katerera, Nyaruhandagazi, Kizimbi, Kasaana, Kibaare, Katukuru, Rwemigina, Nyabikungu, Bujaga, Kicwamba, Rugaaga, Nyamuyanja, Nyakabaare, Mirama, Rukindo, Nakisharara, Kooga, Ruceece, Kyarutengura, Kalunyiga, Mazinga, Katara, Kanyabukajja, Rushajje, Kibingo and Nyakambu among others.

The lakes include Nakivale, Kachera, Mburo, and Kijanibalora (Figure 14); they provide livelihoods to communities and contribute to the national economy through fisheries, water transport, and marine tourism. Lakes and wetlands have a significant effect on the flow regime in the Catchment. With the growing population, there is increasing pressure on wetlands and lakes, affecting their extent, biodiversity, and recovery of water levels. Figure 15 shows the inflows, outflows, and the main features of the Catchment in a simple schematisation.

Figure 14: Drainage of Rwizi catchment

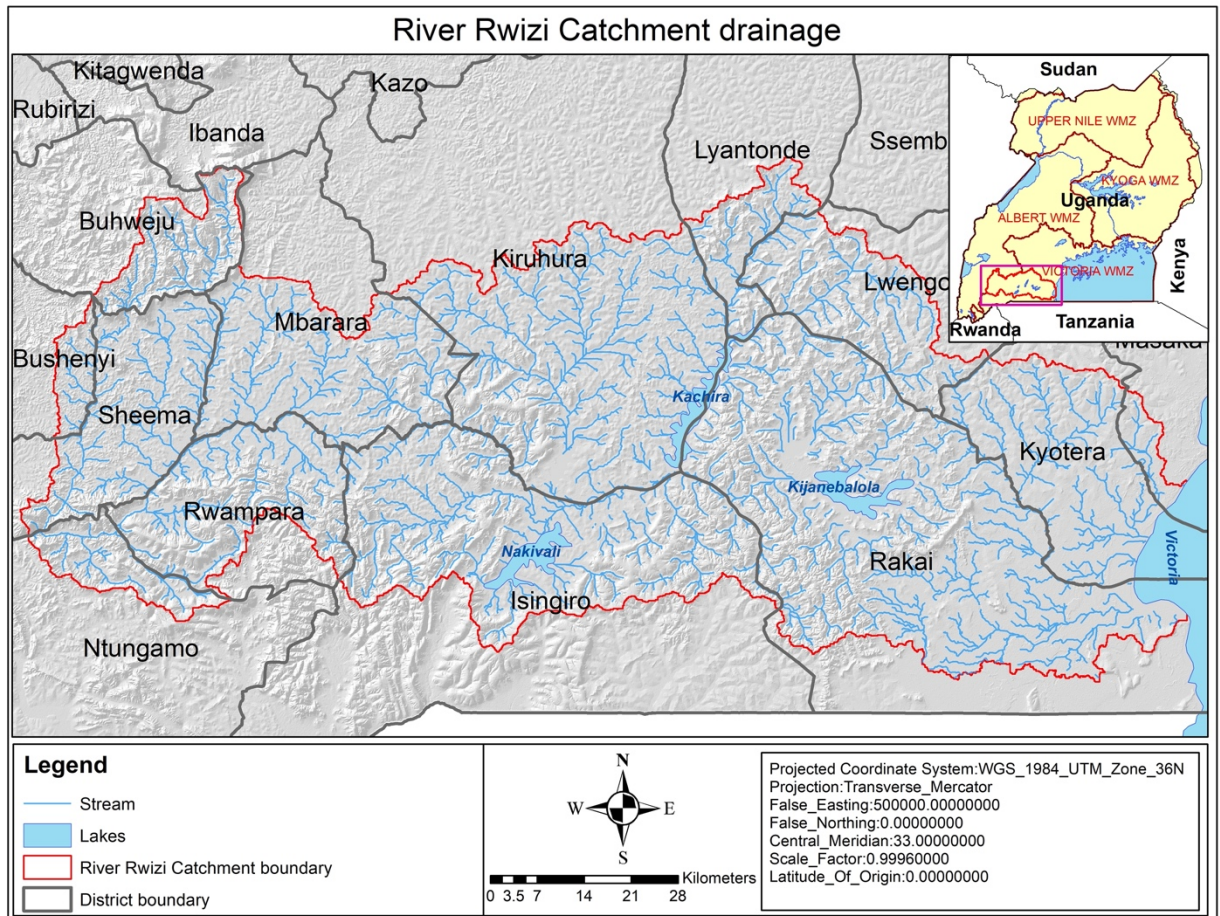
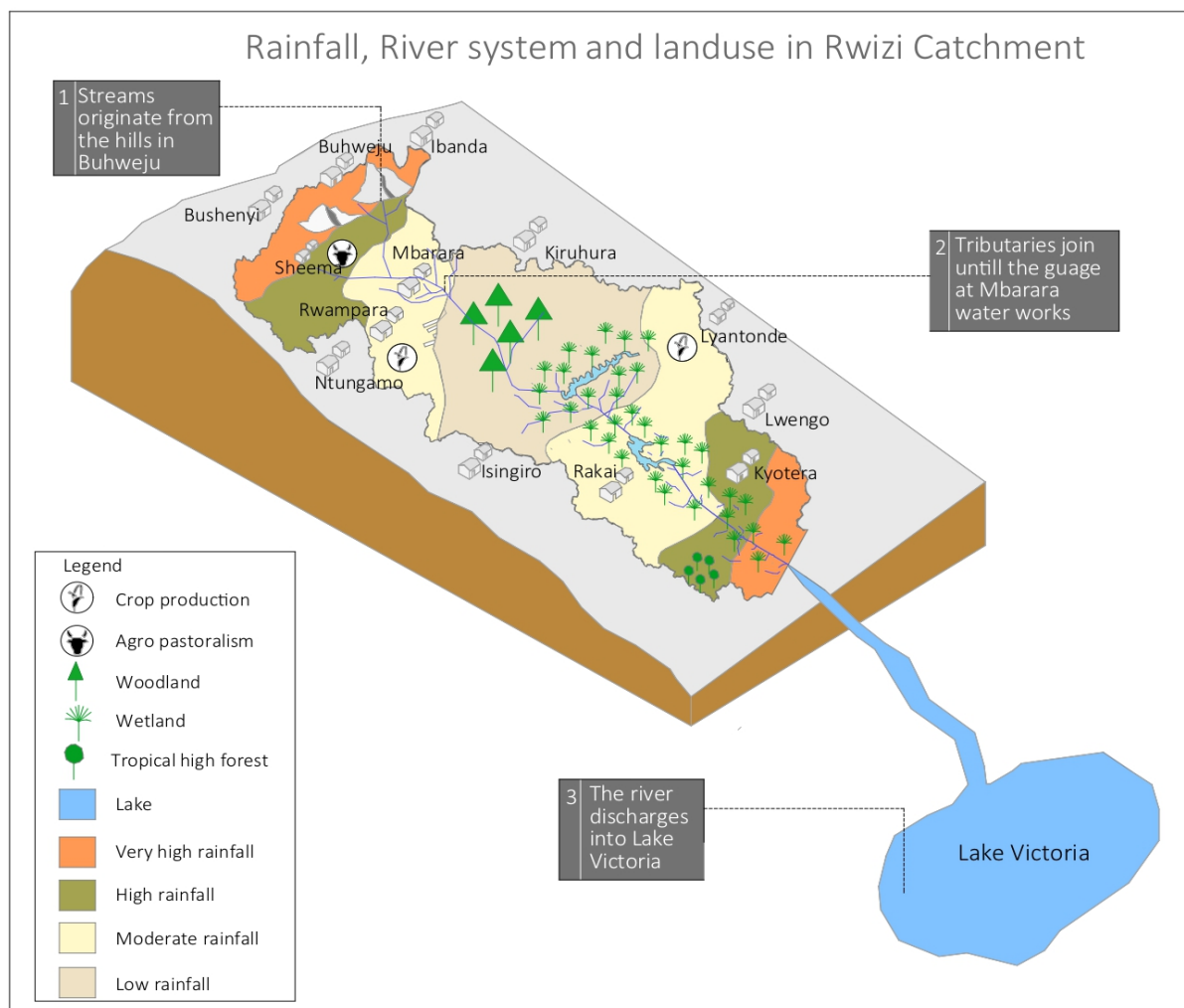


Figure 15: Schematic representation of Rwizi Catchment and its key features



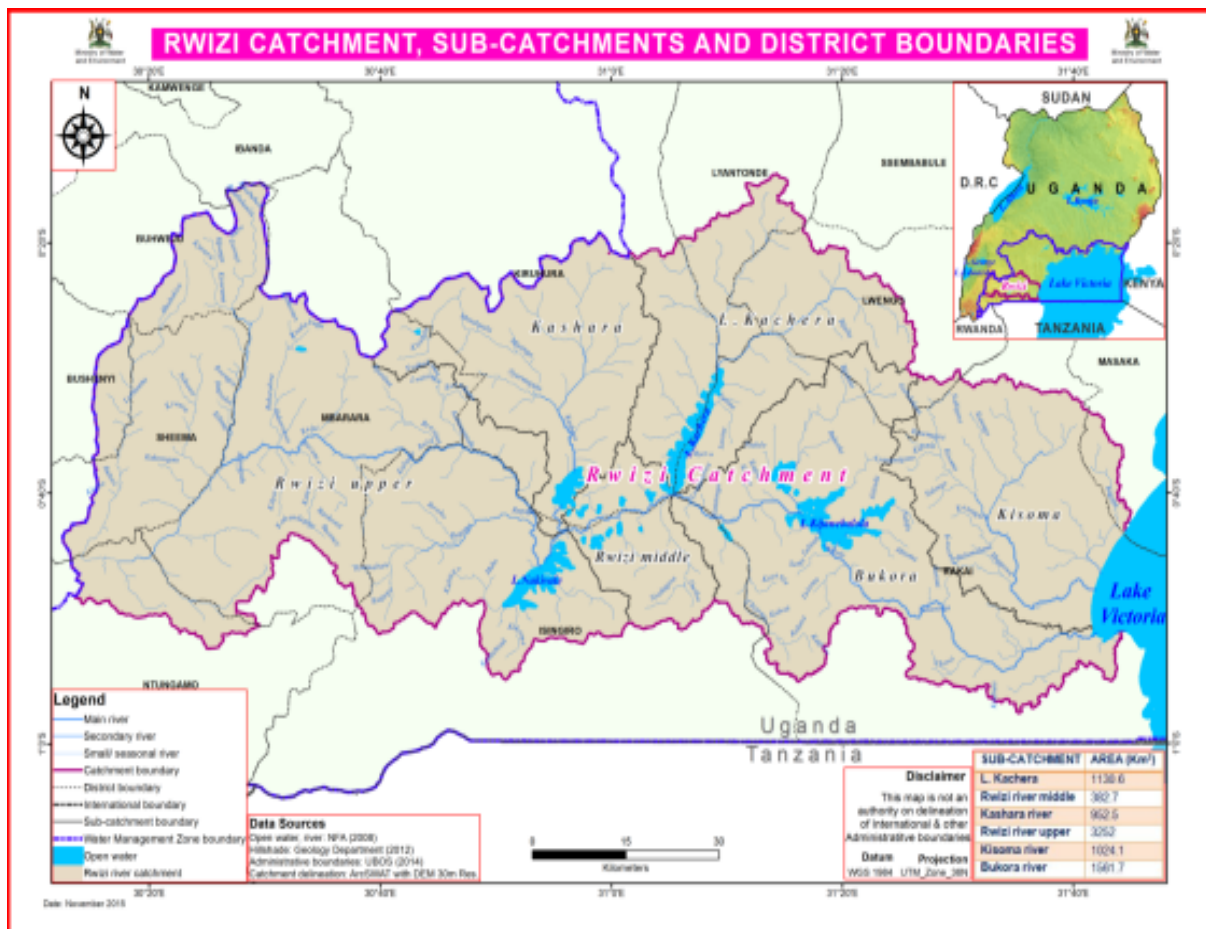
Sub catchments

The Catchment is subdivided into six sub-catchments based on the major surface water bodies. Table 1 and Figure 16 present the sub-catchments, while Annex 1 describes them in detail.

Table 1: Sub Catchments of Rwizi Catchment

Sub-catchment	Description*
Rwizi Upper	It covers the districts of Buhweju, Bushenyi, Sheema, part of Mbarara and, part of Isingiro
Rwizi Middle	Part of Isingiro, Ntungamo, Rwampara, and part of Kiruhura districts
Kashara river	Part of Kiruhura and a small fraction of Mbarara district
Lake Kacheera	Part of Kiruhura, part of Lyantonde, part of Lwengo, and part of Rakai district
Bukora river	Part of Lwango and part of Rakai district
Kisoma river	Majorly Rakai and Kyotera district

Figure 16: Rwizi catchment, sub-catchments, and district boundaries



The Upper Rwizi sub-catchment corresponds to the upper hilly areas and the wetlands below the hills up to the Mbarara town gauging station. It also includes streams draining into Lake Nakivale. The middle Catchment comprises the major marshlands and lakes in the Catchment. Other river systems making sub-catchments are Kashara and Kachera, originating from Kiruhura and Lyantonde district, respectively. The lower reaches of the Catchment are the Bukora and Kisoma sub-catchments.

Each sub-catchment has its unique characteristics. The upper reaches of the Catchment are in the hilly areas, with crop farming as the principal activity; these parts are the primary sources of sediment carried into the river channel. The middle Catchment (Kacheera, Nakivale, and Kashara) is generally flat and lies in the cattle corridor (dry land); ephemeral/ seasonal streams feed the river system. The Kisoma and Bukora sub-catchments represent the marshlands of Rakai and Kyotera districts towards Lake Victoria.

2.2.1.2 Flow analysis

Maximum and minimum flows

Maximum monthly flows for the Catchment range from 92.71m³/s to 8.84m³/s, with an average of 51.76m³/s. On the other hand, minimum monthly flows range from 3.24m³/s to 0.7m³/s, with an average of 1.74m³/s (Table 2). Flow varies significantly between the dry and wet seasons; it reduces considerably between June and September, with the lowest values in July/August, corresponding with the dry season. Flow in the wet season is essentially from rainfall, while that of the dry season is mostly base flow. Average monthly specific discharge (discharge per unit area) follows the monthly rainfall patterns; it varies between 104.1 - 634.7 mm/month, corresponding to the months with the lowest and highest mean flows.

Table 2: Upper Rwizi Monthly Discharge Statistics

Months	Min (m ³ /s)	Mean (m ³ /s)	Max (m ³ /s)	Standard Deviation	Mean Discharge/Area (mm/month)
January	2.66	8.11	65.38	7.3	319.9
February	1.8	5.77	36.09	4.69	187.8
March	1.73	6.15	41.33	4.95	243.2
April	1.9	10.17	58.68	8.54	376.7
May	2.69	12.52	84.12	12.1	495.1
June	1.27	5.4	26.08	3.19	200.1
July	0.92	3.13	8.84	1.09	123.6
August	0.7	2.72	12.98	1.17	104.1
September	0.76	5.44	47.93	6.23	207.7
October	1.19	9.07	65.45	9.24	346.9
November	2.03	15.36	92.71	11.86	587.6
December	3.24	16.62	81.49	12.56	634.7
AVERAGES	1.74	8.37	51.76	6.91	318.95

Flow duration curve

Analysis using a flow duration curve showing excess probability demonstrates the high variability as seen in Figure 17 and Table 3. Catchment yield ranges from 110 m³/s to as low as 2 m³/s. Reliable flow with 90% confidence is 3.3 m³/s. The low variability part of the curve corresponds with the base flows from the Catchment. The extreme low flow (Q-95) is 1.93 m³/s.

Figure 17: Flow duration curve for Rwizi Catchment

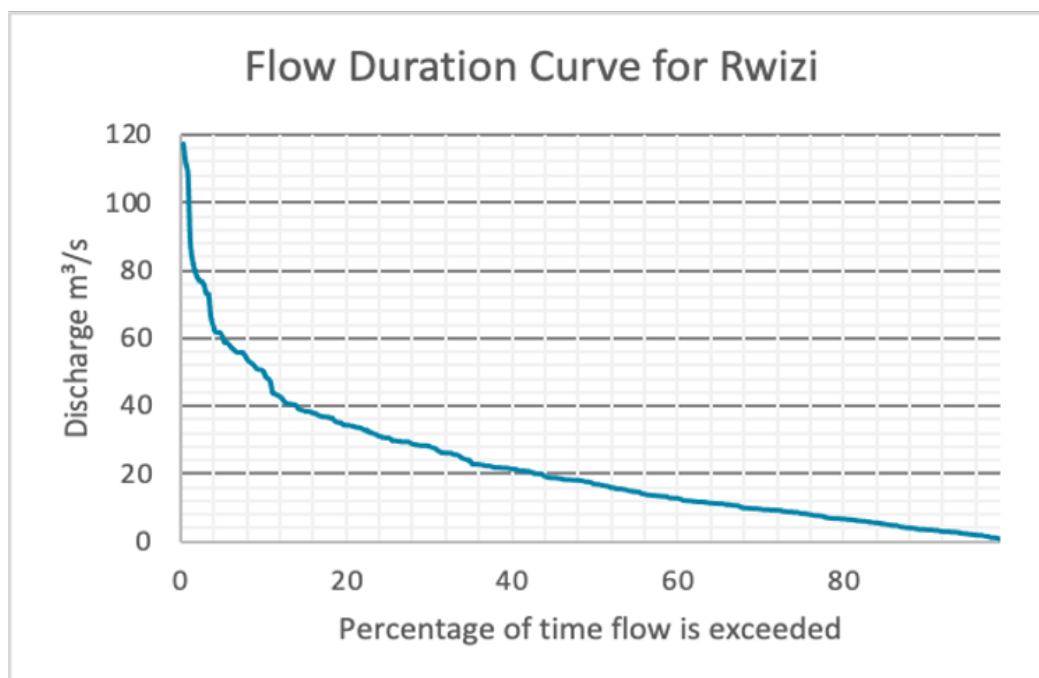


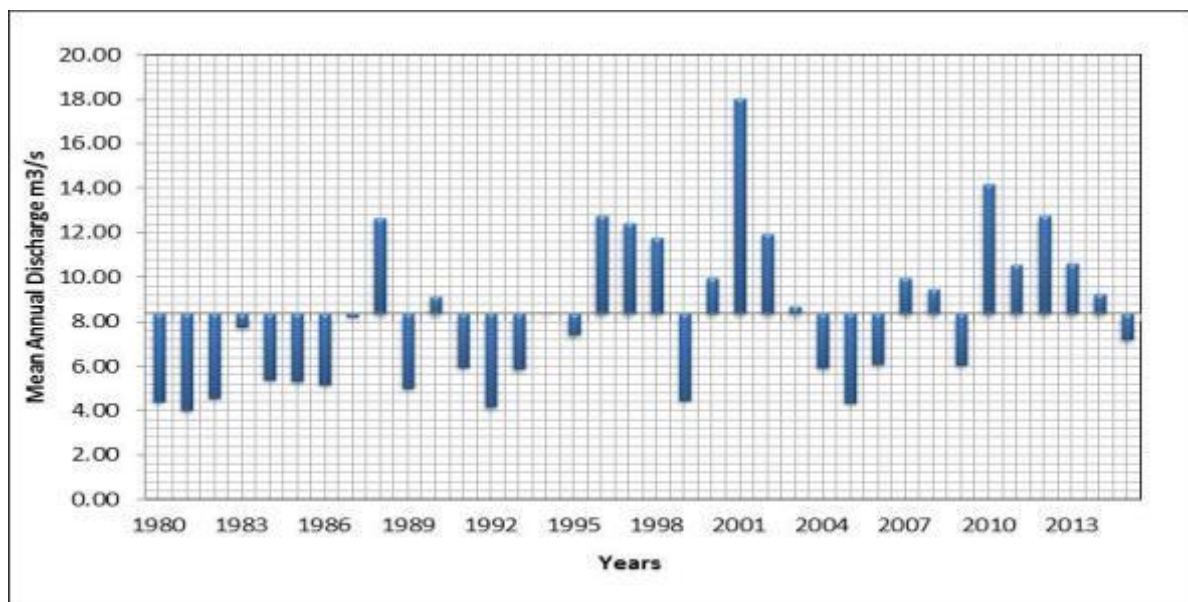
Table 3: Flow Attributes for Rwizi

Attribute	CUMECS (m ³ /s)	Daily Flow (m ³)
Extreme high flow	110	9,504,000
Reliable flow 90% Confidence	3.3	285,120
Extreme low flow Q-95	1.93	166,752

Annual discharge

The mean annual discharge for upper Rwizi catchment for the period of record between 1980 and 2014 was 8.35m³/s (RGS 81224 Rwizi at old NWSC works). There is a general decline in discharge values from the 1990's series, especially the 1998 to 2000's series. Analysis of the mean annual flow pattern revealed clustering of yearly mean values about the long-term mean (Figure 18). The pattern indicates that the Catchment was relatively drier for the record under investigation since 54.3% of the mean annual flows were below the average of 8.35 m³/s; the 1990's series and the early 2000 series had the lowest values.

