



**KENYA URBAN WATER AND SANITATION, OUTPUT BASED AID  
PROJECT (OBA) FUND FOR LOW INCOME AREAS**

**RESETTLEMENT ACTION PLAN (RAP) FOR PROPOSED  
CONSTRUCTION FOR SABASABA WATER SUPPLY PROJECT  
FOR MURANG'A SOUTH WATER AND SEWERAGE COMPANY  
LIMITED (MUSWASCO).**

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## TABLE OF CONTENT

<b>I</b>	<b>INTRODUCTION .....</b>	<b>4</b>
1.1	Description and Scope of Works .....	5
1.2	Treatment Works.....	5
1.3	Transmission Pipeline.....	6
1.4	Pipe Material.....	6
1.5	Valves and Chambers.....	7
1.6	Pipe Location and Depth.....	7
1.7	Break Pressure Tanks .....	7
1.8	Ancillary to Laying of Pipes.....	8
1.9	Resettlement Action Plan .....	8
<b>2</b>	<b>PROJECT IMPACTS.....</b>	<b>9</b>
2.1	Zones of Potential Impact.....	9
2.2	Identification of the Project Potential Impacts .....	9
2.3	Extent of Project Impact on Property and Livelihoods.....	10
2.4	Impact on Structures.....	10
2.5	Impact on Public and Community Infrastructure.....	10
2.6	Impact on Cultural Sites .....	10
<b>3</b>	<b>APPENDIX.....</b>	<b>11</b>
3.1	PHOTOGRAPH PLATES.....	11

## I INTRODUCTION

The proposed transmission main will transmit water from Kinyona treatment works located at the edge of Aberdares ranges at coordinates 255695 Eastings and 9918003 Northings to Mariira tank near Gakira Town in Kigumo Sub-county. The water treated at Kinyona Treatment Works is diverted from Irati River via an intake constructed deep inside the Aberdares forest. From Mariira tank water will be transmitted to the supply area through existing distribution mains.

Sabasaba Water Supply Project is majorly intended to serve Sabasaba and its environs comprising Kaharati, Iganjo, Kamahuha, Githembe, Gakuyu, Kahariro, Kandani and Mugumoini sub-locations. The project area is approximately 81 Km<sup>2</sup>.

Sabasaba town and Kaharati are expanding rapidly partly due to their strategic location along the Murang'a - Kenol road and the influence of the devolved system of governance. Consequentially water demand has been on the rise thus putting more pressure to the already strained water supply system. To alleviate this water shortage situation, MUSWASCO is intending to improve the water supply in this area through the construction of Sabasaba Water Supply Project under OBA financing program.

Sabasaba water supply project involves construction of 18km water transmission main from Kinyona t/works to Mariira tank and upgrading/rehabilitation works at Kinyona treatment works to double its treatment capacity. It is to be noted that a section of the above transmission main (10km) is being implemented by MUSWASCO. However, this design covers the entire pipeline (18km). The objective of this project is to increase the flow into the Mariira tank which is the main distribution tank serving the target area thereby increasing the supply capacity to this area.

The proposed project "Sabasaba Water Supply Project" comprises the following two key components of works:

- a) Construction of 2No. Sedimentation basins and Rehabilitation of existing utility buildings
- b) Laying of 8 km transmission main from Kinyona T/Works traversing Kinyona and Kagundu area and shall be connected to the 10km pipeline being implemented by MUSWASCO traversing Karinga - Ikumbi to Mariira tank.

