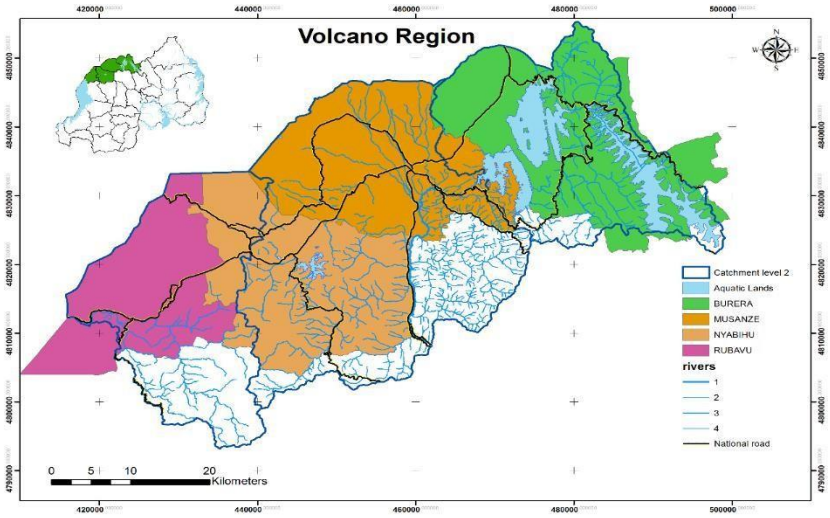
Floods Management in Volcano Area Project

Background

The volcanoes region located in the Northern part of Rwanda is formed by the Districts of Rubavu, Nyabihu, Musanze and Burera as illustrated by the map below. The region is characterized by frequent flooding events that damage infrastructures, properties and sometimes human lives are lost. It is against this background that a project is being implemented to control floods affecting the area.



Volcanoes Region

In 2018, the Rwanda Water Resources Board has been working on a detailed design of flood control measures in the Volcanoes area, and to this study aims to implement flood mitigation measures and protection structures in Burera, Musanze, Nyabihu and Rubavu districts. Various structural and non-structural measures are being implemented to mitigate flood risks and to optimize benefits from flood plain areas.

Major flooding characteristics of rivers in the volcanoes area

Twenty-two main gullies have been identified partitioned in the four districts. Burera District has been identified with 11 gullies, Musanze District with 8 gullies, Nyabihu District with 2 gully, and finally Rubavu District with 1 gully.

Major flooding impacts in the volcanoes area

The following are the major flooding impacts on the community, infrastructure and agriculture activities in the Volcanoes Region:

- Damage to properties
- Loss of land and other properties
- Infrastructure damage (roads, bridges, culverts etc.)
- Disturbance to the traffic flow
- Agriculture damage such as loss of crops

Mitigation Measures

The overall mitigation measures focus on reducing the flooded areas in the Volcanoes region and include:

i. Structural measures
   - Implemented infrastructure control measures like retention ponds to reduce peak flow and store.
   - Rehabilitate, extend and construct water channels or ditches to increase conveyance capacity of gullies.
   - Rehabilitate and construct small bridges, wooden foot bridges and culverts to allow the transport of floodwaters downstream, with little or no damage and facilitation of community movement across main gullies
   - Installing gabions check dams for the rehabilitation and maintenance of the caves.

ii. Non-structural measures

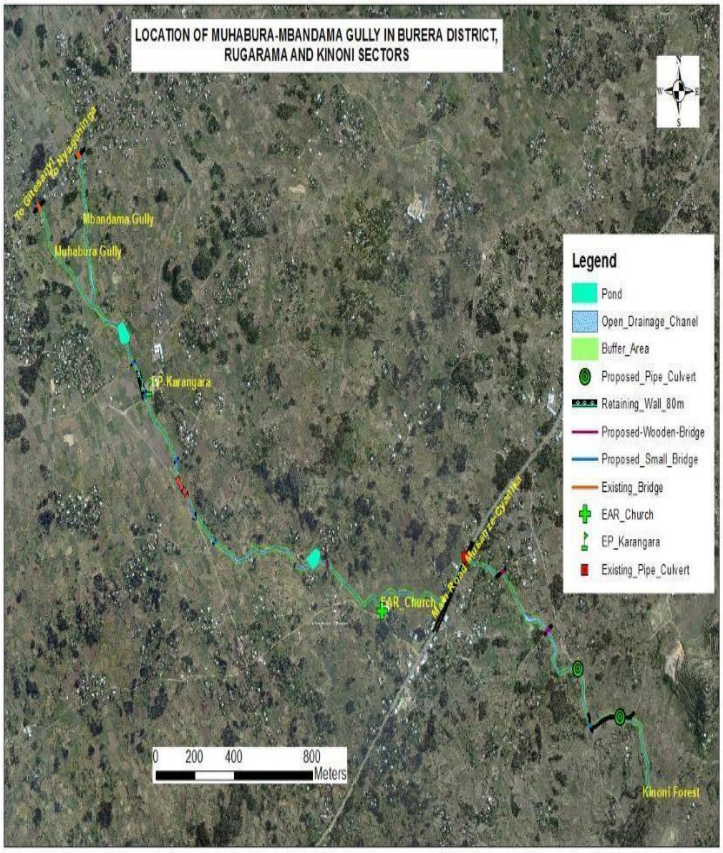
   - Implemented ecosystem, nature-based approaches to managing flood risk
   - Erosion and runoff control measures
   - Gullies bank protection
   - Plant riparian buffer trees, shrubs and grass to prevent further enlargement of the gully
   - Relocation of people from high-risk areas