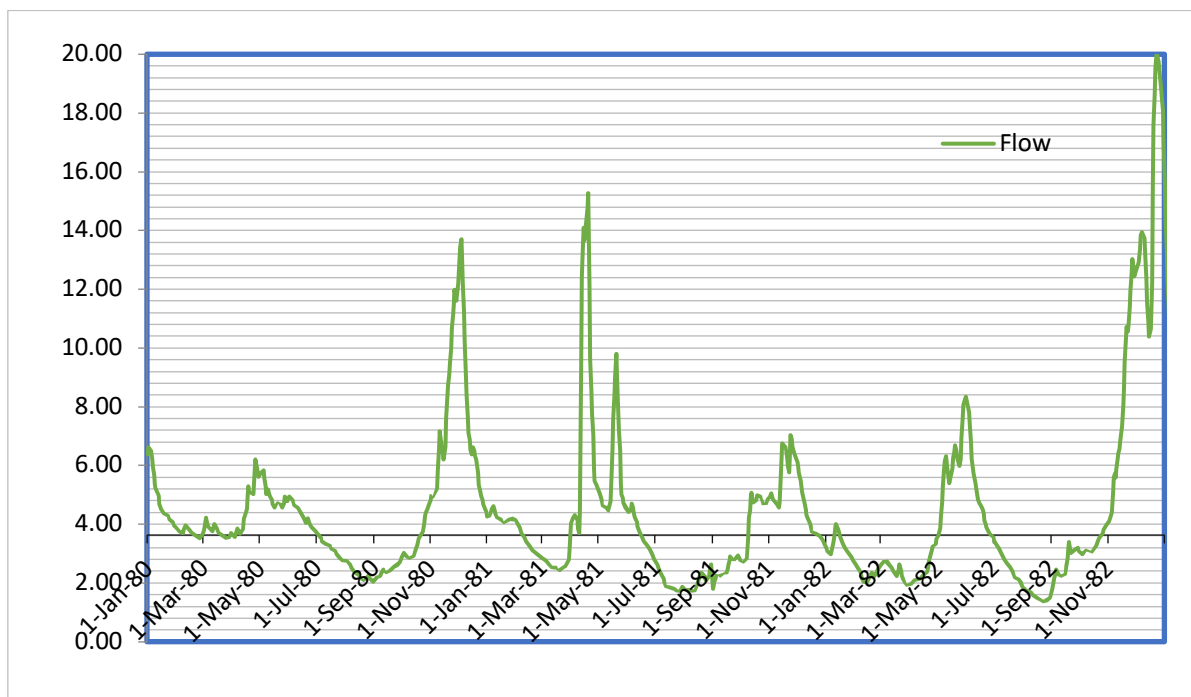
Figure 18: Mean Annual discharges for Rwizi compared to the overall mean annual discharge



Drought flows

Drought flows are similar to low flows, except that the duration of the period is given in months instead of days. The values are average low flows developed from monthly records (as opposed to daily records). These values are helpful when determining reservoir yields for which drought severity over a lengthy period is a critical parameter. The drought durations and severities for all streamflow drought events were calculated based on the streamflow drought concept and threshold levels. A series of drought parameters were obtained by considering values below a threshold. The threshold value was obtained as 70% exceeded flow (3.63m³/s) from the flow duration curve. The frequency of drought minimum flows was highest in October and September. However, the mean frequency of drought amounted to less than one per year. The drought duration analysis showed years with droughts grouping in 2 to 3 years cycle and even multi-annual ones, a fact also observed within the Catchment (Figure 19).

Figure 19: Low flows below 7-day moving average for hydrological drought analysis



The most prevalent number of droughts per year was three, while the maximum droughts were the seven that occurred in 2006. The mean numbers of droughts per year were two with a minimum of one drought. Therefore, Rwizi Catchment has a high prevalence of hydrological droughts. The course of minimum annual discharge (1-day) identified within the period of record corresponds with the number of days with the discharges equal to or less than 90%. The mean minimum flow for drought periods considered was $2.75\text{m}^3/\text{s}$ while minimum and maximum flows during the drought periods were $1.12\text{m}^3/\text{s}$ and $3.62\text{m}^3/\text{s}$, respectively.

2.2.2 Groundwater

The availability of groundwater depends primarily on the geology in combination with the possibilities for recharge. The amount of recharge sets an upper limit for groundwater replenishment, which defines the renewable groundwater resource. On the other hand, geology determines how water can be stored and can flow within the rock. According to the State of Water Resources Basin Report for Victoria Water Management Zone, Rwizi catchment has limited groundwater availability.⁹

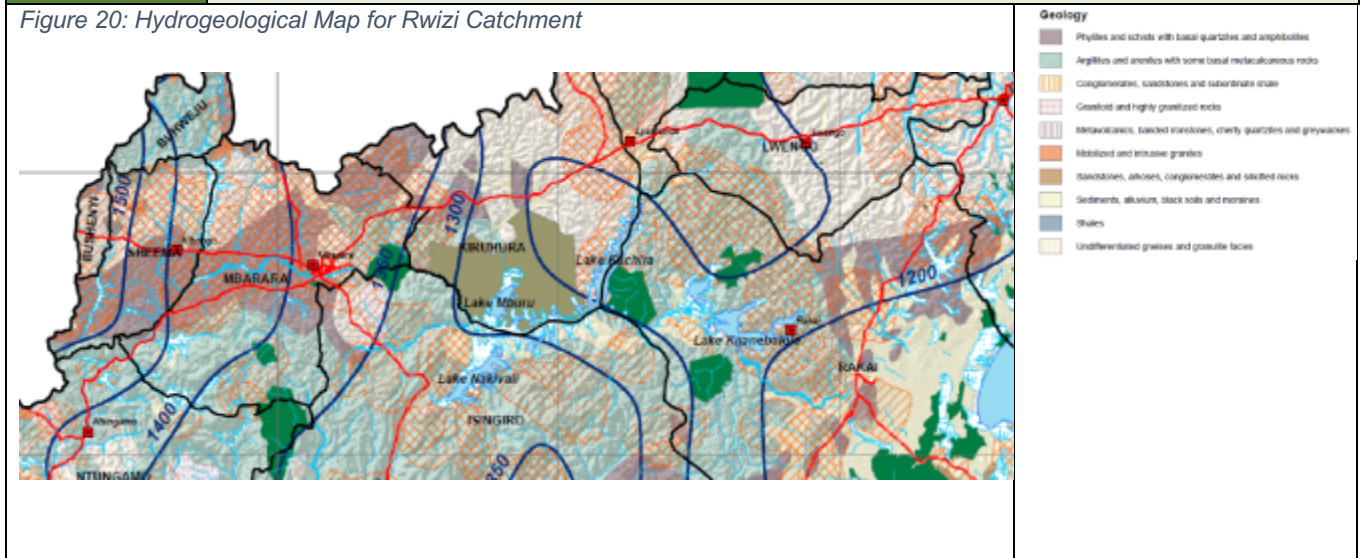
Given the nature of the aquifers (Table 4) and overburden in the Catchment (Figure 24), groundwater recharge happens mostly during heavy rainfall events. The percentage of rainfall that becomes recharged depends mainly on soil properties, vegetation cover or land use, topography, and depths to water table. The estimated groundwater recharge rates range from 90 - 238 mm/yr accounting for 7 - 24% of the average annual rainfall.

⁹ MWE (2017) State of Water Resources Basin Report for Victoria Water Management Zone.

Table 4: Main aquifer types in the Rwizi Catchment

Aquifer Type	Characteristics
Fractured bedrock	These aquifers are from variably fractured fresh bedrock and the sap rock or weathered bedrock. The sap rock-fresh bedrock junction is generally transitional or even fluctuating in banded sequences. Fractured systems are related either to decompression or to tectonic forces. Fissure permeability is assumed to correlate to some degree with the frequency of fracture occurrence, with a further assumption that both parameters will decrease with depth. The rocks are typically of low productivity, and development is mainly from point sources utilizing hand pumps. The aquifers are generally phreatic in character but may respond to localized abstraction in a semi-confined fashion if the rest water level occurs in a low permeability horizon such as clay regolith. Although the aquifers have a regional occurrence, they respond to abstraction in a discontinuous fashion due to discontinuities or barrier boundaries within the fracture system being tapped or the constraints of the low permeability regolith. These features are reflected in a significant borehole failure rate and a wide range of yields, despite the apparent regional uniformity of the basic controls of climate, morphology, and geology. ¹⁰
Regolith	The regolith consists of the collapsed zone and saprolite. Since weathering is most effective in the vadose zone and the zone of the water table fluctuations, there is a tendency to develop subdivisions into an upper and lower saprolite relative to current (or previous) water levels. Regolith thickness and lithology, along with corresponding aquifer hydraulic parameters, depend on the complex combination of controls, including bedrock characteristics, climate, and relief.

Figure 20: Hydrogeological Map for Rwizi Catchment



Groundwater potential in the Catchment is highly variable but is generally poor (Figure 21). Groundwater quality is also poor mainly because of high Iron, Calcium, and Magnesium content in many areas. Groundwater levels are monitored at a few specific locations across the Catchment, for example, Rwonyo (Figure 22) and Rakai (Figure 23). Trends indicate declining groundwater levels, possibly due to increased abstraction levels in the face of reduced recharge from rainfall. Groundwater depletion could be a possible risk where the low permeability basement aquifers are exploited by high-yielding electric pumps, which is the case with areas abstracting water for industrial use in the urban centres.

¹⁰ Wright, E. P. & Burgess, W. G. & Geological Society of London (1992). The hydrogeology of crystalline basement aquifers in Africa. London: Geological Society

Generally, interviews with stakeholders suggested that the yields of groundwater-based sources are reducing; and that it is not uncommon for groundwater-based sources (such as boreholes) to reduce in yield and subsequently be abandoned.

Figure 21: Groundwater potential for Rwizi catchment

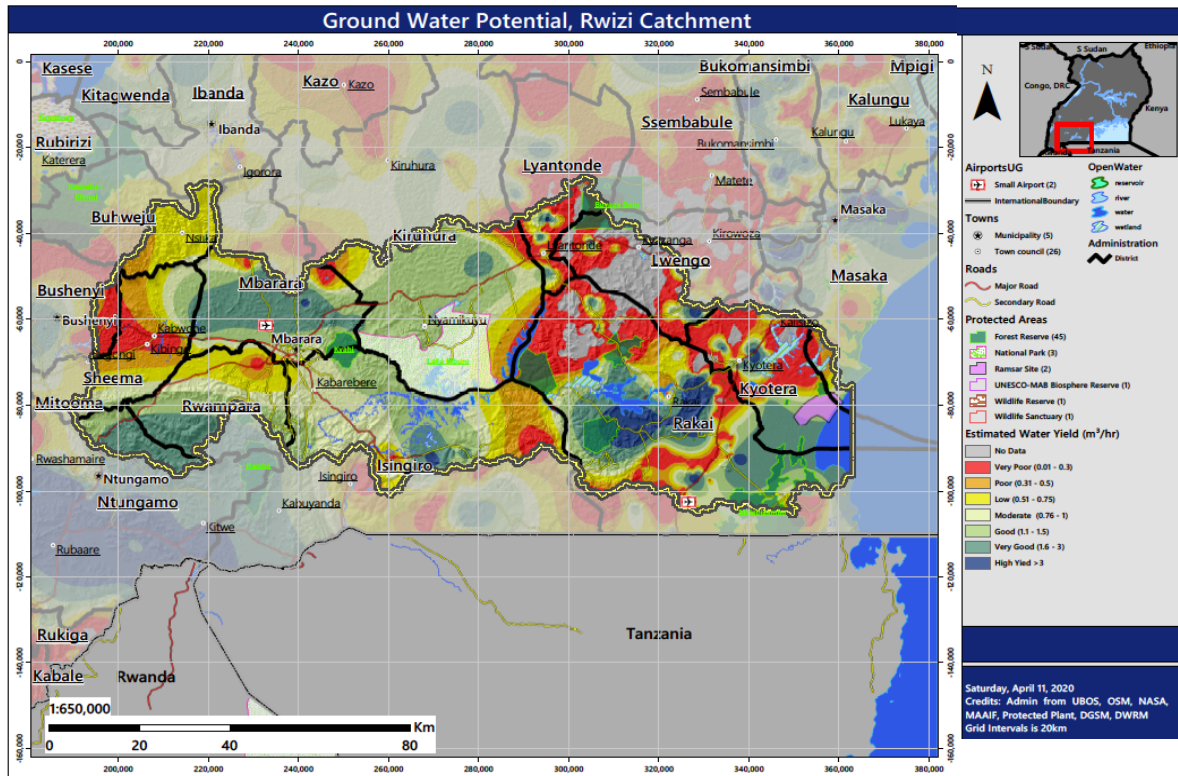


Figure 22: Groundwater levels at Rwonyo Monitoring well in Mbarara

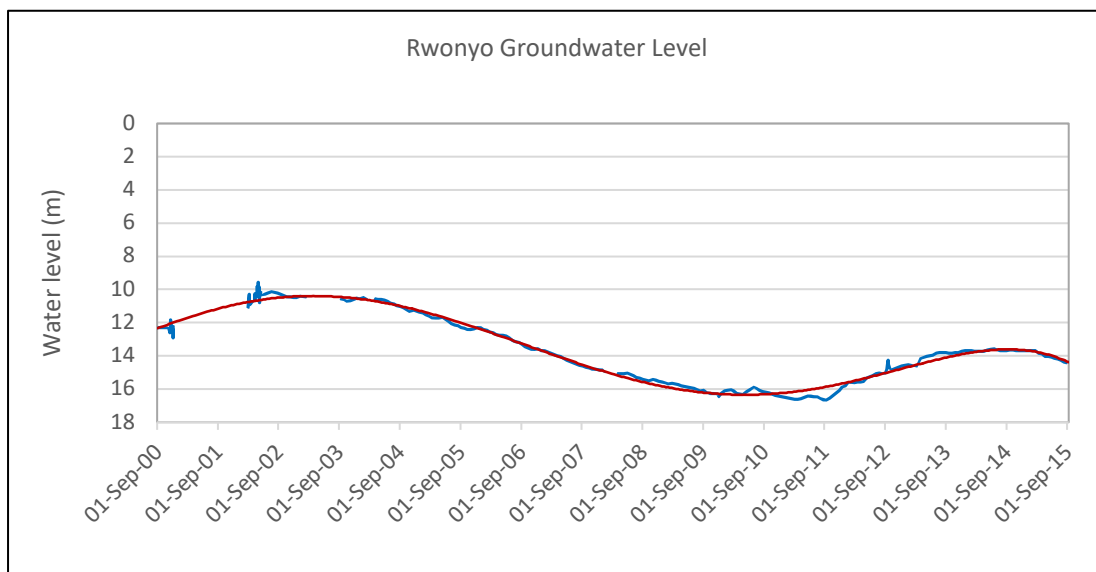
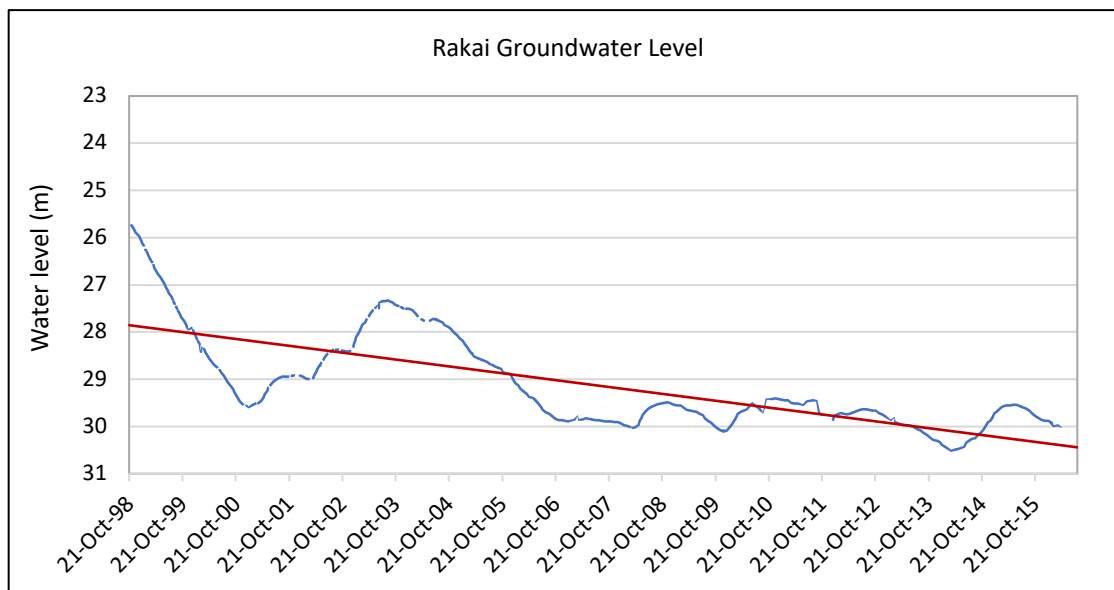


Figure 23: Groundwater monitoring well in Rakai



2.2.3 Water quality

2.2.3.1 Surface and groundwater Quality

The Directorate of Water Resources Management carries out water quality sampling and monitoring at various locations along river Rwizi and monitors groundwater, surface water, and effluents discharged to water bodies (Table 5).

Table 5: Water Quality of Rwizi Catchment

Site ID	EC (us/cm)	pH	T.Hard (mg/l)	COD (mg/l)	BOD (mg/l)	TSS (mg/l)	PO4 (mg/l)
L.Kijanibarora (surface)	438	7.57	105	3	3	16	<0.08
L.Kachera	200	6.4	64	<22	<0.5	16	<0.08
L.Kachera (surface)	242	7.15	64	68	4.4	21	<0.08
L.Mburo	116	5.7	42	34	<0.5	15	<0.08
L.Mburo (surface)	156	6.93	48	3	1.8	62	<0.08
L.Nakivale	713	7.6	215	135	24	65	<0.08
L.Nakivale (shore)	547	8.24	175	135	3.1	34	<0.08
R. Bukora	189	7.4	99	45	0.8	19	<0.08
R. Kisoma	269	6.9	250	38	2.5	23	0.55
R. Rwizi	89	6.3	41	<22	<0.5	65	<0.08
Required standard	1500	5.5-8.5	600	100	50	500	10

Source: Draft Rwizi CMP 2015

Most of the ambient water sources present good quality water except Lake Nakivale that has high COD levels. The high COD in Lake Nakivale is mainly due to human excreta deposition in the lake due to the

high population of refugees living along the lake's shoreline. All the water sources have acceptable physical and chemical quality.

Previous assessments¹¹ revealed high levels of color and turbidity in River Rwizi water, especially in areas where wetlands have been converted to different land use. Sediments may transport various contaminants from land, including nutrients, bacteria, and toxic chemicals from agricultural activities. Moreover, the sediments are deposited in the lake/wetland system of Mburo, Kacheera, and Kijanibarola, silting those water bodies, thereby increasing the incidence of floods due to reduced capacity of the water bodies to hold water.

2.2.4 Water demand

The common water uses in the Catchment were identified through literature and in consultation with Catchment stakeholders. The main water demand categories in the catchment area are:

- Domestic water demand
- Industrial water demand.
- Agricultural water demand: livestock, aquaculture, crop cultivation, and irrigation

2.2.4.1 Domestic/Urban water demand

The current and projected water demand (Table 6) was estimated based on population figures obtained from UBOS and a daily per capita water consumption of 25 litres per the basic service levels specified in the Uganda National Water Policy 1999. The current (2020) and projected (2040) annual domestic water demand in Rwizi Catchment are 17.4 and 28.1 million cubic meters, respectively. The domestic water demand will increase by 62% by the year 2040. National Water and Sewerage Corporation (NWSC) is the major abstractor of water for domestic use in the Catchment.

Table 6: Current (2020) and projected (2040) domestic water demands in Rwizi Catchment

District	%age of district in the Catchment	Population growth rate	Current (2020)			2040 (projected)		
			Population		Domestic water demand	Population		Domestic water demand
			Rural	Urban	m ³ /year	Rural	Urban	m ³ /year
Buhweju	38	3.36	46,554	2,757	449,958	90,158	5,339	871,410
Bushenyi	10	1.13	27,861	1,651	269,300	34,882	2,067	337,160
Isingiro	60	3.69	331,397	8,721	3,103,575	675,848	17,786	6,329,410
Kiruhura	30	3.64	120,875	3,099	1,131,266	247,107	6,336	2,312,667
Lwengo	30	1.09	96,654	2,990	909,246	119,463	3,695	1,123,817
Lyantonde	10	2.99	10,506	324	98,828	18,938	585	178,147
Mbarara*	80	2.26	419,818	41,520	4,209,709	656,413	64,919	6,582,155
Ntungamo	10	3.57	63,839	3,159	611,355	90,286	4,468	864,630
Rakai	80	2.06	483,564	17,539	4,572,566	727,052	26,370	6,874,976
Sheema	80	1.34	215,014	4,389	2,002,053	280,599	6836	2,622,844
Total			1,816,082	86,149	17,357,857	2,940,746	138,401	28,097,216
<i>*Includes present day Rwampara district</i>								

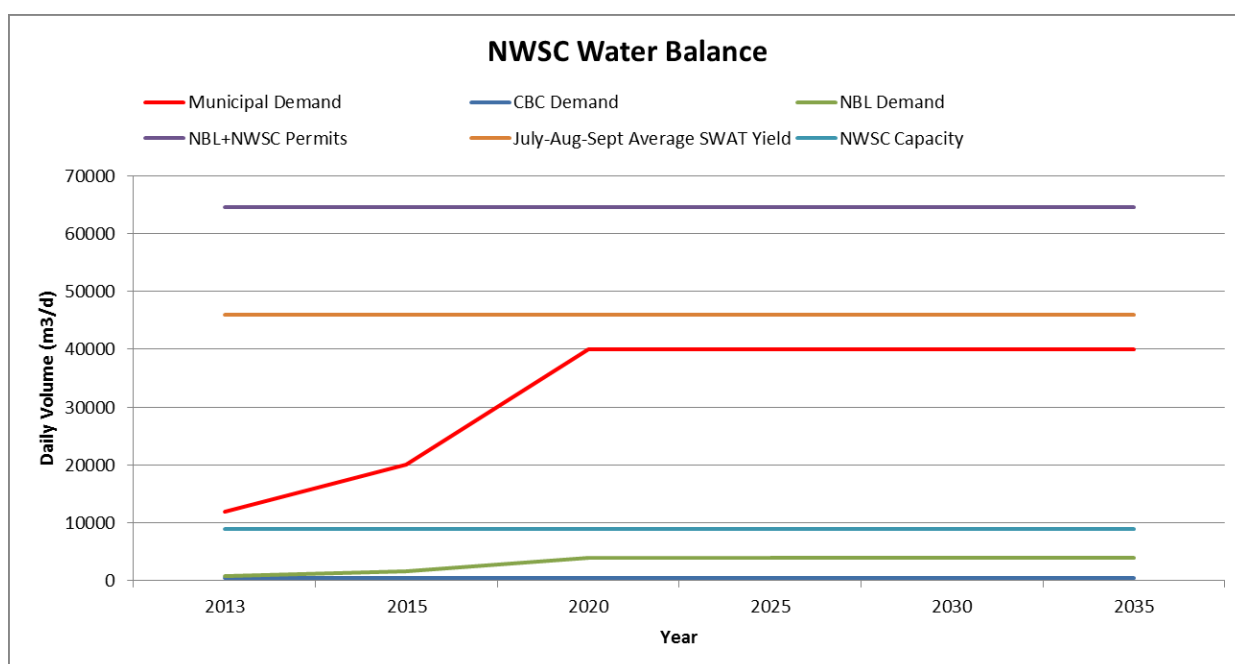
¹¹ E.g., the Water Risk and Sustainability Assessment for Rwizi Catchment 2014 and State of Basin Report for Victoria Water Management Zone 2016

NWSC demand

Mbarara city’s water demand forms about 25% of the current domestic water demand in the Catchment. NWSC reported the current demand to be 10,000 – 12,000 m³/d. The demand increases in the dry season and supersedes the total available water treatment capacity; simultaneously, the actual production capacity drops by up to a third because of low water levels in the river. As a result, water rationing is common in Mbarara during the dry season between June and September.