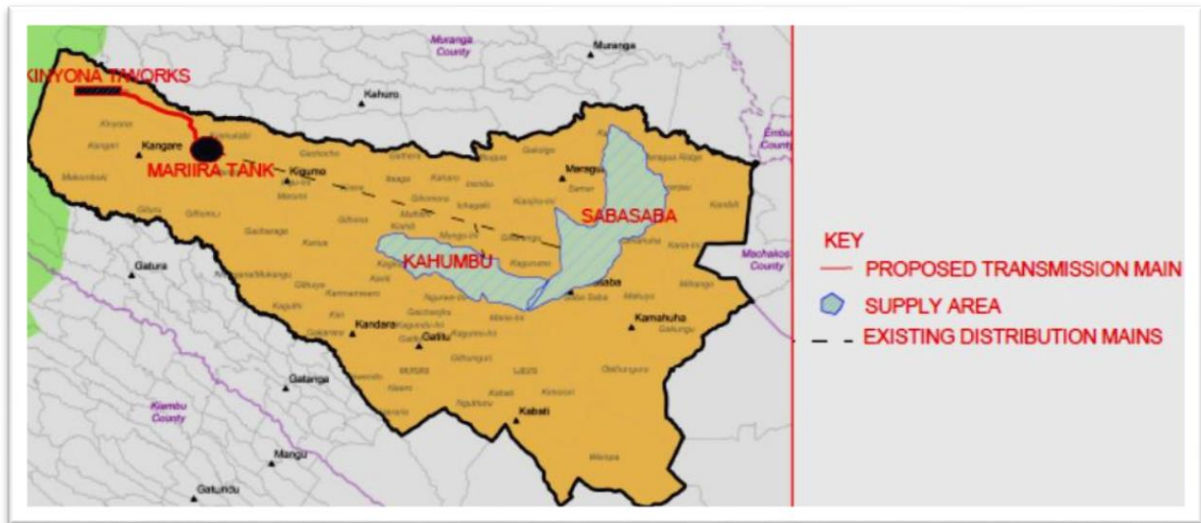


Fig:1. The general layout of the project

### 1.1 Description and Scope of Works

The water pipeline will transmit treated water from the Kinyona Treatment Works to the existing storage tank at Mariira. The proposed line is 8,000 m long comprising of 3,700 m OD 315 mm and 4,300 m OD 280 of uPVC material of varying pressure ratings – PN 12.5 and PN 16.

Large orifice air valves (40 to 50 mm openings) are provided at all accentuate high points while 80 mm washouts are provided at all accentuate low points. Section or isolation valves have been provided at the inlet point and outlets of the BPTs to enable easy flow control during O&M activities.

### 1.2 Treatment Works

Many literatures reviewed indicate that the existing t/works was designed to cater for 10,370 m<sup>3</sup> /day. However, assessment carried out by Howard Humphrey's in 2010 noted that the existing capacity of the treatment works is about 15,300 m<sup>3</sup> /day. From either source it is clear that the existing capacity is less than the design capacity of the 2No. raw water mains (20,740 m<sup>3</sup>/day). Further assessment of the systems design has been carried out with respect to the guidelines in the MWI Design Manual to confirm the current capacity and establish the need for expansion. Additional sedimentation tanks will be designed for horizontal flow and sized at least to handle the excess design raw water flow to the t/works. Sedimentation tanks are provided for the removal of silts and grits as well as other suspended or colloidal matter in accordance with MWI Design Manual as follows:

1. The weir loading overflow rates will be 250 -300m<sup>3</sup> /m<sup>2</sup> /day

2. Sedimentation tanks are provided for the removal of silts and grits as well as other suspended or colloidal matter in accordance with MWI Design Manual as follows:
3. Effective depth of the tank to be minimum of 2.0 m while the total net allowing for sludge will be set at 2.5m
4. Velocity of water between the inlet works and the settled water tank will be maintained at 0.2 m/s.
4. Velocity of water between the inlet works and the settled water tank will be maintained at 0.2 m/s.

Horizontal flow sedimentation tanks will be provided because of their efficiency.

1. The length to breadth ratio will be kept between 3 to 6
2. Detention time will be set at 3-4 hours for chemical sedimentation
3. Velocity of flow through slots at the inlets will be kept at 0.15-0.25m/sec
4. The volume of the settling tanks has been designed to allow for sludge accumulation.

### **1.3 Transmission Pipeline**

The transmission main has been sized to transmit the ultimate demand flow of 3600 m<sup>3</sup> /day, by gravity. The hydraulic analysis are to be carried out by iteration on an excel software using Darcy-Weisbach equation. Colebrooke White (universal) formula will be used to estimate friction losses whereby the coefficient of friction to be used for uPVC pipes is 0.1mm (MWI design Manual, 2005). Afterwards the design will be rechecked using EPANET computer hydraulic modelling software. The Hazen-Williams formula will be used for the EPANET hydraulic design. The roughness coefficient (Hazen-Williams Coefficient - HWC) used in this formula is dependent on a number of factors, including the type of pipes material, corrosiveness of the water, and the age of the installation. Plastic Pipes, which are not susceptible to corrosion, will remain relatively smooth with a HWC value in the range of 100-140. It is preferable that flow velocities remain in the range of 0.6 to 2.0 m/s although in exceptional conditions this can be in the range of 0.2 – 2.5m/s. The minimum heads for the transmission line shall not be less than 4m as per the MWI design manual (2005)

### **1.4 Pipe Material**

The choice of pipe material is dependent on the following criteria:

- Chemical nature of soil
- Chemical nature of water
- Operating pressure of the system
- Comparative cost of alternatives
- Weather conditions of the area
- Rock formation of the pipe route
- The overburden pressures

- Avoiding illegal connection

On economic and durability considerations uPVC pipes is the preferred material for the Pipeline. However, for the river and road crossings and along rocky sections steel pipes will be used.