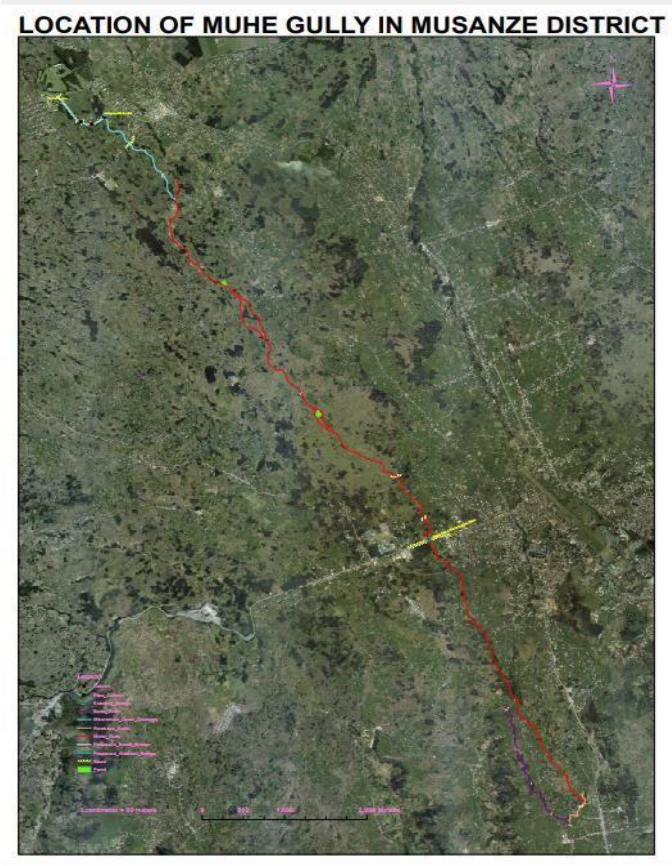
Ongoing Flood Implementation Measures in Burera and Musanze Districts

In 2019, the Rwanda Water Resources Board (former RWFA) began working with a company to complete flood control works for the Muhabura-Mbandana.

The overall objective of this assignment is to implement the planned structural measures and non-structural measures to the highest possible standard, including construction of retention and infiltration ponds, construction and extension of open water channels or ditches, construction of small bridges, gully bank protection, road drainage rehabilitation and construction of footbridge and culverts.

Flood Control Intervention Works in Burera and Musanze Districts





❖ **Muvumba Multipurpose Water Resources Development Project**

A. Background

Muvumba Multipurpose Dam Project will construct a dam of 30.5m high and will impound 35 million cubic meter of water in Karama, Gatunda and Rukomo sectors and will supply water for domestic use to Karangazi, Rwempasha and Nyagatare sectors, this dam will supply water for irrigation of 7380 ha (net command area) and water for 16 reservoirs for livestock and it will produce annual energy of 5719 Mwh with installation capacity of 740 KW (370x2). The implementation of this project will affect 489.02 ha of land, different crops and 265 houses.

The program objective is to improve water, energy and food security of Nyagatare District by harnessing water resources for irrigation, domestic& livestock water

supply and hydropower use while ensuring sustainability of the resources and building resilience against climate change and variability through catchment protection, and capacity development.

A.1. Location of Muvumba Dam Project

The first phase of the program will primarily focus on dam construction including installation of the hydropower plant and preparatory studies for downstream investments for water supply and irrigation.

- **Muhazi Dyke Project**

A. Background

Muhazi Lake is fed by 870 km² watershed and spans over around 38 km. It is drained by the Nyabugogo River. At the outlet of the lake there is an earth fill dam of 225m long, 4m height, 5 m crest width, with 2/1 side slope on the upstream side of the dyke and 3/2 side slope in the downstream side of the dyke.

The dyke was constructed in 1999 as emergent solution, when it was observed that the lake was drying due to uncontrolled outlet;

The existing earth fill dam is unstable and prone to overtopping during the rainy season due to its reduced freeboard. The instability of the dyke is characterized by the breakings on some parts of the dyke, differential settlement making the change of the dyke shape, water seeping to the parts of the dyke etc. Different attempt to fix the dyke issues have been done since 2013 up to date. The recent attempt is the use of sandbag to limit the overtopping in April-May,2020.

If the dam breaks it has the potential of flooding Nyabugogo area which is a commercial hub in Kigali town, and may cause significant damages of properties and lives.

A Pre-feasibility study carried out in 2019 has shown that the cost and the difficulties involved in the rehabilitation of the existing dam are higher than building a new dyke downstream.

The feasibility Study and Detailed design completed in June, 2019 has shown that the foundations of the potential sites are all made of a 7 to 12 m deep layer of peat up to the bedrock. No alternative site has been found in the area. The Downstream axis was chosen for having shorter section on peat.

Peat has been described as one of the poorest foundation material due to its high compressibility, low density, weak strength and commonly high permeability. Consequently, building a dyke on peat entails specific knowledge to propose adapted design and construction methods.

The comparison between the homogenous embankment and concrete gravity dyke has been carried out and it was proven that homogeneous embankment is feasible with proper design for stability.

The designed dyke will be 6.5m high, with crest elevation of 1437.5m. a free board of 0.6m will be provided on Muhazi lake having 328.8 million cubic meters and area of 38.5 km^2. Upstream and downstream side slope will be 1:3, dyke crest 7m, while the excavation depth is set at 1.5m in general and 4m on the upstream side where cut off drain will be built. Use of geogrid was proposed for stabilizing unsuitable soil.

A.1. Location of Muhazi