NWSC anticipates that water demand in Mbarara city will grow to 40,000m³/d in the next 5 – 15 years,¹² representing a 300% increase from current demand levels. The long-term NWSC supply-demand balance is projected to change, as illustrated in Figure 24.

Figure 24: Long term NWSC supply-demand



2.2.4.2 Industrial water demand

Industrial water use includes water used for processing, washing, diluting, cooling, or transporting a product or sanitation needs within the manufacturing facility. Due to increasing urbanisation, the industrial water demand is growing exponentially, directly impacting water resources in the region. The industrial water demand was estimated by summing up all the water withdrawals of all existing industries in each district. The water used by each industry was obtained from secondary water use data obtained from the Ministry of Trade, Industries, and Cooperatives.

Industrial water demand in Rwizi Catchment is mainly within the districts of Mbarara, Rakai, and Sheema, with Mbarara District presenting the highest demand (69%) (Table 7). The industrial water demand will increase by 106% by the year 2040.

¹² ARUP (2014) Water Risk and Sustainability Assessment for Rwizi Catchment

Table 7: Present industrial water demand in Rwizi Catchment

District	%age of district in R. Rwizi basin	Industrial Water demand (m ³ /year)				
		2020	2025	2030	2035	2040
Buhweju	38%	12,096	13,500	15,200	16,900	20,280
Bushenyi	10%	1,663	1,996	2395	2,874	3,449
Isingiro	60%	13,880	16,656	19,987	23,984	28,780
Kiruhura	30%	13,542	16,247	19,496	23,395	28,074
Lwengo	30%	181	217	260	312	374
Lyantode	10%	60	72	86	103	124
Mbarara*	80%	300,888	361,066	433,279	519,935	623,922
Ntugamo	10%	3,233	3,880	4,656	5,587	6,704
Rakai	80%	89,194	107,034	128,441	154,129	184,955
Sheema	80%	907	1,088	1,306	1,567	1,880
Total		435,664	521,756	625,106	748,786	898,542

*Includes present day Rwampara district

2.2.4.3 Agricultural water demand

Irrigation water demand

Currently, agriculture in the Rwizi Catchment is predominantly rain-fed. In recent decades, droughts (in the dry season) and floods (in the wet season) have become more frequent. So is food demand due to high population growth, nutritional deficiencies, and periodic famines. This condition is partly due to occasional poor harvests caused by erratic rain seasons that significantly impact the rain-fed subsistence farming system. There are no major irrigation schemes in the Catchment.

Currently, approximately 774,119 hectares of land in the Catchment is potentially irrigable. The 2010 -2035 National Irrigation Master Plan¹³ for Uganda quotes an irrigation expansion rate of roughly 0.05%. The projected irrigable area (A_n) was estimated using the formula $A_n = A(1 + r)^n$, in which A is the present potentially irrigable area, n is the number of years under projection, and r is the estimated irrigation expansion rate (0.05%).

The difference between total annual rainfall and potential evapotranspiration over the Catchment formed the basis for estimating the irrigation water requirement (Table 8), considering the current and projected potentially irrigable area per district. The current irrigation water demand in Catchment was estimated to be 3.53 million cubic meters per year; however, this is anticipated to rise to 3.57 million cubic meters per year in 2040 (Table 8) because of the increasingly erratic rains and increased demand for food.

¹³ MWE (2011) A National Irrigation Master Plan for Uganda (2010 – 2035). Ministry of Water and Environment

Table 8: Current (2020) and projected irrigation water demand in Rwizi Catchment

District	%age of district in the Catchment	Potential irrigable area (ha) 2020	Irrigation Water demand (m3/year)				
			2020	2025	2030	2035	2040
Buhweju	3%	26,242	220,661	221,213	221,767	222,322	222,878
Bushenyi	1%	9,100	190,571	191,048	191,526	192,005	192,485
Isingiro	15%	16,006	802,403	804,411	806,424	808,442	810,465
Kiruhura	17%	138,655	361,081	361,985	362,891	363,799	364,709
Lwengo	7%	30,811	290,871	291,599	292,329	293,060	293,794
Lyantode	3%	8,909	180,541	180,992	181,445	181,899	182,355
Mbarara*	15%	143,459	361,081	361,985	362,891	363,799	364,709
Ntugamo	2%	20,550	180,541	180,992	181,445	181,899	182,355
Rakai	31%	324,212	581,742	583,198	584,657	586,121	587,587
Sheema	7%	56,176	361,081	361,985	362,891	363,799	364,709
Total	100%	774,119	3,530,573	3,539,408	3,548,266	3,557,145	3,566,047

*Includes present day Rwampara district

Livestock water demand

The current livestock water demand per district was estimated by summing the water demand for each livestock type (i.e., cattle, goats, sheep, pigs, and poultry). The current water demand for each livestock type was estimated by multiplying the livestock count for each livestock type with the unit water demand for one (1) Tropical Livestock Unit (TLU) and the respective livestock coefficient.

The current (2020) livestock counts (Table 9) were projected from UBOS's 2014 livestock census using the formula $L_n = L(1 + r)^n$, where L_n is the livestock count after n years, L is the baseline (2014) livestock count, and r is the annual growth rate (%). A similar study in the sub-Saharan region recommends growth rates of 0.002, -0.048, -0.041, and 0.061 for cattle, sheep, goats, and pigs, respectively. Estimates by the Food and Agricultural Organisation¹⁴ in 2010 put Africa's annual poultry growth rate at 3.1%. The same formula was used to project the livestock counts for the subsequent years, as presented in Annex 2.

¹⁴ FAO (2010) Smallholder poultry production – livelihoods, food security and sociocultural significance, by K. N. Kryger, K. A. Thomsen, M. A. Whyte and M. Dissing. FAO Smallholder Poultry Production Paper No. 4. Rome

Table 9: Current (2020) Livestock numbers for different livestock in Rwizi Catchment

District	%age of district in R. Rwizi basin	Cattle (#)	Goats (#)	Sheep (#)	Pigs (#)	Poultry (#)
Buhweju	3%	289	574	50	121	28
Bushenyi	1%	23	23	4	3	21
Isingiro	15%	27,112	33,210	4,541	1,139	36,921
Kiruhura	17%	53,455	17,206	2,554	734	13,285
Lwengo	7%	3,136	4,358	393	1,266	14,879
Lyantonde	3%	2,117	1,316	155	290	2,079
Mbarara*	15%	143,217	83,792	7,409	10,705	152,768
Ntungamo	2%	4,634	5,516	838	181	4,494
Rakai	31%	64,363	85,273	9,944	42,097	258,586
Sheema	7%	3,343	6,060	1,283	931	23,754
Total	100%	301,689	237,329	27,171	57,467	506,814

*Includes present day Rwampara district

The current (2020) and future water demand (m³/year) per district was estimated by summing the product of the livestock count, the unit water demand for one (1) Tropical Livestock Unit (TLU), and the respective livestock coefficient. In 2000, the Directorate of Water Development¹⁵ guided that one TLU needs 50 litres/day and that one head of cattle shall be deemed to be 0.7 of a TLU while one goat shall be considered to be 0.15, one sheep shall be considered to be 0.15, and one pig shall be considered to be 0.4. In 2001, Winchell¹⁶ proposed 0.005 as the conversion factor for poultry. Table 10 summarizes the current (2020) and future annual livestock water demand (m³/year) per district.

Table 10: Current (2020) and future annual livestock water demand

District	%age of district in the Catchment	Total Livestock Water Demand (m ³ /year)				
		2020	2025	2030	2035	2040
Buhweju	3%	6,293	6,293	6,293	6,294	6,294
Bushenyi	1%	394	394	394	394	394
Isingiro	15%	460,722	460,549	460,424	460,339	460,289
Kiruhura	17%	743,245	743,156	743,084	743,026	742,981
Lwengo	7%	63,238	63,100	62,981	62,878	62,790
Lyantonde	3%	33,325	33,306	33,289	33,275	33,262
Mbarara*	15%	2,167,311	2,166,046	2,164,977	2,164,075	2,163,318
Ntungamo	2%	78,261	78,248	78,240	78,238	78,239
Rakai	31%	1,405,426	1,402,646	1,400,199	1,398,037	1,396,120
Sheema	7%	71,150	70,955	70,790	70,652	70,535

¹⁵ DWD (2000) Water Supply Design Manual, 2nd Edition; Directorate of Water Development, Ministry of Water and Environment, Kampala.

¹⁶ Winchell (2001) Water Requirements for Poultry, Canada Plan Service.

Total	5,029,365	5,024,693	5,020,671	5,017,207	5,014,224
<i>*Includes present day Rwampara district</i>					

2.2.4.4 Environmental flows

Environmental and ecosystem water needs are not straightforward to estimate. They vary with season, and thus ecosystems are usually adapted to seasonal occurrences such as droughts and floods. The environmental flow that should be left in the river at all times is estimated as the “flow in the river equalled or exceeded 95% of the time (Q95)”. In the absence of detailed environmental asset mapping in the Catchment, the Q95 considered for the environmental flow would be sufficient for maintaining the river’s natural ecosystem functions. Therefore, considering the River Rwizi flow attributes (Table 3), the environmental flow is 1.93 m³/s (60,864,480 m³/year).

2.2.4.5 Total water demand

The total current (2020) consumptive water demand for the Rwizi catchment is about 26.35 Million Cubic Meters per year (MCM/yr). The total consumptive water demand is expected to rise to an estimated 37.58 MCM/yr in 2040. Table 11 provides a sectorial breakdown of this projection. Crop irrigation is projected to become even more dominant in the future when plans for new irrigation projects are implemented.

Table 11: Total current (2020) and projected consumptive water demand by different sectors

Category	Million cubic meters per year				
	2020	2025	2030	2035	2040
Domestic	17.36	19.60	22.18	25.13	28.10
Irrigation	3.53	3.54	3.55	3.56	3.57
Livestock	5.03	5.02	5.02	5.02	5.01
Industrial	0.44	0.52	0.63	0.75	0.90
Total	26.35	28.69	31.37	34.46	37.58

2.2.5 Water balance

While the water availability assessment provides insights on the quantity of water available in time and space, the water demand assessment quantifies the required amounts. The water balance weighs the available water resources (both surface water and groundwater) against the estimated water demand; to determine if the current and future demand can be met. While a water surplus would imply an opportunity to increase productive water use, a deficit necessitates enhanced water use efficiency and other measures to manage the water deficits.

With the Catchment’s current (2020) and projected (2040) consumptive water demand being 26.35 MCM/year and 37.58 MCM/yr, the consumptive water demand can be met by the low flows equivalent to 60.86 MCM/yr. The available water resources are further supplemented by the groundwater resources estimated at 875 MCM/yr. Consequently, the water available in the Catchment per year exceeds the total annual consumptive water demand. Therefore, water available in the Catchment can meet all current (2020) and projected (2040) consumptive water needs in the Catchment if the water would be distributed evenly in time and space.

2.2.6 Issues on water resources

2.2.6.1 Water quality issues and low water supply coverage

Districts that form part of the Ankole cattle corridor have low water supply coverage.¹⁷ Generally, surface water in the Catchment shows significant levels of turbidity (Plate 1). In contrast, borehole water shows high levels of hardness and high contents of calcium, magnesium, iron, fluoride, manganese, and other elements, making the water unpotable.

Plate 1: River Nyamuyanza, Isingiro district, exhibiting high turbidity



2.2.6.2 Pollution of water resources

The rapid urbanisation and industrial development in urban areas, especially in Mbarara, Buhweju Sheema (Kabwohe), Lyantonde, and Ntungamo exert pressure on the water resources; resultant issues include:

- i. Inadequate wastewater treatment facilities for industries and discharge of untreated wastewater into rivers, streams, and wetlands;
- ii. Improper solid waste management practices both at source and dump sites such as those located in TASO Village, Kolanoolya, and Kenkombe in Mbarara city;
- iii. Indiscriminate waste disposal in wetlands; and
- iv. Increased sedimentation of open water bodies: runoff water erodes the soil from the increasingly bare hillslopes.

For example, in Buhweju district, the river and streams are points for waragi distillation, and the wastes are dumped directly in the water. Almost throughout the Catchment, animals drink directly from the water reservoirs (Plate 2), often defecating in the water and potentially leading to the easier spread of livestock diseases. In Mbarara City (at Kolanoolya) and in Lyantonde Municipality, the gazetted waste disposal sites have no mechanism for handling leachate; these residual liquids are left to flow into streams and ultimately into rivers and other water bodies (Plate 3).

¹⁷ according to the Uganda Water Supply Atlas 2020

Plate 2: Cows being watered directly from a water source



Plate 3: Part of the dumping site at Kolanoolya, Mbarara Municipality



2.2.7 Key messages and conclusions on water resources

1. Rwizi catchment has many wetlands and the major ones include: Nyarubungo, Katerera, Nyaruhandagazi, Kizimbi, Kasaana, Kibaare, Katukuru, Rwemigina, Nyabikungu, Bujaga, Kicwamba, Rugaaga, Nyamuyanja, Nyakabaare, Mirama, Rukindo, Nakisharara, Kooga, Rucece, Kyarutengura, Kalunyiga, Mazinga, Katara, Kanyabukanja, Rushanje, Kibingo, and Nyakambu. The lakes include Nakivale, Kachera, Mburo, and Kijanibalora.
2. Groundwater in the Rwizi catchment is poor and highly variable. The poor groundwater potential is also attributed to the dry Ankole cattle corridor – most of the wells drilled in the dry corridor are either dry or low yielding.
3. Even at its lowest flows of 60.86 Million Cubic Metres per year (MCM/yr), available surface water exceeds the Catchment's current (2020) and projected (2040) consumptive water demand of 26.35 MCM/year and 37.58 MCM/yr, respectively. The available surface water resources are supplemented by the groundwater resources estimated at 875 MCM/yr.
4. The water available in the Catchment per year exceeds the total annual consumptive water demand. Therefore, water available in the Catchment can meet all current (2020) and projected (2040) consumptive water needs in the Catchment if the water would be distributed evenly in time and space.
5. Surface water sources have water of good quality except for Lake Nakivale that indicates contamination from human excreta deposited in the lake by the high population of refugees living along the shoreline. The River Rwizi water is turbid due to the reclamation of wetlands as they are converted to different land use.
6. Groundwater in the Catchment shows high levels of hardness and high contents of calcium, magnesium, iron, fluoride, manganese, and other elements, making it unpotable.
7. Observations made at the Rwonyo and Rakai groundwater monitoring stations indicate that groundwater levels are declining. The decline in groundwater levels could be attributed to increased abstraction levels with a possible risk of depletion, especially when low permeability basement aquifers are exploited by high-yielding electric pumps, especially for industrial use in the urban centres. In addition, the decline indicates that the groundwater aquifers have a reduced recharge from rainfall. Estimates indicate groundwater recharge rates of 90 - 238 mm/yr, accounting for 7 - 24% of the average annual rainfall, with the most recharge happening during heavy rainfall events. Reduce recharge is a consequence of land-use types that reduce water infiltration.

2.3 Stakeholders

2.3.1 Inventory of stakeholders

Main stakeholder categories in the Rwizi Catchment include the Central Government, Local Governments, Civil Society Organisations, water supply and sanitation operators, the private sector, academic and research institutions, and local communities.

2.3.1.1 Central Government

This category includes Ministries, Departments and Agencies of the Central Government, for example, the Directorate of Water Resources Management (DWRM), the Directorate of Water Development (DWD), the Directorate of Environment Affairs (DEA), the Wetland Management Department, the National Environment Management Authority (NEMA), the National Forestry Authority (NFA), the Uganda Wildlife Authority (UWA), the Ministry of Health (MoH), the Ministry of Lands, Housing and Urban Development (MLHUD), and the Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF), among others.

Stakeholders in this category put in place the enabling environment for catchment management in the form of relevant resource use and management guidelines, policies, and institutional frameworks. They also bear the responsibility of providing relevant strategic information and technical support to the other stakeholders. Therefore, they should be involved early enough in the planning process and throughout the implementation phase to provide technical oversight.

2.3.1.2 Local Governments

This category includes District, City, Municipality, Town Council, Sub-county, Parish, and Village Council political, technical, and administrative offices. They are interested in ensuring that the persons they represent have access to resources and services and that they meet development needs (water, food, income, social services, infrastructure, etc.). They bear the responsibility to develop local policies and bylaws that guide access to (and use of) resources. They should also be engaged early enough in the catchment planning stage to seek their buy-in and during the implementation phase. They provide the necessary policy, legal and institutional frameworks at the local level and co-financing for implementation.

2.3.1.3 Catchment Management Committee

The Rwizi Catchment Management Committee (CMC) surveyed the entire Catchment in August 2013 that formed the foundation for this Catchment Management Plan. The CMC continues to visit specific sites before its quarterly meetings to acquaint its members with the hotspots requiring immediate attention. Informed by technical oversight by the Victoria Water Management Zone, the CMC recommends management interventions for the Catchment and supervises implementation.

2.3.1.4 Local community members

This category includes crop and livestock farmers, fisherfolk, and business persons, both male and females of various ages. They use the Catchment's resources and services (water, land, trees, fish, minerals, art and crafts materials from wetlands, etc.) to satisfy their livelihood and development needs.

One essential category of local community members is the landlords, who make critical decisions on utilizing land and related resources (decisions on farming, wetland/woodland reclamation for grazing or crop farming, mining minerals, among others). Therefore, they should be involved in identifying catchment issues, defining solutions, and developing implementation modalities. During the implementation of the CMP, they should be supported to adopt wise resource-use and sustainable management strategies.

Although they are aware of their importance in water resource management, the local community members often view themselves as having little influence and power than Local Government officials; this often results in tensions between these two stakeholder categories. To mediate in these power and relation struggles are the faith-based and cultural institutions at the community level; are interested in society in promoting harmony and "responsible-living" in society. Because the faith-based and cultural institutions command considerable respect at different levels and have a significant constituency, they should be involved in the Plan's development process and implementation.

2.3.1.5 Civil Society Organisations (CSOs)

These include Non-Governmental Organisations (NOGs) and Community-Based Organisations (CBOs) working in the water, community development, natural resources, land, and environment sub-sectors. They are interested in sustainable resource use and management and community livelihoods support. Additionally, they play a "public watchdog role" in monitoring the quality of governance and lobbying duty-bearers to deliver water resources development as provided for in the policy aspirations of the country. Further, CSOs are the Government's partners of choice in development by sourcing complementary resources for implementing development initiatives. Therefore, CSOs should be involved in identifying catchment issues, presenting community views and concerns, discussing options, and providing recommendations and approaches for addressing the problems. During Plan implementation, CSOs can

guide communities on the wise use of catchment resources and provide knowledge and experiences on best practices from elsewhere.

2.3.1.6 Water Supply and Sanitation operators

Water supply and sanitation operators include the National Water and Sewerage Corporation, water boards, water user associations, etc. They want assurance of adequate quantities and quality of water to supply to their customers and, lately, invest resources in catchment restoration and management. They can provide resources for implementing interventions related to sustainable management of catchment areas for water supply systems.

2.3.1.7 Private sector

The private sector's interests are in catchment goods and services, e.g., water, agricultural produce, livestock and livestock products, etc. They include Nile Breweries, Century Bottling Company, Pearl Dairy, Amos Diaries, GBK, Tip Top Diaries, and Hotels. They have a role in maintaining sustainable catchment goods and services, investing in programs that support catchment sustainability, e.g., tree planting, sustainable agriculture, wetland rehabilitation, etc. Some of these stakeholders have already committed resources to support projects and programs related to catchment restoration in the upper parts of the Rwizi Catchment. They view themselves as having medium to low power and influence because they do not have decision-making authority over water resources management in the Catchment.

2.3.1.8 Development partners

These are mainly partners supporting development initiatives in the water, community development, natural resources, land, and environment sub-sectors. They are interested in sustainable resource use and management, community livelihoods, and general development. Their role is to provide technical and financial support towards the proposed investments in the CMP. Their interest is to identify bankable proposals for sustainable investment; they should be onboarded during planning and implementation.

2.3.1.9 Academic and research institutions

The sustainability of the Catchment requires research related to water resources management, aquatic biodiversity, ecosystem services restoration, impacts of climate change on water resources and related livelihoods, and social issues. Academic and research institutions such as Mbarara University of Science and Technology, National Fisheries Resources Research Institute, National Forestry Resources Research Institute, and the World Agroforestry Centre should be part of the development and implementation of the CMP.

2.3.2 Current partnership

Partnerships exist between public authorities, companies, and civil society to address shared threats to water security in the Rwizi Catchment. These include:

- Various NGOs and faith-based organizations, e.g., IUCN, ACODE, ACORD, WWF, Mbarara Diocese, Kigezi Diocese, CECODE, Active Citizen, UNHCR, and others
- Development partners, including World Bank, DANIDA, Austria Development Aid, DFID, GIZ, FAO, and others
- Other government programmes, for example, Operation Wealth Creation, Inclusive Green Growth for Poverty Reduction, Youth Livelihoods Programs
- The private sector, e.g., Coca-Cola, Nile Breweries, Hotels, Banks.
- The 11 District Local Governments that will implement the CMP and rollout CbIWRM
- The Green Economy Network, which engages civil society to play its role in galvanizing good governance in the Catchment.

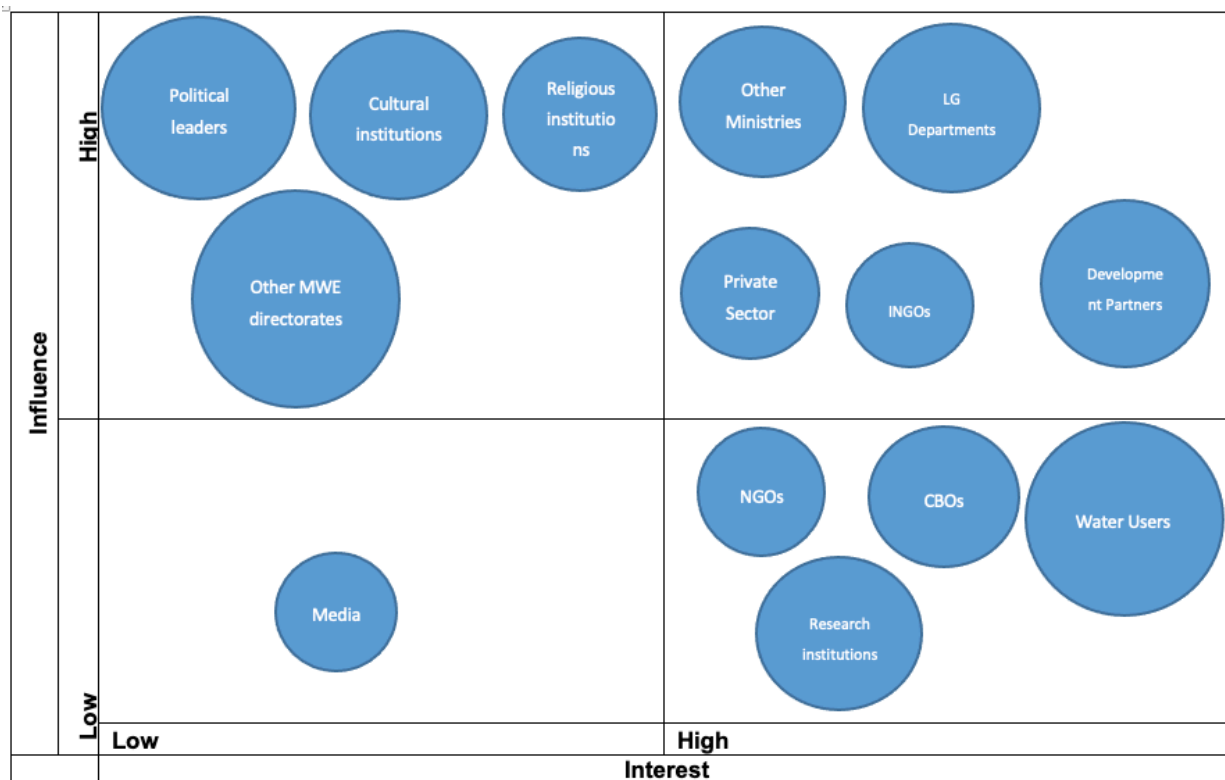
2.3.3 Power dynamics

Figure 25 presents a snapshot of the interests and influencing power of the different stakeholder groups. A stakeholder's positioning in the chart and circle size shows their relative importance in water resources

management, i.e., whether they would comprise an ally or a potential blocker to the implementation of the Rwizi CMP.

With high influence and high interest, the stakeholders positioned in the top right corner could be strong allies for water resources management in Rwizi Catchment. These stakeholders must be engaged fully and outstanding efforts made to address their interests. Because of their roles and responsibilities within the Rwizi Catchment and Uganda in general, the stakeholders with a larger circle would potentially form stronger partners than the others.

Figure 25: Rwizi catchment Stakeholder Power dynamics



With high influence and low interest, the stakeholders positioned in the top left can be blockers of the catchment management process. Therefore, it is important to keep them well-informed and lobby their support for improved water resources management in collaboration with other stakeholders. These stakeholders are all very influential. A strategy for their engagement needs to be carefully rolled out by keeping these stakeholders informed but not to the extent that they become bored with the message.

With high interest but low influence, the stakeholders positioned bottom right could become vital participants in water resources management. However, their capacity in this (e.g., negotiation skills) should be strengthened to become strong discussion partners and collaborators. This group of stakeholders is highly affected by a lack of proper water resources management frameworks and probably has thought of some strategies to overcome their issues. Representatives of these primary beneficiaries of the resources should be involved in the catchment management processes.

A few NGOs have also been found to have high interest in water resources management but have limited influence. In as much as they may not be very influential, they are essential in community mobilisation and capacity building and can mobilise resources for implementing interventions in the CMP. Rwizi Catchment Management Plan.

2.3.4 Issues on stakeholders

The challenges highlighted by stakeholders in the Rwizi Catchment include limited awareness of the importance of water resources management (WRM), limited prioritization (and therefore funding) of WRM by Central and Local governments, inadequate stakeholder capacity in WRM planning and implementation, limited coordination and collaboration among stakeholders, and negative attitude towards natural resources conservation in general. Table 12 below summarizes the concerns, their causes, and associated impacts.

Table 12: Voices of concern raised by stakeholders

Voice of concern	Immediate cause	Proposed solutions
Deterioration in attitude and behavior towards management of natural resources	<ul style="list-style-type: none"> ▪ Failure to attach economic value to environment and natural resource ▪ Failure in extension service delivery at the household level to raise awareness about the importance of the environment and natural resources. 	<ul style="list-style-type: none"> ▪ Undertake an economic evaluation of natural resources ▪ Improve and fund the provision of extension services ▪ Create awareness about the environment and natural resources
Failure of environment and natural resources management institution to collaborate	<ul style="list-style-type: none"> ▪ Lack of capacity, primarily financial and human capacity, for the institutions to implement their mandate. ▪ Uncoordinated planning and implementation of projects and programs. 	<ul style="list-style-type: none"> ▪ Improve the funding of institutions responsible for environment and natural resources management. ▪ Improve the coordination of government projects and programs ▪ Mainstream environment and natural resources management into projects and programs of sectors with high impact on natural resources
Lack of information and data related to water resources management in the Catchment	<ul style="list-style-type: none"> ▪ Weak mechanisms for collection, analysis, and sharing of water resources management information and data 	<ul style="list-style-type: none"> ▪ Improve the collection, storage, and management of data and information relating to water resources management

2.3.5 Key messages and conclusions on Stakeholders

<p>1. Main stakeholder categories in the Rwizi Catchment include the Central Government, Local Governments, Civil Society Organisations, water supply, and sanitation operators, the private sector, semi-autonomous agencies, academic and research institutions, and local communities.</p> <ul style="list-style-type: none"> ▪ Central Government Ministries, Departments, Agencies create the enabling environment for catchment management, such as relevant resource use and management guidelines, policies, and institutional frameworks. Also, this category bears the responsibility of providing relevant strategic information and technical support to the other stakeholders. Further, they can directly implement water resources management interventions. ▪ Political, technical, and administrative offices of Local Governments at the District, City, Municipality, Town Council, Sub-county, Parish, and Village Council levels are interested in ensuring that the persons they represent access resources and services. This category provides the necessary policy, legal and institutional frameworks at the local level and co-financing for implementation. ▪ Civil Society Organisations (CSOs) and Development Partners are interested in sustainable resource use and management, and community livelihoods support. They play a "public watchdog role" in monitoring the quality of governance and lobbying duty-bearers to deliver water resources development as provided for in the policy aspirations of the country. Further, this category is the Government's partner of choice in development by sourcing complementary resources for implementing development initiatives. CSOs can guide communities on the wise use of catchment resources and provide knowledge and experiences on best practices from elsewhere.
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- Water supply and Sanitation Operators, including the National Water and Sewerage Corporation, water boards, water user associations, etc., want assurance of adequate quantities and quality of water to supply to their customers and, lately, invest resources in catchment restoration and management.
 - The private sector's interests are in catchment goods and services (e.g., water, agricultural produce, livestock and livestock products, etc.). When adequately engaged, they can invest resources in catchment restoration and management. Some of these stakeholders have already committed resources to support projects and programs related to catchment restoration in the Catchment.
 - Academic and research institutions are interested in studying various aspects of water resources management, aquatic biodiversity, ecosystem services restoration, impacts of climate change on water resources and related livelihoods, and social issues.
 - Local Communities, including crop and livestock farmers, fisherfolk, and business persons, both male, and females of various ages, use the Catchment's resources and services to satisfy their livelihood and development needs.
2. The challenges hindering the full participation of stakeholders in water resources management in the Catchment include limited awareness of the importance of water resources management (WRM), little prioritization (and therefore funding) of WRM by Central and Local governments, inadequate stakeholder capacity in WRM planning and implementation, limited coordination and collaboration among stakeholders, and negative attitude towards natural resources conservation in general. In addition, the lack of information and data related to water resources management in the Catchment compounds the above challenges.

2.4 Social and Environmental Context

2.4.1 Demography in the Catchment

The Catchment had a total population of about 3,000,000 persons in 2019, likely to have doubled by 2040.¹⁸ The average population density in the Catchment is around 174 persons per square kilometre of land. Fifteen percent (15%) of the population will live in urban areas by 2035.¹⁹

The Catchment faces increased pressures due to the increasing human and animal population, seasonal migrations by pastoralists, land reclamation for farming and construction, clearing of hill slopes for agriculture, and sand mining from the river bed. These pressures have resulted in the degradation of the natural environment, particularly along livestock corridors, wetlands, and hill slopes.

The Catchment hosts industries, secondary schools, tertiary educational institutions, universities, and hospitals. Tourism is also a vital sector of the economy in the Catchment due to the presence of Lake Mburo National Park and the proximity of Queen Elizabeth National Park, which makes hotels a vibrant business in the Catchment. These schools, tertiary educational institutions, universities, and hotels present a significant transient population that varies over the year.

The growing population in the Catchment has the following impacts:

- Increased demand for water and other natural resources for domestic and commercial use
- Increased demand for land for settlement, urban infrastructure development, and crop farming, thereby accelerating land conversion from other forms of land use. For example, by 2019, 168 hectares of Mbarara Forest Reserve had been encroached upon for urban development since 2007.
- Increased solid and liquid waste generation could increase the risk of pollution of the environment if the wastes are mishandled.

¹⁸ According to projections based on the National Population and Housing Census 2014

¹⁹ Ntale. H. K (2012) River Rwizi Water Balance Analysis, Vala Associates Ltd.

2.4.2 The Nakivale refugee settlement

Nakivale refugee settlement (185 square kilometres), established in 1960, is located in Isingiro District. The settlement has become an ecological hotspot because of the increasing population and the resultant demand for natural resources. By April 2019, the settlement hosted 109,820 persons, comprising 104,169 refugees and 5,651 asylum seekers. These were mainly from the Democratic Republic of Congo (54,336), Burundi (31,037), Somalia (13,050), Rwanda (9,278), Eritrea (1,041), and Ethiopia (852). The population density in the settlement is upwards of 500 persons per square kilometre, compared to the 174 persons per square kilometre elsewhere in the Catchment.

The impacts associated with the refugee settlement include:

- i) Opening up more land as adult refugees are assigned land for settlement.
- ii) Refugees largely depend on charcoal and firewood for cooking, which impacts the environment, especially trees.
- iii) Refugees, too, require water that is not readily available, especially in the dry season
- iv) Refugees generate waste that, if mismanaged, directly impacts the quantity and quality of water.
- v) Refugees keep animals dependent on the ecosystem for survival and require water, which is scarce in the dry season.
- vi) Because of the high population density, areas around Nakivale are highly degraded, requiring a comprehensive ecosystem restoration plan.

2.4.3 Land ownership

Stakeholders pointed out that historically land use in Rwizi catchment was under communal grazing and cultivation, particularly in the districts of Kiruhura, Isingiro, and Ntungamo. There is increased individualization of land ownership, resulting in an easy change of land use in fragile areas, such as wetlands, riverbanks, and woodlands. Lake Mburo National Park in Kiruhura district is a protected and gazetted area for wildlife. There is pressure to de-gazette more forest reserves and encroachment on wetlands. Yet, the sub-region is one of the most highly deforested,²⁰ significantly contributing to soil erosion. Currently, the land tenure systems in the Rwizi catchment area are freehold, leasehold, customary, and common property land ownership. The latter is the most typical form involving communal grazing on natural pasture.

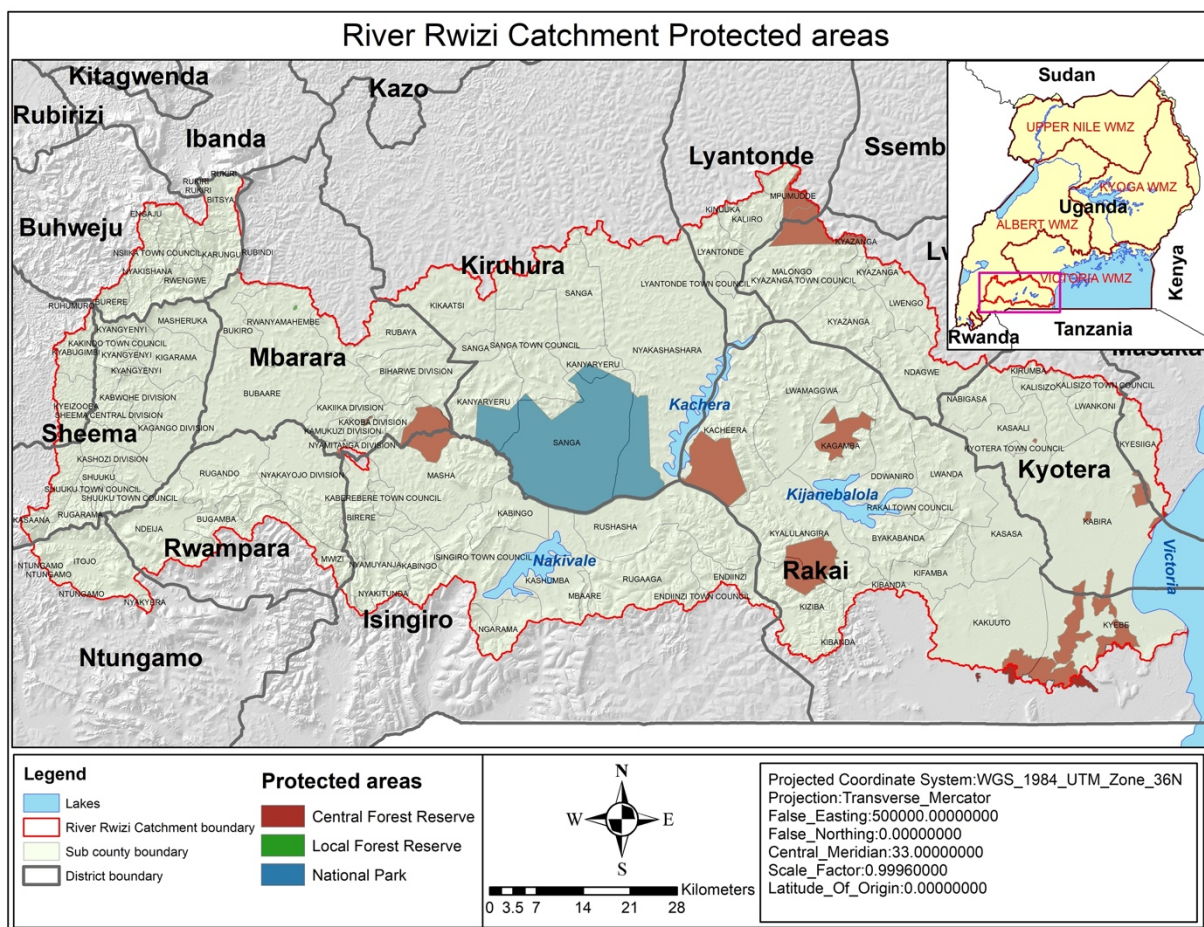
2.4.4 Protected sites and nature reserves

Rwizi catchment has wildlife resources found within National Parks, Ramsar sites, and Forest Reserves (local and central forest reserves) shown in Figure 26. In the upper part of the Catchment (i.e., Mbarara and Isingiro districts) are Mbarara and Kyahi Central Forest Reserves (CFRs). In the mid Catchment (i.e., Kiruhura and Isingiro districts) are Lake Mburo National Park and Lake Mburo-Nakivale Ramsar site,²¹ and Kijanebarola and Kyamazzi Central Forest Reserves in Rakai district. The lower part of the Catchment, near the Lake Victoria shores, is dominated by wetland vegetation where the Nabajjuzi Ramsar site, an important bird area, is located. Also, the area has extensive forest cover, including the Kigona, Kabira Tero, and Namalala Central Forest Reserves in Rakai District.

²⁰ ARUP (2014) Water Risk and Sustainability Assessment for Rwizi Catchment

²¹ A Ramsar site is an important bird area harboring the diversity of birds and other biodiversity both fauna and flora

Figure 26: Protected areas of Rwizi Catchment.



2.4.5 Economic activities

River Rwizi is an essential direct and indirect source of water for agricultural, domestic, industrial, and small-scale economic activities across the Catchment. It is the only source of water for Mbarara City, the largest urban centre in Western Uganda. A diverse range of small, medium and large water users rely on the Catchment's water resources, including groundwater and surface water (from the river, lakes, naturally occurring wetlands, valley dams, and valley tanks). The main economic activities in the Catchment rely on water from the river and the rest of the surface water system, mainly through naturally occurring wetlands and constructed valley dams and tanks.

The main economic activities carried out in the districts in the Catchment are:

- Subsistence and commercial crop agriculture, including eucalyptus plantations.
- Livestock rearing (and the associated livelihood opportunities).
- Fish farming and rudimentary fishing on lakes such as Lake Kachera.
- Tourism, even outside the gazette protected areas.
- Manufacturing and processing industries.
- Local industries such as brick-making, sand mining, and the use of papyrus reeds for making baskets, mats, and crafts.
- Local subsistence activities such as motor vehicle/motorcycle washing and repair.
- Gold mining, especially within the upper parts of the Catchment.
- Charcoal production, transportation, and trade.
- Trade in agricultural products which happens in market places.

2.4.5.1 Crop farming

Major crops grown in the Catchment are fruits, perennial pulses, root crops, cereal grains, and vegetables. They include bananas, beans, millet, coffee, tea, groundnuts, citrus, tomatoes, cabbages, onions, and pineapples. Farmers are organized under a network of cooperative societies, mainly under the umbrella of *Banyankole Kweterana* Cooperative Union, specializing in coffee, ranching, and distribution of Agrochemicals. Uganda Crane Creameries Cooperative is also supporting dairy farmers in improved production and productivity and the marketing of milk and dairy products.

2.4.5.2 Livestock rearing

River Rwizi is one of the main rivers in Southwestern Uganda and is a water source for thousands of local people and their livestock. Cattle keeping is a significant economic activity, and the indigenous Ankore long-horned, exotic, and cross-bred cattle are reared for beef and dairy products. Cattle rearing is the predominant economic activity in Isingiro, Kiruhura, and the northern part of Mbarara district. Natural vegetation in these areas is mainly shrubs and small trees, suitable for open grazing. Other livestock types kept in the Catchment include pigs, sheep, goats, and poultry.

2.4.5.3 Fisheries

Fishing and fish farming are also common in the lakes, rivers, and wetlands within the Catchment. Fishing from River Rwizi and the lakes in the Catchment is on a declining trend, with some species almost getting extinct. Small-scale fishing takes place on lakes (Mburo, Kachera, Kijanibarola, and Nakivale), rivers, and major wetlands in the Catchment.

2.4.5.4 Tourism

Tourism is another important economic activity in the Catchment. Lake Mburo National Park (LMNP), popularly known as the "home of zebras," located in Kiruhura district, is the main tourist attraction in the Catchment. Wildlife found in LMNP includes hippos, zebra, warthogs, impala, topi, oribi, eland, klipspringer, buffalo, waterbuck, reedbuck, baboon, and vervet monkeys.

Other tourist attractions in the Catchment include:

- Sanga Cultural Village – a cultural centre for Hima ethnic group
- Lakes Kachera, Kijanibarola, and Nakivale – the landing sites/beaches and open grounds along the lake shores are ideal for campsites and can be used for sport fishing and boat rides.
- The hilly terrain of Buhweju provides an opportunity for climbing and sightseeing
- Igongo Cultural Centre – for cultural education
- Kasensero landing site has been developed into an eco-tourism and picnic site
- Musambwa Island and Serinya tombs in Rakai district are important cultural sites.

Wetlands and forests in the Catchment are home to wildlife. However, these habitats are facing increasing pressure of conversion to other land uses. Human-wildlife conflicts are increasing where animals such as baboons and monkeys raid and destroy crop fields; farmers kill such animals.

2.4.5.5 Industries

Major natural resources dependent industries in the Catchment include:

- Animal products processing (honey, milk, beef, skins, and hides)
- Crop products processing (coffee, tea, grains, etc.)
- Artisanal mining (gold, limestone, clay, and sand)
- Wood carving and carpentry
- brick making
- bakeries
- Food and beverage manufacture (soft drinks and beer brewing), and others.

Gold mining in Buhweju district

Gold in the Buhweju-Mashonga goldfield was discovered in 1933, and mining commenced the following year in 1934. Buhweju District has eight Sub-counties, half of which are thought to have gold deposits (Plate 4). There are fears that artisanal miners use heavy metals (such as mercury) in mining, which could result in the pollution of water resources in the Catchment.

Plate 4: Gold mining in Buhweju District, one of the causes of degradation



2.4.6 Land cover and land use

Land cover types in the Rwizi Catchment include built-up areas, farmland, bushland, grassland, woodland, wetland, forests, and open water.

Based on the image classification of LandSat Imagery, the Rwizi catchment land cover images were analysed for over 15 years, i.e., for 2005, 2010, and 2019. The analysis (Figure 27 and

Table 13) indicates that bushland, forest, grassland, and wetland have reduced by 64%, 634%, 48%, and 46%, respectively, between 2005 and 2019. On the other hand, the area under built-up area and farmland increased by 77% and 85%, respectively, in the same period.

The land use/land cover change is attributed to the high demand for land for settlement and crop farming by the increasing human population, leading to encroachment on bushland, forests, woodland, and wetlands in the Catchment. Further, the reduction in forests and woodland is a consequence of the increased demand for charcoal and wood products due to the increasing human population and the refugee influx in the Nakivale refugee settlement located in Isingiro District. Urbanisation, especially in the Upper and middle parts of the Catchment and around Lake Kachera, has also contributed to the land cover changes from forests, bushland, woodland, and wetland.

The water resources assessment report for the Victoria Water Management Zone (2017) describes the Rwizi catchment as being degraded by runoff, deforestation, encroachment on wetlands, sand mining, brick making, overgrazing, and poor agricultural practices.

Figure 27: Land use/land cover change for Rwizi Catchment 2005, 2010 and 2019

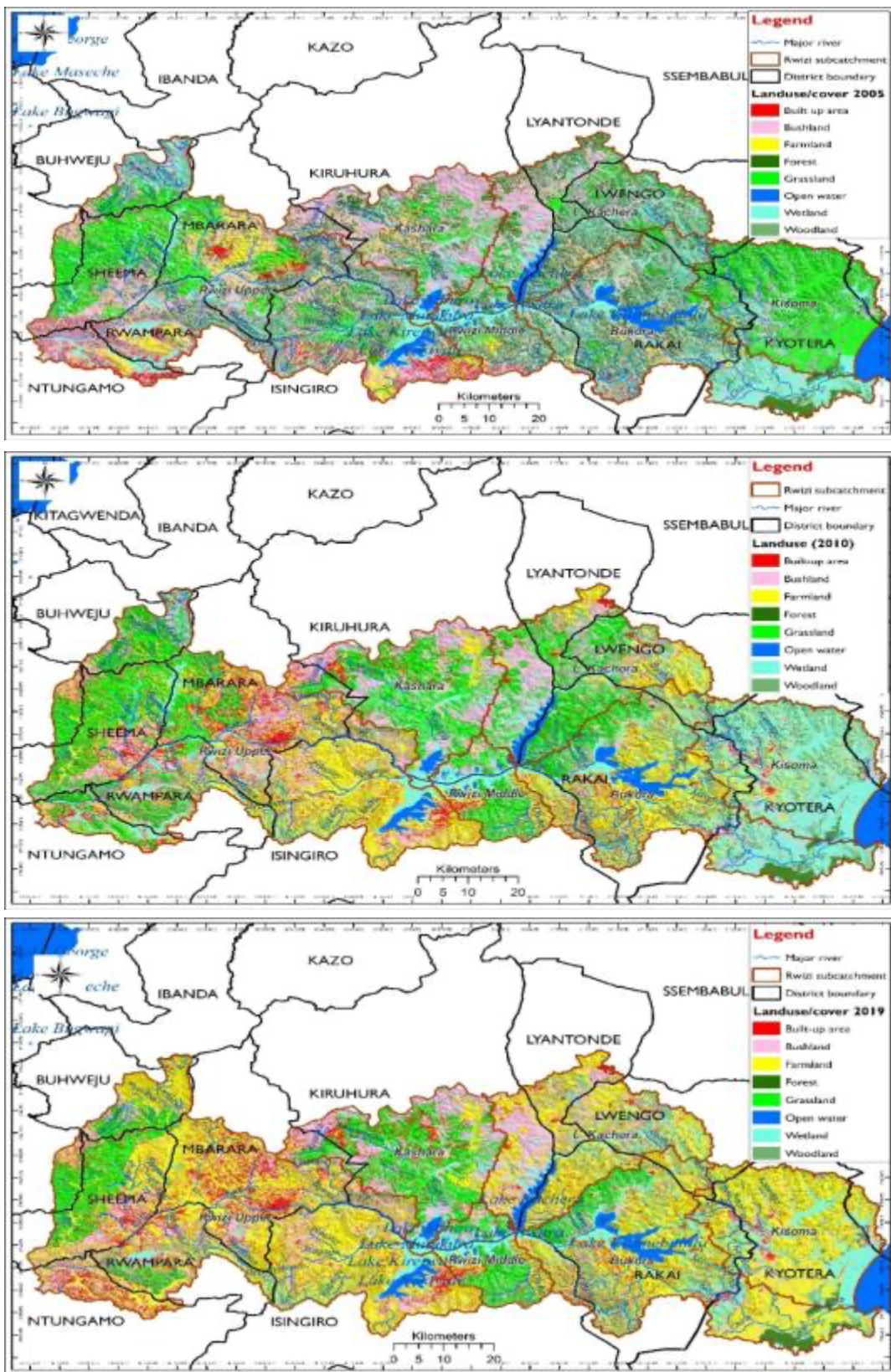


Table 13: Land use/land cover changes for the Rwizi Catchment

LANDUSE/COVER	2005	2010	2019	%age change in land use/land cover
Built-up area	199.75	790.32	867.87	77.0
Bushland	2379.57	1526.37	1451.13	-64.0
Farmland	503.37	1899.37	3452.04	85.4
Forest	1166.45	164.73	158.99	-633.7
Grassland	1336.79	1662.99	900.72	-48.4
Open water	156.80	153.28	153.24	-2.3
Wetland	1710.26	1961.38	1174.08	-45.7

2.4.7 Issues on the social and environmental context

The Catchment is facing increased pressures due to the increasing human and animal population, seasonal migrations by pastoralists, wetland reclamation for farming and settlement, de-vegetation of hill slopes for crop farming, and sand mining in riverbeds. These issues are anthropogenic (i.e., result from human activity) and have socio-economic implications. During consultations, stakeholders mentioned high poverty levels as a critical problem affecting socio-economic progress and fuelling environmental degradation.

2.4.7.1 Wetland degradation

In the Rwizi catchment, wetlands are degrading due to intensified human activity (for example, brick making; see Plate 5), unplanned development, absence or inadequate capacity of local management structures, inadequate enforcement of legislation, and lack of awareness about their functions and values.

Plate 5: Wetland degradation in Mbarara municipality



The draining of wetlands for eucalyptus growing, especially in Ntungamo, Buhweju, and Sheema districts, has contributed to the loss of valuable wetland flora and fauna. Community members plant eucalyptus in wetlands to drain the wetlands for the establishment of crop or livestock farms. For example, the Orusindura wetland in Ntungamo district was encroached on for millet farming alongside eucalyptus growing.

2.4.7.2 *Deforestation and biomass loss*

In the Catchment, forests are cut to create more land for settlement and agricultural activities and provide firewood and charcoal for households, institutions like schools and hotels, and industries. Estimates indicate that an average school uses 150 tonnes of fuelwood per year, 545454 while an average household uses nine to 14 tonnes of firewood or almost one tonne of charcoal annually.

The loss of trees and other vegetation can accelerate runoff generation resulting in increased soil erosion and the resultant reduction in crop yields (when fertile topsoil is washed away by runoff), increased flooding downstream (when there is no vegetation to intercept runoff), and reduced capture of greenhouse gases. The large-scale loss of trees affects a landscape's microclimate (i.e., local temperatures, atmospheric pressure, and water vapor), reducing rainfall formation. Flooding leads to the destruction of crop fields (Plate 6) and property.

Plate 6: Banana plantation in Isingiro flooded after a heavy downpour.



2.4.7.3 *Climate change and its effect on the environment and livelihoods*

Climatic change or variability has made it difficult for communities to predict planting seasons and maintain crop fields for good crop yields. Farming communities depend mainly on subsistence agriculture for their livelihood. However, extended dry spells with unpredictable onset and cessation of rains have reduced upland productivity, fuelling crop farming in fragile virgin areas like wetlands and hillslopes, especially in Mbarara, Buhweju, Sheema, Lyantonde, Rakai, Kyotera, and Ntungamo districts.

Coupled with overgrazing, cropland expansion into hillslopes has resulted in bare hills that cannot hold and infiltrate runoff, accelerating soil erosion in hilly areas and flooding in lowlands. The eroded soil is deposited in wetlands, streams, and rivers, causing their siltation. Increased siltation of rivers and streams (evidenced by the brown coloration of water; Plate 7) increases the water treatment cost by utilities such as the National Water and Sewerage Corporation (NWSC).

Plate 7: A heavily silted NWSC abstraction point in Mbarara



The districts of Isingiro, Kiruhura, Lyantonde, Lwengo, and Rakai, which form part of the cattle corridor, receive low rainfall and experience increasingly high drought conditions, resulting in an acute shortage of water and pasture during the dry season. Lack of water and pasture during the dry season results in animal emaciation (Plate 8), reducing milk and beef production.

Plate 8: An emaciated cow due to lack of pasture and water during one of the severe droughts in Isingiro



2.4.8 Key messages and conclusions on the Social and environmental context

1. The main economic activities dependent on water resources in the Catchment are: subsistence and commercial crop farming, including eucalyptus plantations, livestock rearing, fish farming and rudimentary fishing on the lakes, tourism, manufacturing and processing industries, local industries such as brick-making, sand mining, and the use of papyrus reeds for making baskets, mats, and crafts.
2. The cattle corridor receives low rainfall and experience increasingly high drought conditions, resulting in an acute shortage of water and pasture during the dry season. Lack of water and pasture during the dry season results in animal emaciation, reducing milk and beef production.
3. The Catchment faces increased pressures due to the increasing human and animal population, seasonal migrations by pastoralists, land reclamation for farming and construction, clearing of hill slopes for agriculture, and sand mining from the river bed. These pressures have resulted in the degradation of the natural environment, particularly along livestock corridors, wetlands, and hill slopes. Nakivale refugee settlement (185 square kilometres), established in 1960, located in Isingiro District, has become an ecological hotspot because of the increasing population and the resultant demand for natural resources.
4. The growing population in the Catchment has the following impacts:
 - Increased demand for water and other natural resources for domestic and commercial use
 - Increased demand for land for settlement, urban infrastructure development, and crop farming, thereby accelerating land conversion from other forms of land use. For example, by 2019, 168 hectares of Mbarara Forest Reserve had been encroached upon for urban development since 2007.
 - Increased solid and liquid waste generation could increase the risk of pollution of the environment if the wastes are mishandled.
5. The analysis of land cover change in the Catchment indicates that bushland, forest, grassland, and wetland have reduced by 64%, 63%, 48%, and 46%, respectively, between 2005 and 2019. The reduction is attributed to the increased demand for charcoal and wood products (refugee influx in the Nakivale refugee settlement), urbanisation (in the Upper and middle parts of the Catchment and around Lake Kachera), high demand for land for settlement and crop farming by the increasing human population, leading to encroachment on bushland, forests, woodland, riverbanks, and wetlands in the Catchment. On the other hand, the area under built-up area and farmland increased by 77% and 85%, respectively, in the same period.
6. The draining of wetlands for eucalyptus growing has contributed to the loss of valuable wetland flora and fauna. Community members plant eucalyptus in wetlands to drain the wetlands for the establishment of crop or livestock farms.

2.5 Main issues, causes and impacts

Drawing from the preceding sections, Table 14 summarises the major water resources related issues in Rwizi Catchment, their causes and potential impact. Also, the table gives some of the areas most affected by the issues. Annex three presents the information received from district officials regarding issues, locations, on-going remedial actions and key stakeholders involved.

Table 14: Summary of the main issues in the Rwizi Catchment

Main issues	Hotspot areas	Causes	Impact
Low safe water coverage	Widespread	<ul style="list-style-type: none"> Groundwater potential is poor and variable Poor quality of groundwater water 	<ul style="list-style-type: none"> Shortages of water supply for domestic use High risk of spreading waterborne diseases
Poor solid and liquid waste management	Urban areas, especially: <ul style="list-style-type: none"> Mbarara city, Kaberebere Kyotera: Kyotera Town, Kalisizo Town Kiruhura: Sanga Town Lyantonde: Lyantode Town Lwengo: Kyazanga Town Rakai: Rakati Town Landing sites: <ul style="list-style-type: none"> Kiruhura: Nyakasharara Rakai: Kachera, Lwamaggwa Nakivale refugee settlement	<ul style="list-style-type: none"> Wastewater treatment facilities for industries are either lacking or inadequate Improper solid waste management practices both at source and dump sites Low latrine coverage especially in Nakivale refugee settlement 	<ul style="list-style-type: none"> Pollution of water sources High risk of spreading sanitation-related diseases
Shortage of water for animals	Cattle corridor	<ul style="list-style-type: none"> Existing valley dams and valley tanks do not cover livestock demand Shortages are aggravated by the low and increasingly variable rainfall received in the cattle corridor 	<ul style="list-style-type: none"> Animal mortality Low income as a result of reduced productivity of animals (beef and milf)

		<ul style="list-style-type: none"> High livestock numbers increase the demand for water 	
Low agricultural productivity	Widespread	<ul style="list-style-type: none"> Limited investment in soil and water conservation practices Poor agricultural practices undermine soil fertility Limited access to agricultural inputs Increasingly erratic weather patterns resulting from global climate change 	<ul style="list-style-type: none"> Low income as a result of crop failure High vulnerability to disasters Increased risk of food insecurity
Encroachment of lakeshores, riverbanks, and wetlands	<p>Sheema: Nyakambu wetland</p> <p>Isingiro: Nyamuyanja wetland</p> <p>Kyotera: Wetlands in Kyebe and Kakuuto Sub-counties, Katengo wetland in Kyotera TC, Kisoma wetlands (Kisasa Sub-county)</p> <p>Urban areas throughout the catchment</p>	<ul style="list-style-type: none"> Population growth has led to increased demand for land for settlement and urban development Community members plant eucalyptus in wetlands to drain the wetlands for the establishment of crop or livestock farms. 	<ul style="list-style-type: none"> Land degradation in and around urban areas Loss of aesthetic value of the environment Deposition of sediment into the water Increased vulnerability to natural disasters, especially floods and droughts
Accelerated deforestation de-vegetation	<p>Widespread, but hotspot areas include:</p> <p>Buhweju: Karungu, Nyakishana, Rwengwe</p> <p>Shema: Kakindo</p> <p>Isingiro: Nyamuyanja, Kabingo, Birere</p> <p>Kiruhura: Sanga, Kanyaryeru, Kikaatsi</p> <p>Lweng: Malongo, Lwengo, Ndagwe</p> <p>Rakai: Kifamba</p> <p>Kyotera: Kyebe</p>	<ul style="list-style-type: none"> High dependence on firewood and charcoal for energy Trees are cut for commercial charcoal production for urban centres within and outside the Catchment High demand for land for settlement and crop farming by the increasing human population 	<ul style="list-style-type: none"> Soil erosion Increased frequency of floods and droughts
Deterioration in attitude and behavior towards management of natural resources	General	<ul style="list-style-type: none"> Failure to attach economic value to environment and natural resource Failure in extension service delivery at the household level to raise awareness about the 	Environmental degradation

		importance of the environment and natural resources.	
Limited stakeholder coordination and collaboration	General	<ul style="list-style-type: none"> ▪ Lack of capacity, primarily financial and human capacity, for the institutions to implement their mandate. ▪ Uncoordinated planning and implementation of projects and programs. 	
Lack of information and data related to water resources in the Catchment	General	<ul style="list-style-type: none"> ▪ Weak mechanisms for collection, analysis, and sharing of water resources management information and data 	

2.6 Completed, on-going, and planned activities

There are several on-going and planned interventions aimed at addressing the above issues in the Rwizi catchment. The interventions include:

2.6.1 Catchment management initiatives

Under a Public-Private Partnership (PPP) arrangement, the MWE, GIZ, and Coca-Cola support catchment management initiatives through the "*Improved Community Livelihoods and Sustainable Water Management in River Rwizi Catchment*" project. The project aims to increase water availability, sustainable water use, and improved water resources management in the Catchment. The on-going work includes restoration of degraded wetlands of Nyakambu, Masheruka, Nyakaikara, Kashasha, Katara, Kanyabakajja, and Nyaruteme, among others.

Additionally, there are several government initiatives by the Victoria Water Management Zone, including landscape restoration in Masyoro (Sheema district) and Rubara (Buhweju district), demarcation of the river protection zone in Mbarara City, and the rollout of the Community Environment Conservation Fund (CECF). Further, a Water Stewardship partnership between the Government of Uganda (through the MWE), the World Wide Fund for Nature Uganda Country Office (WWF UCO), and ABInBev (a parent company to Nile Breweries Limited) is implementing a project aimed at improving community livelihoods and water resources management in the Rwizi catchment.

2.6.2 Water and natural resources-related activities

The MWE, MAAIF, MEMD, District Local Governments, NGOs/CBOs, and the private sector propose several projects to enhance water availability for communities. These include:

- Planning and development of Gravity Flow Schemes for domestic water use
- Planning and developing water for production infrastructure (valley tanks and earth dams) to provide water for livestock and small-scale irrigation development.
- Planning and development of Bulk Water Transfer Schemes from areas of sufficient water resources to the water-stressed areas.
- Implementation of water source protection measures, including tree planting, soil and water conservation measures.
- Planning and developing on-farm and off-farm irrigation infrastructure.
- Wetlands, riverbanks, and lakeshores restoration and management.
- Planning and implementation of catchment afforestation measures.
- Water resources planning, monitoring, and regulation.
- Implementation of environmental and social management measures for water resources-related investment projects.
- Planning and development of micro, mini and small hydropower schemes.
- Climate adaptation measures.

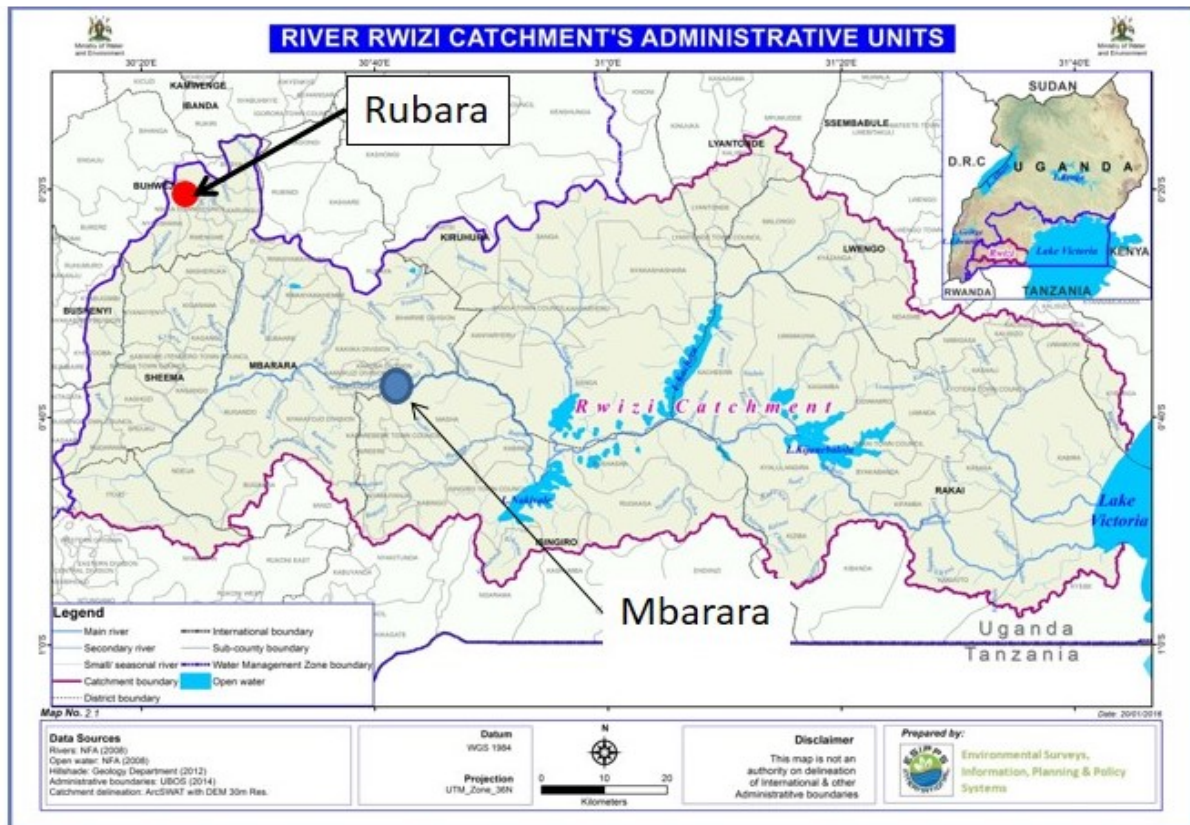
2.6.3 Completed and on-going interventions in the Catchment

Since 2013, several water resources management interventions have been piloted in hotspot micro catchments identified through a participatory process involving key stakeholders, including the Rwizi Catchment Management Committee, local leaders, and community members. Some of the interventions are highlighted below, based on information drawn from VWMZ factsheets and reports.

2.6.3.1 Restoration of Rubara micro catchment

The challenges faced in Rubara Micro Catchment (Figure 28), Buhweju District, include flash floods, soil erosion, occasional landslides, crop loss, loss of agricultural land, and significant seasonal fluctuations in water quantity a gravity flow scheme. Further, the water supply scheme infrastructure was, on two occasions, washed away by landslides.

Figure 28: Location of Rubara in Rwizi catchment



The main interventions include constructing infiltration pits, contour bunds, stone bunds, gully plugs, and trenches, promoting tree planting on bare hill slopes, and awareness creation on good practices in soil and water conservation. The significant changes observed after implementing the interventions include reduced runoff at the restoration site, increased water table at the Rubara gravity flow scheme, and improved crop yields in farmers' gardens.

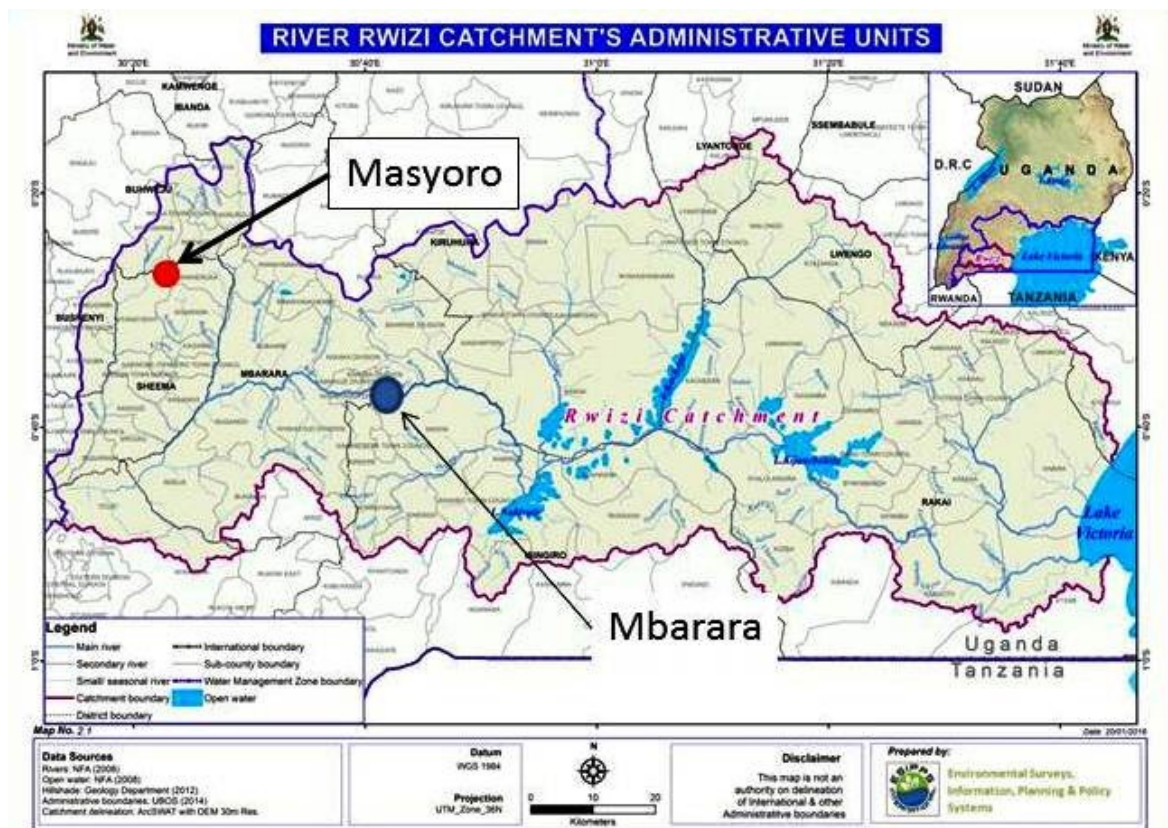
Plate 9: Gullies (Top) and check dams (bottom) constructed in gullies to regulate water flow and trap debris from upstream



2.6.3.2 Restoration of Mashyoro micro catchment

Mashyoro Micro Catchment (Figure 29), Sheema district, is characterised by rugged ridges under intensive farming of cereals and legumes (upstream) with occasional bush burning and gentle to flat fertile plains (lower stream) where bananas and coffee are the predominant crops. At the foot of the ridge is a gravity flow scheme supplying water to three sub-counties in Sheema district.

Figure 29: Location of Masyoro in Rwizi catchment



Major challenges faced before restoration were periodic flash floods and landslides, soil erosion, loss of soil fertility, and crop loss. Measures implemented include stone bunds, trenches, and infiltration pits. The main changes observed after implementation include:

- Reduction of flash floods in the lower plains during rainy seasons: no flash floods happened in the area during the October-December 2018 rainy season.
- Reduction in landslide occurrence.
- An increase in the water table at the Masyoro Gravity Flow Scheme (GFS): there was an overflow at the GFS spring box throughout the December 2016 - March 2017 dry spell, which had not happened in a decade.

Plate 10: Some of the measures implemented in Mashyoro Micro catchment: stone bunds (top and right) and infiltration pits (bottom left)

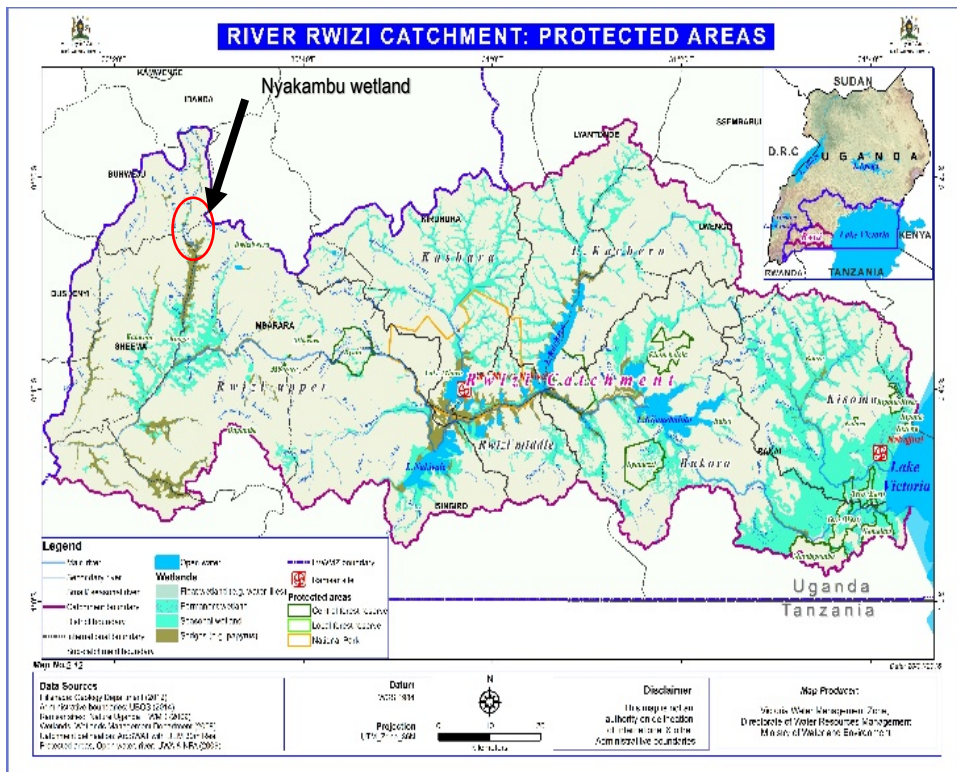


2.6.3.3 Restoration of Nyakambu wetland

Nyakambu wetland (Figure 30) lies in the upstream Rwizi catchment on the northern tributary of the river at the border between Sheema and Mbarara districts. A Water Risk and Sustainability Assessment for Rwizi catchment conducted in 2013 identified this wetland system as one of the very critical ecosystems that had been significantly degraded and recommended for its urgent restoration.

Major challenges experienced before restoration were encroachment and perceived ownership of the wetland by cattle keepers and crop farmers. After digging channels to drain the wetland, community members would burn the wetland vegetation (papyrus) and uproot its rhizomes. The restoration was done under a Public-Private Partnership (PPP) between the Ministry of Water and Environment (MWE), GIZ, and Coca-Cola following a Water Stewardship approach under a project, "*Improved community livelihood and sustainable Water Resources Management in Rwizi.*"

Figure 30: Location of Nyakambu wetland in Rwizi catchment



Some of the key achievements include:

- One hundred eighteen (118) hectares of wetland were restored in Nyakambu, Bukiro, and Katwe villages (Plate 11).
- Through training, community awareness on sustainable wetland use was raised.
- increased quality and quantity of water in the immediate River Rwizi system at Nyakambu
- Introduced the Community Environment Conservation Fund (CECF), amounting to UGX 53.7 million, to three wetland conservation groups (Nyakambu, Bukiro, and Katwe) to promote sustainable water resources management and livelihood improvement
- Piped water was extended to Nyakambu, Bukiro, and Katwe villages to provide clean water to the community in exchange for their promise to stop activities degrading the wetland.
- Currently, community members enjoy the benefits of the restoration by harvesting wetland vegetation for handcrafts-making and mulching banana plantations and harvesting fish for sale, among others.

Plate 11: Progress of Nyakambu wetland restoration since 2013



2013

2014

2016

2.6.3.4 Survey and demarcation of River Rwizi buffer zone in Mbarara City

In 2013, a rapid assessment of the Catchment by the Rwizi Catchment Management Committee (CMC), environmental degradation and pollution as the biggest threats to the Catchment. Pollution was found highest in the Mbarara city (then a Municipality) section of the river; the CMC recommended urgent remedial action. In-field assessments and stakeholders' interviews in 2015 revealed several issues (Plate 12), including:

- Two hundred thirty-eight (238) persons claimed land ownership in the buffer zone, some with unverified land titles.
- Pollution through direct discharge of solid and liquid waste into the river
- Direct sand mining in the river
- Crop Cultivation along the riverbanks without leaving the required buffer zone of 100 meters.
- Siltation of the river

Plate 12: Some of the issues identified in the Mbarara City section of R. Rwizi



From 2015 to 2018, the extent of the buffer zone was measured, over 300 pillars were installed within Mbarara city (Plate 13), and restoration works were commenced. Before installing the pillars, sensitization of communities owning land adjacent to the river was undertaken.

Plate 13: Installing a boundary pillar near GBK premises



3 VISION, OBJECTIVES, OPTIONS AND SCENARIOS FOR RWIZI CATCHMENT MANAGEMENT

3.1 Vision and strategic objectives

At a workshop held in Masaka on 7th April 2016, Catchment stakeholders agreed on a vision and strategic objectives for the Catchment (Box 1).

Box 1: Vision and strategic objectives for Rwizi catchment

Vision:

A sustainable, beautiful Rwizi Catchment environment for better livelihoods

Strategic Objectives:

1. To ensure sustainable access to water of adequate quality and quantity for domestic use and production
2. To ensure that farming, animal husbandry systems, and industrial establishments are productive, drought and climate-resilient, and improve household income.
3. To restore degraded natural resources.
4. To strengthen natural resources management systems and structures.

3.2 Options and Scenarios

To achieve the vision and strategic objectives, there is need to undertake measures which address the main issues and reverse the trends that undermine sustainable development in the Catchment. These measures are called options. A set of options combined with external factors, government policy, ongoing trends and projections for the future then forms a scenario.

Considering the issues faced and the stakeholders' vision and objectives for water resources management in Rwizi Catchment, three scenarios were developed: (i) ecosystem protection and conservation, (ii) water resources infrastructure development, and (iii) a combination of (i) and (ii).

3.2.1 Scenario 1: Ecosystem Protection and Conservation

This scenario envisages investments towards ecosystem protection and conservation (Table 15) with limited water infrastructure development for multipurpose uses. Options under the ecosystem protection and restoration scenario can address the following (possible) trends worsened by climate change.

- The increased unsustainable and destructive practices in livestock herding and crop farming threaten the ecosystem functions of woodlands and wetlands.
- Wetlands in the Rwizi Upper and Rwizi Middle will silt up more due to soil erosion arising from an expansion of farmland without adequate soil and water conservation practices – downstream flooding will increase due to the reduced ability of wetlands to soak water.
- Arable land will deteriorate. More people will fall into the poverty trap, making them turn to alternative livelihoods such as brick-making or charcoal production that damage the environment.

Table 15: Strategic options for consideration under scenario 1

Trends	Options	Impact at Catchment Level
<p>Increased deforestation caused by charcoal burning and agricultural encroachment likely to take place in Middle Rwizi, Kashara, Bukora, and Kisoma sub-catchments</p> <p>Increased demand for timber and non-timber forest products will trigger afforestation efforts and improved forest management, therefore increasing tree cover</p>	1.1 Productive and protected forests and woodlands	Tree plantations on private land will provide an alternative source of tree products, reducing pressure on natural forests. These tree plantations and the proposed collaborative forest management will increase tree cover and water infiltration and minimize runoff generation. The regulation of the charcoal business should lead to a decrease in denudation in critical zones. Thereby option 1.1 presents opportunities for improving the Catchment's water balance
Increased encroachment on wetlands for agriculture, settlement, and other activities such as brick-making, for example in Buriro-Nyakambu, Rwanyamahembe, Orukorohwa, Kooga, Nyakisharara, Rwibogo, Nyaruhandagazi, Kashsha, Orunyeri, Kibingo, Rushanje, Nyakekara, Bujaga, Kibuba, Nyabikungu, Kinoni, Katereza, Mwizi central, Mucucu, Kashojwa, Rwemigina, Mankanke, Katengyeto, and Rwagaju.	1.2 Productive and protected wetlands	The proposed wetlands rehabilitation and management will increase vegetation cover, and water retention, regulating water flows in the Catchment. Option 1.2 provides opportunities for improving the Catchment's water balance.

The development path envisaged is majorly through:

- Wetlands, rivers, and flood plain protection and stabilisation,
- Mapping and demarcation of riparian protection zones,
- Identification and implementation of water source protection measures for existing water supply schemes,
- Promoting productive and sustainable rangelands,
- Promoting productive and protected forests and woodlands
- Supporting improved farming practices

The envisaged limited infrastructure investments include construction and rehabilitation of valley tanks and earth dams for livestock watering, gravity flow schemes for domestic water supplies, boreholes equipped with hand pumps, and motorised groundwater abstractions for rural domestic/urban water supplies and direct water abstractions from River Rwizi for urban water supplies. The scenario does not envisage major infrastructure for irrigation development in the Catchment; hence, the demand for water for irrigation is low.

3.2.2 Scenario 2: Water Infrastructure Development

The water balance assessment for the Catchment shows that the rainfall and annual flow are sufficient to meet the projected demands. However, spatial and temporal variability and the anticipated droughts due to climate change result in periods with insufficient water resources. Therefore, it is necessary to equalise and balance the flows between the dry and wet seasons and provide water for bulk transfer. Consequently, an assessment of several areas with potential storage (including gorges, tributary confluences) in high-demand areas was undertaken (Table 16). These sites provide more than 27 million cubic metres of water storage for multipurpose uses, including drinking water, irrigation, livestock watering, and fish farming. Hydropower generation is not one of the expected benefits since the height of the dams would not allow such use.

Table 16: Identified strategic water storage sites

Dam	Sub-county	District	Latitude (°S)	Longitude (°E)	Dam crest level (m.a.m.s.l)	Dam height (m)	Embankment length (m)	Reservoir inundation area (ha)	Capacity (Mm ³)	Catchment area (km ²)	Mean annual runoff (Mm ³ /y)	Potable demand (m ³ /y)	Irrigation area (ha)	Irrigation demand (m ³ /y)	Total supply capacity (m ³ /y X 1000)	Cost estimate (M US\$)
Rugaaga	Rugaaga	Isingiro	-0.793	31.108	1,249	6.6	350	43	3.53	21.9	25.6	691,825	748	2,206,175	2,826	18.6
Ngarama	Ngarama	Isingiro	-0.868	30.866	1,330	9.3	300	12	2.58	15	11.5	0	699	2,063,000	2,063	28.2
Kakuuto	Kakuuto	Rakai	-0.805	31.370	1,191	17.0	600	50	3.11	5,812	55.0	2,462,014	6	25,986	2,488	14.9
Byakabanda	Byakabanda	Rakai	-0.733	31.420	1,248	13.4	545	172	3.35	11.4	0.108	2,036,559	153	641,441	2,678	10.7
Ddwaniro	Ddwaniro	Rakai	-0.618	31.380	1,249	19.0	502	106	3.41	11.2	0.106	2,495,948	55	229,052	2,725	10.6
Lwanda	Lwanda	Rakai	-0.696	31.433	1,239	3.0	384	143	1.86	12.9	0.122	1,447,998	10	43,002	1,491	5.4
Kagamba	Kagamba	Rakai	-0.601	31.317	1,258	9.2	259	7	1.95	6.4	0.060	0	371	1,560,000	1,560	6.2
Ndaija	Ndaija	Mbarara	-0.707	30.377	1,424	7	526	267	7.4	641	7	2,000,000	500	2,000,000	4,000	20
Lake Kacheera WSS Intake*		Kiruhura	-0.570	31.117	1,238 ^a	n/a	n/a	n/a	n/a	n/a	n/a	759,200	0	0	759.2	6.5

This scenario envisages investments towards developing potential multipurpose water storage reservoirs in the Catchment, and bulk water transfer schemes to meet water demands in the long term (Table 17).

Table 17: Water Supply Options for different locations in the Catchment

No.	Water Supply Demand Sites	Available Water Supply Options
1	Middle Rwizi - Kiruhura, Isingiro	<ul style="list-style-type: none"> ▪ Lake Kacheera Water Supply and Sanitation Intake (Bulk Water Transfer), ▪ Rugaaga Dam ▪ Ngarama Dam, ▪ Rugongi Dam in Kiruhura ▪ Kigabagaba Dam in Kikatsi Sub-county ▪ Rwabigyemano Dam in Keshunga Sub-county ▪ Kenwa Dam ▪ Rubare Dam
2	Middle Rwizi - Mbarara,	<ul style="list-style-type: none"> ▪ Ndaija Dam, ▪ Rwizi NWSC Intakes
3	Upper Rwizi - Sheema, Buhweju, Ntungamo, Igara	Gravity Flow Schemes <ul style="list-style-type: none"> ▪ Biswa GFS ▪ Nyabuhikye GFS ▪ Shuku GFS
4	Lower Rwizi Catchment – Rakai, Masaka, and Lyantonde	Small Earth Dams <ul style="list-style-type: none"> ▪ Kakuuto, ▪ Byakabanda, ▪ Ddwaniro, ▪ Lwanda and ▪ Kagamba

The investments to be implemented under this scenario include:

- Rugaaga and Ngarama Earth Dams
- Ndaija Earth Dam
- Kakuuto, Byakabanda, Ddwaniro, Lwanda, and Kagamba Small Earth Dams
- Lake Kacheera Water Supply and Sanitation Intake (Bulk Water Supply Transfer Schemes)
- Large-scale irrigation projects
- Gravity Flow Water Supply Schemes

3.2.3 Scenario 3: Ecosystem Protection and Conservation and Water Resources Infrastructure Development

This scenario envisages optimal development of identified potential multipurpose water storage reservoir sites in the Catchment, bulk water transfer schemes, and optimal development of irrigation potential in the Catchment. This scenario also envisages investments in ecosystem protection and conservation. The investments to be implemented within this scenario include:

- Multipurpose Water Resources Management and Development Projects (domestic water supply, irrigation water use, flood control, livestock watering)
- Bulk Water Transfer Schemes
- Large scale irrigation projects
- Green infrastructure
- Restoration and protection of ecosystems (forests, wetlands, and agricultural landscapes).

3.2.4 Scenario Comparison

Some options are similar among the three scenarios, while others are unique to each scenario (Table 18). Options may water infrastructure construction for domestic water supply and sanitation systems, multipurpose water storage reservoirs, or interventions on water governance, information systems, institutional strengthening, capacity building, etc.

Table 18: Comparison of the three scenarios.

Scenario	Environmental options	Development of socio-economic options	
		Options related to small water storage infrastructures	Option related to Large Water Resources Infrastructure and Irrigation Development
Scenario 1: Environmental conservation and Protection	Priority for the scenario.	Includes only options with an impact on the environment (e.g., improvement of sanitation)	Not developed
Scenario 2: Full Development of Water Resources Infrastructure	No effort toward this type of option	Priority for the scenario	Developed up to the maximum with all the areas identified as irrigable in uplands developed (type B)
Scenario 3: Optimal Water Resources Infrastructure Development and Environmental conservation and protection	Priority for this scenario	Priority for the scenario	Identified strategic water resources infrastructure for multipurpose uses developed

The scenario analysis is based on the output of the water resources assessment, identifying critical issues and opportunities in the Rwizi catchment. A water resources analysis was undertaken to check the feasibility of the scenarios, determine if the available water resource can meet the projected demand, and estimate the need for storage associated with each scenario in the different sub-catchments (or group of sub-catchments).

Multi-criteria Analysis

Multi-criteria analysis (MCA) establishes preferences between options (e.g., scenario) by referencing an explicit set of objectives for which measurable criteria/indicators exist to assess progress. The weighted average method is the proposed method. It is possible to describe the consequences of a set of scenarios regarding a single set of characteristics. The relative merit of the scenarios is expressed in numeric form, e.g., ranging from 0 for very unfavourable aspects to 100 for very favourable ones. A table was set up listing each competing scenario and its scores against each characteristic (Table 19). For each scenario, an overall merit score was calculated.

Scenario (iii), combining ecosystem protection and conservation and water infrastructure development, is the most suitable course of action towards attaining the stakeholders' vision and objectives for Rwizi Catchment; it is the maximum-benefit Scenario for the Catchment. Section 3.3 presents the priority interventions under Scenario 3.

Table 19: Scores of the Scenarios

Criteria	Scenario 1 Environmental Conservation and Protection	Scenario 2 Water Resources Infrastructure Development	Scenario 3 Ecosystem Protection and Conservation and Water Resources Infrastructure Development
Watershed protection and enhancement	5	0	3
Improvement of water quality	5	2	3
Wetland conservation	5	0	3
Well balanced use of water resources	3	2	5
Mitigation/adaptation to natural disasters and Climate change	3	2	5
Income increase per capita	2	5	5
Improved food production per capita	2	5	5
Feasible cost	5	2	5
implementability (realistic and acceptable)	2	3	5
Overall Score	32	21	39
Rank	2	3	1

3.3 Strategic Interventions for the maximum benefit scenario

Table 20 shows the priority interventions and activities for the maximum benefit scenario. Implementing these interventions will address concerns by catchment stakeholders, including high drought conditions, increased water demand for different uses, water pollution, impacts of climate change and variability, and critical dependency on natural resources and wetlands encroachment for increased agricultural production. In addition, the interventions will resolve threats, pressure, and impacts associated with loss of vegetation cover, soil erosion and siltation of lakes and rivers, reduction in water levels impacting on water availability, nutrient enrichment and eutrophication, disease risks through poor waste disposal, loss of current livelihoods due to water stress and increased conflicts from limited water access.

Table 20: Main Issues, their locations, and Proposed Interventions

Main issues	Intervention	Priority actions
Lack of information and data related to water resources in the Catchment	Water Resources Monitoring Network	<ul style="list-style-type: none"> Expand and automate the monitoring network for surface water, groundwater, and climate
Accelerated deforestation de-vegetation	Catchment Afforestation	<ul style="list-style-type: none"> Establish and support tree nurseries Support agroforestry and tree growing for timber
Encroachment of lakeshores, riverbanks, and wetlands	Wetland restoration	<ul style="list-style-type: none"> Verify maps for wetlands Establish Wetland Management Committees Develop community-based Wetland Management Plans, including bush fire management Demarcate wetlands zones (critical zones, protection, buffer zone, production zone for cultivation and settlement) Develop by-laws and ordinances for wetland protection Implementation of by-laws and ordinances Demarcate protected zones (e.g., using trees or pillars) in the wetlands and decide/agree on permitted activities for the zone Enforce regulations on unsustainable activities (environmental degradation) in the protected zones Establish a fund for wetland protection (e.g., Community Environment Conservation Fund)
	River Banks and Lake Shores Rehabilitation	<ul style="list-style-type: none"> Identify, map, and designate sites where sand or gold mining can sustainably take place Demarcate buffer zone using live markers Restore degraded river banks and buffer zones (tree planting, grassing) Riverbank stabilization, e.g., by using gabions and other structural interventions Build capacity of extension services on soil and water conservation measures (mulching, composting, manuring), good agricultural practices, pest/disease control
Low safe water coverage	Development of Water Allocation Plan	<ul style="list-style-type: none"> Develop Rwizi Water Allocation Model Train Staff in the use of the model Use model in water resources planning at Catchment and sub-catchment levels
	Rainwater harvesting	<ul style="list-style-type: none"> Promote rainwater harvesting at the household level Promote rainwater harvesting at the institutional level – schools, health centres, faith-based institutions Promote rainwater harvesting at the community level
	Bulk water transfer schemes	<ul style="list-style-type: none"> Undertake feasibility and detailed engineering design studies Undertake environmental and social impact assessments Develop Resettlement Action Plans

		<ul style="list-style-type: none"> • Implement feasible schemes
Shortage of water for animals	Develop Multipurpose Water Resources Infrastructure	<ul style="list-style-type: none"> • Undertake feasibility and detailed engineering design studies for multipurpose water storage infrastructure • Undertake environmental and social impact assessments • Develop Resettlement Action Plan • Implement feasible schemes
Low agricultural productivity	Improved and climate-resilient farming	<ul style="list-style-type: none"> • Promote soil and water (SWC) measures including regenerative agriculture • Support small-scale irrigation • Support private sector development for input supply
Poor solid and liquid waste management	Waste management systems	<ul style="list-style-type: none"> • Improve solid waste collection and management systems in collaboration with local entrepreneurs • Stakeholder sensitization on proper handling and disposal of waste (including sorting) • Encourage and support ventures that can utilize (reuse or recycle) solid waste, especially by working with community groups and local entrepreneurs
<ul style="list-style-type: none"> ▪ Deterioration in attitude and behavior towards management of natural resources ▪ Limited stakeholder coordination and collaboration 	Institutional Strengthening and Capacity Development	<ul style="list-style-type: none"> • Implement CMO governance system • Support and strengthen the CMC • Establish a technical support team for CMP implementation • Monitoring and evaluation of CMP implementation • Sub-catchment, micro-catchment, and community action planning • Awareness-raising on CMP

3.4 Key messages and conclusions on the vision, objectives, options and scenarios

1. Based on the critical issues identified, their causes, and impacts, Catchment stakeholders agreed on a vision for the Catchment: “A sustainable, beautiful Rwizi Catchment environment for better livelihoods.”
2. To achieve this shared vision, the CMP addresses four strategic objectives, which the stakeholders formulated:
 - I. To ensure sustainable access to water of adequate quality and quantity for domestic use and production
 - II. To ensure that farming, animal husbandry systems, and industrial establishments are productive, drought and climate-resilient, and improve household income.
 - III. To restore degraded natural resources.
 - IV. To strengthen natural resources management systems and structures.
3. Considering the issues faced and the stakeholders' vision and objectives for water resources management in Rwizi Catchment, three scenarios were developed:
 - Scenario 1: Ecosystem Protection and Conservation envisages investments towards ecosystem protection and conservation with limited water infrastructure development for multipurpose uses. The envisaged infrastructure investments include construction and rehabilitation of valley tanks and earth dams for livestock watering, gravity flow schemes for domestic water supplies, boreholes equipped with hand pumps, and motorised groundwater abstractions for rural domestic/urban water supplies and direct water abstractions from River Rwizi for urban water supplies.
 - Scenario 2: Water Infrastructure Development envisages investments towards developing potential multipurpose water storage reservoirs in the Catchment and bulk water transfer schemes to meet water demands in the long term.
 - Scenario 3: Ecosystem Protection and Conservation and Water Resources Infrastructure Development envisages investments in ecosystem protection and conservation and optimal development of identified potential multipurpose water storage reservoir sites, bulk water transfer schemes, and optimal development of irrigation potential in the Catchment.
4. A water resources analysis was undertaken to check the feasibility of each scenario, determine if the available water resource can meet the projected demand, and estimate the need for storage associated with each scenario in the different sub-catchments (or group of sub-catchments). In addition, multi-criteria analysis was used to compare the three scenarios.
5. Considering the vision and objectives for water resources management in Rwizi Catchment, Scenario (iii), combining ecosystem protection and conservation and water infrastructure development, is the maximum-benefit Scenario for the Catchment. The scenario foresees interventions that will showcase the benefits of Integrated Water Resources Management at the Catchment level. These interventions include (i) Strengthening the Catchment Management Organization, (ii) investing in ecosystem restoration, (iii) investing in water and sanitation (and related infrastructure), (iv) investing in economic development, including investments in income-generating activities for livelihood improvement, infrastructure development and green economy investments aimed at achieving sustainable development while combating poverty.

4 FINANCING AND IMPLEMENTATION PLAN

4.1 Financing plan

4.1.1 Funding requirements

The interventions in Section **Error! Reference source not found.** are grouped into the below investment priorities, each with a corresponding budget need (Table 21).

Finalize the components of the Catchment Management Plan

The implementation of the CMP will require updating the stakeholder analysis and mapping of on-going interventions vis-a-vis the existing hotspots. It will also require undertaking field data collection and verification for modelling surface and groundwater and validating the Catchment's water balance.

Additionally, funds will be required to popularize the CMP to trigger implementation, targeting all stakeholder categories, including:

- Central Government Ministries, Departments, and Agencies
- District Local Governments
- Development partners
- Civil Society Organisations (NGOs, CBOs)
- Cultural institutions
- Faith-based institutions
- Private sector players
- Academic and Research Institutions
- Resource User Groups, and others.

Institutional strengthening

Resources are required for strengthening the Rwizi Catchment Management Organisation. The specific interventions include supporting and strengthening the CMC, and establishing and supporting the Catchment Management Secretariat, supporting and strengthening the CSF, and establishing a Catchment Technical Committee.

Resources are also required for monitoring and evaluation of the CMP implementation. Specifically, a CMP monitoring and evaluation framework will be developed and implemented. Further, resources are needed to prepare the Local Governments for CMP implementation through mainstreaming the CMP in District planning and budgeting processes, supporting cross-sectoral operations at the district level, and guiding lower local governments in CMP implementation.

The other areas requiring funding under institutional strengthening are sub-catchment, micro-catchment, and community action planning. Budget for implementing management plans at these levels and learning, communications, and knowledge management, is prioritised.

Ecosystem protection and restoration

Resources are needed for improving the management of Central and Local Forest Reserves, forestation of bare hills, greening the charcoal production and firewood value chains, and promoting the use of alternative sources of energy. Additionally, funding is required to protect and rehabilitate rangelands including the establishment of water for production facilities for livestock. Other areas requiring funding under ecosystem protection and restoration include funds for interventions on protecting wetlands, flood plains, rivers, and riverbanks, including enhancing the reach of the Community Environment Conservation Fund.

Water and sanitation

Resources will be required for learning and knowledge management, including promoting capacity building, supporting extension services, and improving communication and knowledge management on water and sanitation. Additionally, resources are required to support the monitoring and planning services through strengthening monitoring networks for surface water, groundwater, and water quality and enhancing compliance monitoring. Further, the piped water network will be extended to underserved areas, and operation and maintenance of point water sources will be improved. Moreover, sanitation programmes will be upscaled, and waste management will be enhanced.

Agriculture and economic development

One of the proposed interventions is to improve agroforestry in banana growing and livestock farming communities, requiring commensurate research and developing and implementing a plan to improve access to water for livestock. The other priorities requiring funding in the agriculture and economic development are improvement in rain-fed farming, promoting irrigation (small scale (<2ha) and medium scale (>2ha)), promoting road water harvesting, and promoting alternative Income Generating Activities aimed at improving livelihoods in the Catchment.

Table 21: Funding required to implement the CMP

IMPLEMENTATION PLAN - RWIZI CATCHMENT MANAGEMENT PLAN					
ID	Sub-activities	Budget for implementation (UGX)		Budget for O&M (UGX/year)	
	INTERVENTION P: FINALISE COMPONENTS OF THE CATCHMENT MANAGEMENT PLAN	78,750,000		0	
Sub-total	FINALISE COMPONENTS OF THE CATCHMENT MANAGEMENT PLAN		78,750,000		-
	Intervention A1. Strengthen the Catchment Management Organization	608,875,000		264,000,000	
	Intervention A2 Monitor and evaluate the implementation of the CMP	82,250,000		214,250,000	
	Intervention A3 Coordinate at district level	30,700,000		110,000,000	
	Intervention A4 Sub-catchment, micro-catchment and community action planning	992,250,000		1,600,000,000	
	Intervention A5 Funding of the Catchment Management Plan	854,625,000		-	
	Intervention A6 Learning and knowledge management	1,406,525,000		36,000,000	
Sub-total	A) INSTITUTIONAL STRENGTHENING		3,975,225,000		2,224,250,000
	Intervention B1 Productive and protected forests and woodlands	33,838,542,143		296,140,000	
	Intervention B2 Promoting productive and sustainable rangelands	321,076,429		20,000,000	
	Intervention B3 Protecting wetlands and flood plains	774,904,301		46,900,000	

	Intervention B4 Protecting rivers and riverbanks	585,628,571		-	
Sub-total	B) ECOSYSTEM PROTECTION AND RESTORATION		35,520,151,444		363,040,000
	Intervention C1 Learning and knowledge management	203,975,000		20,860,000	
	Intervention C2 monitoring and planning of water services and resources	600,498,214		169,200,000	
	Intervention C3 Piped water supply systems	67,848,000,000		3,388,125,000	
	Intervention C4 Rural water supply	763,812,500		18,328,125	
	Intervention C5 Sanitation and waste management	3,683,250,000		220,710,000	
Sub-total	C) WATER AND SANITATION		73,099,535,714		3,817,223,125
	Intervention D1 Improve agroforestry in banana growing communities Livestock farming	995,435,000		15,000,000	
	Intervention D2 Improve Rainfed farming	471,055,000		18,750,000	
	Intervention D3 Promoting irrigation (small scale (<2ha) and medium scale (>2ha))	342,500,000		-	
	Intervention D4 Promote road water harvesting	178,500,000		6,000,000	
	Intervention D5 Promote Income Generating Activities	637,500,000		-	
Sub-total	D) AGRICULTURE AND ECONOMIC DEVELOPMENT		3,067,490,000		39,750,000
Grand total			115,741,152,158		6,444,263,125

4.1.2 Sources of funding

4.1.2.1 Existing Funding streams

Funding for public water-related infrastructure development, water resources, and environmental management, and livelihood improvement interventions in the Catchment and the entire country currently comes from Central Government budgets, development partners, and NGOs. The existing funding streams will continue to finance some elements of the CMP.

Line ministries and agencies of the Central Government can finance some of the interventions, especially the large water infrastructure. Such projects include valley tanks and earth dams, irrigation infrastructure, and bulk water transfer schemes.

In addition, the District Local Governments in the Catchment can use their budgets to implement some interventions, especially if the District Development Plans and the CMP are aligned. For this funding source to be fully exploited, the CMP should include the interests of the different districts.

NGOs and other development partners can continue to mobilize funding for implementing interventions in their areas of interest. This funding stream could be focused more on the CMP, for instance, by district

councils conditioning their development partners and NGOs to align activities to the CMP and DDPs. In addition to proving they have the requisite technical capacity, the development partners and NGOs must demonstrate that the proposed activities are recommended by the CMP or otherwise present evidence that those activities are appropriate even if not recommended by the CMP.

4.1.2.2 New funding streams

Limited funding remains a critical challenge the water and environment sector faces in pursuit of national and sector targets. Generally, the cost of managing water resources to achieve social, economic, and environmental goals is increasing because of population and economic growth, urbanization, food needs, and the threats of droughts and floods. The consequence is that traditional funding streams (such as government budget and CSOs) will increasingly become inadequate for implementing the CMPs. New funding opportunities have to be pursued. Examples of such new funding sources, suitable for the Catchment, are suggested below, including ways of positioning the CMO and districts to attract and secure these funding streams.

Programme/Project development and fundraising by the CMO

The Rwizi CMO (through the CS supported by the CTC and advised by the CMC) can either solely or in partnership with individual districts and development partners source funding from donors for implementing (parts of) the CMP. For this, the CS and districts need to have sufficient capacity to develop proposals and later manage the implementation of activities.

Public-Private Partnerships (PPPs)

PPPs are considered an important tool in Uganda's plan to bridge the infrastructure financing gap in the next years. The PPP Act, passed in 2015, provides methods for procurement and the engagement of private partners in PPPs. It also regulates the roles and responsibilities of government bodies during the development and implementation of PPP projects. The PPP Act established two PPP agencies: the Public-Private Partnerships Committee and the Public-Private Partnerships Unit (within the Ministry of Finance). Furthermore, the vital role of not-for-profit agencies (CBOs and NGOs) shall be included in the private sector's contribution to the implementation of the CMP.

4.2 Roles and responsibilities

The CMP is implemented by the Rwizi Catchment Management Organisation (CMO) in close collaboration with the Victoria Water Management Zone (VWMZ). VWMZ and the Rwizi CMO take the initiative and provide guidance during implementation. However, project implementation can be done by any stakeholder willing to contribute financial, human and other resources. Therefore, stakeholders ranging from resource users to development partners and private sector can collaborate or contribute to the implementation of the CMP. Table 22 summarises some of the roles and responsibilities of various stakeholders.

Table 22: Roles of stakeholders in Catchment Plan Implementation

Stakeholder	Roles and Responsibilities
Rwizi CMO	<ul style="list-style-type: none"> Facilitate and promote the implementation of catchment management and source protection plans Facilitate inclusion of plan projects and programs into District Development Plans Monitor CMP implementation Promote and facilitate compliance regulations and permitting system
VWMZ	<ul style="list-style-type: none"> Coordinate all implementation activities Facilitate and support DWRM coordination of central level implementation and financial resource mobilization Facilitate implementation of catchment plan projects by central departments Identify modalities for zonal and Catchment level implementation among its public and private sector partners Mobilize funds (MTEF, budget, donors, private sector) with the assistance of DWRM for implementation of zonal and Catchment level projects Coordinate, manage, and undertake project preparation for zonal and catchment level plan projects

	<ul style="list-style-type: none"> • Assess water use permit applications under existing regulations • Facilitate implementation and installation of upgraded and expanded monitoring network and WIS, and operate the system within the zone • Monitor hydrologic and meteorological conditions, compliance with regulations, implementation of sub-and micro catchment plans and source protection plans • Support and facilitate the continuing role of the CMC and CTC, and other stakeholder groups, including keeping all stakeholders informed of implementation progress
MWE - DWRM	<ul style="list-style-type: none"> • Organize and coordinate review of the draft catchment plan and facilitate the Ministry's approval and adoption of the final agreed plan • Organize and coordinate the technical review of plan project proposals and assignment of implementation to the appropriate department • Mobilize funds for plan implementation and WMZ support • Review policy, legal and regulatory revision needs based on plan recommendations and manage the process for updating and revision
MWE - NEMA	<ul style="list-style-type: none"> • Review the environmental regulatory needs (actions, new or revised regulations) based on the adopted final plan • Issue required regulations, notices, and permits following legal and regulation requirements
MWE – Line departments	<ul style="list-style-type: none"> • Undertake preparation of projects and investments proposed in the adopted final catchment plan (feasibility studies) • Supervise and manage project implementation (designs, tender documents, procurement, construction) • Operate the completed project following the permit and operating rules agreed with the WMZ
Line departments in the concerned sector Ministries	<ul style="list-style-type: none"> • Undertake preparation of projects and investments within their area of responsibility that are proposed in the adopted final catchment plan (feasibility studies) • Supervise and manage project implementation (designs, tender documents, procurement, construction) • Operate the completed project following the permit and operating rules agreed with the WMZ
District Local government	<ul style="list-style-type: none"> • Facilitate and support the implementation of the adopted final CMP • Incorporate priority projects and program into the District development plan as appropriate
Donor partners and NGOs	<ul style="list-style-type: none"> • Implement priority projects and program in collaboration with the WMZ and stakeholders following agreements and Memoranda of Understanding (MOUs) with the WMZ and DWRM
Private sector	<ul style="list-style-type: none"> • Facilitate and support the implementation of the adopted final catchment plan

4.3 Key messages and conclusions on the financing and implementation plan

1. The priority interventions of the maximum benefit scenario are grouped into the below investment priorities, each with a corresponding budget need:
 - *Finalise the Catchment Management Plan (CMP) components:* The implementation of the CMP will require updating the stakeholder analysis and mapping of ongoing interventions vis-a-vis the existing hotspots. It will also require undertaking field data collection and verification for modelling surface and groundwater and validating the Catchment's water balance. Additionally. Funds will be needed to popularize the CMP to trigger implementation, targeting all stakeholder categories.
 - *Institutional strengthening:* Resources are required for boosting the Rwizi Catchment Management Organisation. The specific interventions include supporting and strengthening the CMC, and establishing and supporting the Catchment Management Secretariat, supporting and strengthening the CSF, and establishing a Catchment Technical Committee. Resources are also required for developing and implementing a CMP monitoring and evaluation framework. The other areas requiring funding under institutional strengthening are sub-catchment, micro-catchment, and community action

planning. Budget for implementing management plans at these levels and learning, communications, and knowledge management, is prioritised.

- *Ecosystem protection and restoration:* Resources are needed for improving the management of Central and Local Forest Reserves, forestation of bare hills, greening the charcoal production and firewood value chains, and promoting the use of alternative sources of energy. Additionally, funding is required to protect and rehabilitate rangelands, including establishing water for production facilities for livestock. Other areas requiring funding under ecosystem protection and restoration include funds for interventions on protecting wetlands, flood plains, rivers, and riverbanks, including enhancing the reach of the Community Environment Conservation Fund.
 - *Water and sanitation:* Resources will be required for learning and knowledge management, including promoting capacity building, supporting extension services, and improving communication and knowledge management on water and sanitation. Additionally, resources are required to support the monitoring and planning services through strengthening monitoring networks for surface water, groundwater, and water quality and enhancing compliance monitoring. Further, the piped water network will be extended to underserved areas, and operation and maintenance of point water sources will be improved. Moreover, sanitation programmes will be upscaled, and waste management will be enhanced.
 - *Agricultural and economic development:* One of the proposed interventions is to improve agroforestry in banana growing and livestock farming communities, requiring commensurate research and developing and implementing a plan to improve access to water for livestock. The other priorities requiring funding in agriculture and economic development include improving rain-fed farming, promoting small-scale (<2ha) and medium-scale (>2ha) irrigation, promoting road water harvesting, and promoting alternative Income Generating Activities aimed at improving livelihoods in the Catchment.
2. Investments in institutional strengthening of the catchment management organization will require UGX 3.98 Billion, ecosystem protection and restoration will require UGX 35.5 Billion, investments in water and sanitation will require UGX 73.1 Billion. In contrast, investments in agriculture, livelihood improvement, and economic development will require approximately UGX 3.1 Billion. Thus, the overall investment to deliver this plan is roughly UGX 115.7 Billion, requiring an additional UGX 6.4 Billion per year for operation and maintenance over ten years.
 3. The first source of funding for the CMP is the Central Government through relevant Ministries and Agencies, starting with the Ministry of Water and Environment, which is the custodian of water resources in the countries, and others whose operations affect or are affected by the status of water resources in the Catchment. Other funding sources include local governments, CSOs, Development Partners, and the private sector.
 4. The CMP is implemented by the Rwizi Catchment Management Organisation (CMO) in close collaboration with the Victoria Water Management Zone (VWMZ). However, project implementation can be done by any stakeholder willing to contribute financial, human, and other resources. Therefore, stakeholders ranging from resource users to development partners and the private sector can collaborate or contribute to the implementation of the CMP.

5 ANNEXES

5.1 Annex 1: Description of sub-catchments of Rwizi catchments

Rwizi Upper sub-catchment

Rwizi upper covers Buhweju, Bushenyi, Sheema, Mbarara, Rwampara, and Isingiro districts. Rwizi upper is mainly hilly, with alternating valleys and gentle slopes in Mbarara and Isingiro districts. The sub-catchment lies at a higher altitude (2,250m [Buhweju and Sheema] to 1,251m [Isingiro, Mbarara, Rwampara]) compared to the other sub-catchments giving it beautiful scenery, especially in the folding and conical hills of Buhweju and Sheema, respectively. Wetlands dominate most of the riverbanks and streams, especially in Buhweju, Sheema, and Rwampara. Most of the hills in the sub-catchment are bare, whereas the gently sloping areas (in Mbarara, Rwampara, Isingiro, and the southern part of Sheema) are bushland and banana plantations. Mbarara city is the most built-up area with almost no vegetation cover in the urban setting. Other emerging urban centres include Kabwohe in Sheema district.

Rwizi upper was previously a very fertile area, especially in the gentle slopes of Buhweju, Sheema, and Ntungamo, with very high food productivity, particularly of bananas and millet. The fertility of these soils has reduced mainly due to massive soil erosion on hill slopes, resulting in a declined potential for food production.

Soil types include Acric Ferralsols that dominate most of Buhweju and some parts of Sheema, Luvisols - mainly in Sheema, Mbarara and Rwampara, Planosols and Histosols - in southern parts of Sheema and Rwampara, and then Eutric Regosols in most parts of Isingiro.

The west and the southwestern parts of Rwizi upper are hilly with a hard rock structure. Swamps and wetlands are dominated by alluvium swamp lacustrine deposits in Nchwezi, Kyania, Kibingo, Rugasha, and Rwengiri streams in Sheema. Mica schist with quartzitic interbeds is common in Sheema, and Mbarara, pelites with minor quartzite beds in Buhweju, quartzitic sandstone (Mpanga, Lusenyi, Kyerera, Rwabuhesi streams) in Buhweju, and mudstone, shale, slate, phyllite in the northern parts of Ntungamo and Rwampara.

Middle Rwizi sub-catchment

Middle Rwizi is mainly Isingiro district and the southern part of Kiruhura district. The sub-catchment is characterized by gentle slopes and low-lying areas, with an elevation of 1600 - 1201m. Middle Rwizi is mainly characterized by bare hills due to over-grazing and bushlands converging on River Kashara and the smaller lakes between Lakes Mburo and Kachera. The vegetation cover has been affected by grazing (in Kiruhura) and cultivation (in Isingiro). Currently, the sub-catchment is described as semi-arid.

Regarding lithology, Luvisols dominate most of the sub-catchment, and eutric regosols are traced along the Nyakagera stream. Other soil types in this sub-catchment include; gleyic arenosols, histosols, and acric ferralsols. Isingiro would be a fertile area, but because of the semi-arid conditions (characterized by unreliable rainfall), the area's productivity is poor.

The geology of the sub-catchment is composed of mudstone, shale, phyllite, oncolite and stromatolite, and Quartzitic sandstone, alluvium, sand silt, and gravel in seasonal wetlands, and Kasagama granite.

Kashara Sub-Catchment

Kashara sub-catchment covers mainly Kiruhura district and a small fraction of Mbarara district. The northern part of the sub-catchment is gently sloping with an elevation of 1400 - 1251m. The middle and southern parts are generally flat, with minor hills ranging from 1250 - 1200m. Kashara sub-catchment is characterized by bare hills, bushlands, grasslands, and seasonal wetlands. Bare hills are due to the impacts of

overgrazing, e.g., soil erosion, while grasslands, bushlands, and seasonal wetlands are due to the semi-arid climate of this cattle corridor.

The most common types of soils in the sub-catchment include planosols (in the northern part), luvisols, acric ferralsols, and histosols. Due to the harsh conditions (prolonged drought), cattle keeping is the main activity in the Kashara sub-catchment, especially in Kiruhura district.

The geology of Kashara sub-catchment is composed of mica schist with quartzitic interbeds in Kisalala, Nyabuhama, and Lwentanga Stream, Rwenshama granite along Musalala stream north of Kiruhura, mudstone, shale, phyllite, oncolite and stromatolite in the eastern part of the sub-catchment, alluvium sand, silt and gravel along streams in the sub-catchment, alluvium swamp lacustrine deposits along River Kashara and Lake Mburo.

Kachera Sub-Catchment

Kachera sub-catchment also doubles as the catchment area for Lake Kachera, forming the boundary between Kiruhura and Lyantonde districts. The sub-catchment covers Kiruhura, Lyantonde, Lwengo, and Rakai districts. The landscape is mainly gently sloping and flat/low-lying areas. The elevation for this sub-catchment ranges from 1400 – 1250m. The only significantly built-up area is Lyantonde town. Vegetation in the sub-catchment comprises mainly bushlands, bare hills, and depleted tropical high forests towards Lwengo district.

In terms of soil types, the Kachera sub-catchment is dominated by acric ferralsols, patches of leptosols, and gleysols.

Geology is composed of Kasagama granite (north and west of Lake Kachera), mudstone, shale, phyllite, oncolite, and stromatolite in most of the sub-catchment, and mica schist with quartzitic interbeds, and alluvium sand silt, and gravel along streams.

Kisoma Sub-Catchment

Kisoma sub-catchment is on the downstream side of the Catchment, in Rakai district. It is generally flat with an elevation of 1200 – 1100m. The stretch towards Lake Victoria is primarily seasonal and permanent wetlands, tropical high forests, and woodland, while commercial farmlands predominate the areas along the Muguswa stream.

Soil types include; luvisols, planosols, acric ferralsols, dystric regosols, and eutric regosols. Regarding geology, Mica schist with quartzitic interbeds dominates most of the sub-catchment. Others include alluvium, sand, silt, and gravel in papyrus swamps and flood plains towards Lake Victoria.

Bukora Sub-Catchment

Like Kisoma, the Bukora sub-catchment is on the downstream end of the Catchment. The upper reaches of the sub-catchment are characterized by gentle slopes, while the lower part is flat as it stretches to Lake Victoria, with an elevation of 1200-1100m. Bukora has tropical high forests that are well stocked towards Lake Victoria. On the other hand, a stretch of bushlands, bare hills, commercial farmlands are found towards Lake Kijanibarola along the Chiroi stream.

Soil types include leptosols, acric ferrasols, gleysols, histosols, dystric regosols, and arenosols. Alluvium, sand, silt, gravel, beach terrace, gravel and sand, mudstone, shale, phyllite, oncolite, and stromatolite form the geology of Bukora sub-catchment.

5.2 Annex 2: Projected Livestock Counts for 2020-2040

Livestock count (2020)

District	%age of District in R. Rwizi basin	Cattle (no)	Goats (no)	Sheep (no)	Pigs (no)	Poultry (no)
Buhweju	3%	289	574	50	121	28
Bushenyi	1%	23	23	4	3	21
Isingiro	15%	27,112	33,210	4,541	1,139	36,921
Kiruhura	17%	53,455	17,206	2,554	734	13,285
Lwengo	7%	3,136	4,358	393	1,266	14,879
Lyantonde	3%	2,117	1,316	155	290	2,079
Mbarara*	15%	143,217	83,792	7,409	10,705	152,768
Ntungamo	2%	4,634	5,516	838	181	4,494
Rakai	31%	64,363	85,273	9,944	42,097	258,586
Sheema	7%	3,343	6,060	1,283	931	23,754
Total	100%	301,689	237,329	27,171	57,467	506,814

*data includes the newly-created Rwampara district

Livestock count (2025)

District	%age of District in R. Rwizi basin	Cattle (no)	Goats (no)	Sheep (no)	Pigs (no)	Poultry (no)
Buhweju	3%	289	573	50	122	32
Bushenyi	1%	23	23	4	3	24
Isingiro	15%	27,114	33,142	4,530	1,142	43,010
Kiruhura	17%	53,460	17,171	2,548	736	15,475
Lwengo	7%	3,136	4,349	392	1,270	17,332
Lyantonde	3%	2,118	1,313	154	291	2,422
Mbarara*	15%	143,232	83,620	7,391	10,738	177,961
Ntungamo	2%	4,634	5,505	836	181	5,235
Rakai	31%	64,369	85,099	9,920	42,225	301,230
Sheema	7%	3,343	6,048	1,280	933	27,671
Total	100%	301,719	236,843	27,106	57,643	590,394

*data includes the newly-created Rwampara district

Livestock count (2030)

District	%age of District in R. Rwizi basin	Cattle (no)	Goats (no)	Sheep (no)	Pigs (no)	Poultry (no)
Buhweju	3%	289	572	50	122	38
Bushenyi	1%	23	23	4	3	29
Isingiro	15%	27,117	33,074	4,520	1,146	50,103
Kiruhura	17%	53,465	17,136	2,542	738	18,028
Lwengo	7%	3,137	4,340	391	1,274	20,191
Lyantonde	3%	2,118	1,310	154	292	2,822
Mbarara*	15%	143,246	83,449	7,373	10,771	207,309
Ntungamo	2%	4,635	5,493	834	182	6,098
Rakai	31%	64,375	84,924	9,897	42,354	350,907
Sheema	7%	3,344	6,036	1,277	936	32,234
Total	100%	301,749	236,358	27,041	57,819	687,757

*data includes the newly-created Rwampara district

Livestock count (2035)

District	%age of District in R. Rwizi basin	Cattle (no)	Goats (no)	Sheep (no)	Pigs (no)	Poultry (no)
Buhweju	3%	289	571	50	122	44
Bushenyi	1%	23	23	4	3	33
Isingiro	15%	27,120	33,007	4,509	1,149	58,365
Kiruhura	17%	53,471	17,100	2,536	741	21,001
Lwengo	7%	3,137	4,331	390	1,278	23,521
Lyantonde	3%	2,118	1,308	154	293	3,287
Mbarara*	15%	143,260	83,278	7,355	10,803	241,497
Ntungamo	2%	4,635	5,482	832	182	7,104
Rakai	31%	64,382	84,750	9,873	42,484	408,776
Sheema	7%	3,344	6,023	1,274	939	37,550
Total	100%	301,779	235,874	26,976	57,995	801,177

*data includes the newly-created Rwampara district

Livestock count (2040)

District	%age of District in R. Rwizi basin	Cattle (no)	Goats (no)	Sheep (no)	Pigs (no)	Poultry (no)
Buhweju	3%	289	570	49	123	51
Bushenyi	1%	23	23	4	3	39
Isingiro	15%	27,122	32,939	4,498	1,153	67,990
Kiruhura	17%	53,476	17,065	2,530	743	24,464
Lwengo	7%	3,137	4,322	389	1,282	27,399
Lyantonde	3%	2,118	1,305	153	294	3,829
Mbarara*	15%	143,274	83,107	7,338	10,836	281,323
Ntungamo	2%	4,636	5,471	830	183	8,275
Rakai	31%	64,388	84,577	9,849	42,613	476,188
Sheema	7%	3,344	6,011	1,271	942	43,742
Total	100%	301,809	235,390	26,911	58,172	933,301

*data includes the newly-created Rwampara district

5.3 Annex 3: Location of hotspot areas

Challenges	Location Sub-county, Village	What has been done?	Proposed interventions	Actors
Kyotera				
<ul style="list-style-type: none"> ▪ Unpredictable rainfall patterns ▪ Siltation of wetlands. ▪ Bush burning on almost all hills and wetlands ▪ Overgrazing ▪ Overfishing ▪ Cultivation of fragile areas. ▪ Deforestation and charcoal burning. ▪ Wetland encroachment for settlement ▪ Uncontrolled hunting. 	<p>Kakuuto, Bukora Jjengere Wetlands, Kakuuto Water Abstraction Point NWSC, Kisoma Wetlands in Kasasa S/C and Kasaali T/C, Sango Bay Wetlands in Kakuuto and Kyebe S/Cs, Katengo Wetlands Abstraction Point NWSC in Kyotera and Kasaali T/C, Musambwa islands (IBA) in Kabira s/c</p>	<ul style="list-style-type: none"> ▪ Preparation of the district state of environment report ▪ Eviction and restoration of over 300 hectares of River Bukoola – Kakuuto Sub-county section. ▪ Continued compliance monitoring and enforcement, limited budgets notwithstanding. ▪ Intensified awareness-raising about critical environmental issues; this is a continuous process. ▪ The District is working closely with other partners to reduce poverty through sustainable utilization of natural resources. Partners include funders (e.g., GEF) and implementing agencies (including UNDP, UNEP, and the World Bank). ▪ Improving the management of forests and woodlands by promoting agroforestry and silvo-pastoralism and efficient biomass energy and wood utilization. ▪ Developing the fisheries potential of the lakes (Victoria) and rivers (e.g., Bukora and others) in the District 	<ul style="list-style-type: none"> ▪ Planting of trees in the bare hills ▪ Implementation of soil and water conservation in individual farmlands. ▪ Demarcation and restoration of degraded wetlands. ▪ Regulated fishing ▪ Compliance monitoring ▪ Promoting the energy-saving technology (Lorena stoves) at the household and institutional level. ▪ Promoting road reserve tree planting. ▪ Promoting woodlots establishment at the household and institutional level ▪ Promoting eco-tourism to foster community participation in natural resources management 	<p>District local government, MWE, NGOs, NEMA, MAAIF</p>
Rakai				
<ul style="list-style-type: none"> ▪ Deforestation (throughout the District) for both timber and fuelwoods. ▪ Poor agriculture practices include over-cultivation on steep slopes, leaving the ground bare and susceptible to soil erosion. 	<p>Lwamagwa and Kasambya Dwaniro and Kasaali sub county Mukogote, Kibaati, Kibaale</p>	<ul style="list-style-type: none"> ▪ District officials sensitize communities about climate change mitigation. ▪ Planted trees in some bare hills in the District, such as in Lwamagwa and Kasambya sub-county. ▪ The district officials have also tried to conserve the catchment area 	<ul style="list-style-type: none"> ▪ Promoting the growing of fast-growing, nitrogen-fixing shrubs, and trees for firewood ▪ Promotion of the growing of drought-resistant agroforestry tree species, fruit trees, and tree species for timber 	<p>DWO, DNRO, DLG, NEMA MWE, MAAIF</p>

<ul style="list-style-type: none"> ▪ Encroachment of wetlands for the cultivation of seasonal crops and establishment of livestock farms. ▪ Bush-burning during the dry season, leaving the land bare and susceptible to soil erosion. ▪ Poor waste disposal that increased the incidence of water and air-borne disease ▪ Draining of wetlands and cultivation along riverbanks, e.g., along River Kachera. ▪ Siltation of rivers and streams due to the cultivation of the river banks. 		<p>such as Kijanibarola and other areas near river Rwizi and Lake Kachera by protecting the banks and advising people not to cultivate along riverbanks and lakeshores.</p> <ul style="list-style-type: none"> ▪ The district officials advise the other staff to consider the environmental screening of every development to be carried out in the District. ▪ The district officials have submitted proposals to different organizations and ministries about climate change for funding, although feedback is outstanding. ▪ The district officials advise communities to form groups and request trees to plant on bare hills. 	<ul style="list-style-type: none"> ▪ Promoting energy-saving stoves (Lorena stoves) at the household and institutional level. ▪ Promoting road reserve tree planting. ▪ Promoting woodlots establishment at Household and institutional level. ▪ Establishing soil and water conservation practices in banana plantations and other croplands. ▪ Restoring degraded bare hills. ▪ Facilitate and enforce land use planning in the District. 	
Ntungamo				
<ul style="list-style-type: none"> ▪ Widespread deforestation for both timber, firewood, and charcoal ▪ Encroachment of wetlands for crop farming and establishing paddocks ▪ Bush burning during the dry season 	<p>Ihunga, Kibatsi, Rutungu, and Rubaare town council. Orusindra, Nyamukana, Munyere, Buhinama, Karagaano, Nyaruteme, Kakingoora wetlands; Encroached Ntungamo forest reserve, Municipality Wastewater treatment plant.</p>	<ul style="list-style-type: none"> ▪ Enforcement and eviction of wetland encroachers ▪ Radio talk show on wetland management and climate change ▪ Training of local environment committees ▪ Tree planting ▪ Establishment of tree woodlots of eucalyptus on government lands ▪ Sustainable land management strategies implementation 	<ul style="list-style-type: none"> ▪ Emphasize awareness creation on wise resource use. ▪ Develop a restoration & management plan. ▪ Extend the green belt establishment ▪ Re-enforce Local Environment Committees (LECs) and establish them in areas where they do not exist. ▪ Emphasize environmental monitoring and compliance enforcement. ▪ Demarcation of wetland boundaries ▪ Promoting sustainable land management practices ▪ Continuous training of communities on environmental protection ▪ Promoting tree growing. 	<p>DNRO, MWE, NEMA, MAAIF</p>
Lwengo				
<ul style="list-style-type: none"> ▪ Encroachment of wetlands ▪ Water stress caused by deteriorating water quality and quantity ▪ Flooding of the lowlands 	<p>Bukoto</p>	<ul style="list-style-type: none"> ▪ Sensitisation of communities on effects of environmental degradation ▪ Planting of trees on the bare hills 	<ul style="list-style-type: none"> ▪ Emphasize awareness creation on wise resource use. ▪ Extend the green belt establishment approach already in place. 	<p>DWO, DNRO, DLG, NEMA, MWE, MAAIF</p>

<ul style="list-style-type: none"> ▪ Bare hills are caused by deforestation. ▪ Over Cultivation 			<ul style="list-style-type: none"> ▪ Emphasize environmental monitoring and compliance enforcement. ▪ Re-enforce Local Environment Committees (LECs) and establish them in areas where they do not exist. ▪ Mapping and demarcating wetland boundaries ▪ Discourage the growing of eucalyptus in wetlands ▪ Develop a District Wetland Action Plan 	
Shema				
<ul style="list-style-type: none"> ▪ Wetland encroachment ▪ Flash floods ▪ Poor agricultural practices ▪ Loss of fauna (including aquatic species) ▪ Bare hills ▪ Deteriorating surface and groundwater quality ▪ 	Nyabwina Village, Kangore village masheruka sub-county, Migyera Village Masheruka town council	<ul style="list-style-type: none"> ▪ Enforcement and eviction of encroachers ▪ Marking boundary with concrete pillars ▪ Radio talk show on wetland management and climate change ▪ Training of local environment committees ▪ Compliance monitoring ▪ Tree planting ▪ Establishment of tree woodlots of eucalyptus on government lands ▪ Sustainable land management strategies implementation 	<ul style="list-style-type: none"> ▪ Boundary opening, gazettement, collaborative tree planting ▪ Sustainable Land Management, energy-saving, ▪ Animal breed improvement 	DWO, DNRO, DLG, NEMA MWE, MAAIF
Kiruhura				
<ul style="list-style-type: none"> ▪ Deforestation ▪ Increased wetland encroachment ▪ Poor agricultural methods ▪ Deteriorating surface and groundwater quality ▪ Increasing demand for surface water for domestic, agricultural, and industrial uses 	Kakyeera Nyakasharara Rushango Rushere Kazo Buremba Kakyaryeru Buremba Rwemikoma Engari Kitura Kenshunga	<ul style="list-style-type: none"> ▪ Enforcement and eviction of encroachers, marking wetland boundaries with concrete pillars ▪ Radio talk show on wetland management and climate change ▪ Training of local environment committees ▪ Compliance monitoring ▪ Tree planting ▪ Establishment of tree woodlots of eucalyptus on government lands ▪ Sustainable land management strategies implementation 	<ul style="list-style-type: none"> ▪ Conducting Radio talk shows on wetland management, physical planning, and land management ▪ Marking wetland Boundary with Concrete Pillars ▪ Enforcement and eviction of encroachers ▪ Compliance monitoring ▪ Formation and training of watershed committees ▪ Receive and distribute tree seedlings to communities and institutions 	DLGs, NGOs, MWE, MAAIF

5.4 Annex 4: Implementation Plan

Provided as a separate file.