### **1.5 Valves and Chambers**

The pipeline profile is very rugged due to the nature of the terrain in the general project area. Air- valves will be provided to bleed air which causes air locks in the pipeline and may stop or lower flows in the pipeline. Water Practice Manual (2005) provides that valves with inlet of 50mm are acceptable for pipeline of up to 400mm diameter. Large orifice valves should be positioned at accentuate high points on pipelines of diameter 80mm or larger. Furthermore, it shall be ensured that there is at least a minimum of one air valve for every 2,000 metres of pipeline. Double orifice valve will be provided where small orifice and large orifice valves would essentially have coincided. Washout valves of 80 mm orifice will be installed at all accentuate low points although a minimum spacing of 2,000 m will also be imposed. Section or isolation valves are recommended at 3km intervals in rural areas according to Water Practice Manual (2005). These valves have been proposed based on nature of the pipeline profile and ease of operation and maintenance of the pipeline.

### **1.6 Pipe Location and Depth**

The MWI water practice manual (2005) recommends that water pipes are be laid with a minimum cover of 0.6m in fields and 0.9 m along road reserves. The minimum pipe slope is 0.2%. Wherever feasible, transmission lines will be located on the road reserves or adjacent to other existing tracks. Although subject to pipeline diameter and exact location, the pipe trench depths will be designed as follows:

- In areas where the pipe will be subjected to vehicular traffic, the minimum depth of cover to be provided is 1.0 m above the top of the pipe;
- In other areas, the minimum depth of cover above the top of the pipe is 0.8 m;
- If the above depths cannot be obtained due to the natural ground profiles, concrete encasement for pipes will be considered.

### **1.7 Break Pressure Tanks**

The existing Break Pressure Tanks (BPTs) will be used to maintain working pressures within the allowable limits. It is expected that the facilities shall retain water for at least 2 minutes before onward distribution. Where applicable the existing BPT/ storage tanks will be used to serve the proposed pipeline. For new BPTs it is deemed more ideal to provide a large tank at least 50 m<sup>3</sup> which can also double up as a distribution tank.

## **I.8 Ancillary to Laying of Pipes**

Anchor or thrust blocks shall be provided for horizontal and vertical bends, capped ends, change of size, appurtenances and tees. For pipes laid in steep slopes greater than 1 in 6 slip anchors will be used. Marker posts will be provided along the pipeline at distances of 300m and at all major bends, crossings and valve locations.

## **I.9 Resettlement Action Plan**

The purpose of a RAP is to identify PAHs and their assets/properties, value them and provide a strategy for resettlement compensation to ensure that the PAHs' livelihoods are restored or improved. A RAP also puts in place appropriate remedial measures, including grievance channels, for the PAHs and other community members.

The main objectives of a RAP are:

- (a) To identify PAHs and their properties and determine the extent of involuntary resettlement/displacements and restricted access impacts associated with the project implementation and put in place measures to minimise and/or mitigate such impacts;
- (b) To value PAHs' property and assets (compensation costs, livelihood/disturbance allowances and other assistance values) and provide a strategy for the compensation of PAHs;
- (c) To set out strategies for the implementation of the RAP, including the process through which to acquire the necessary land and easements for the implementation of the project activities; and
- (d) To carry out consultations with community members and other stakeholders, including PAHs, and make them aware of the project and to obtain their concerns regarding the economic and social impacts of the proposed project and mitigation measures.



## 2 PROJECT IMPACTS

This section describes the project activities and their potential impacts in terms of property and livelihood activities likely to be affected by the implementation of project activities.

### 2.1 Zones of Potential Impact

The proposed transmission main will transmit water from Kinyona treatment works located at the edge of Aberdares ranges at coordinates 255695 Eastings and 9918003 Northings to Mariira tank near Gakira Town in Kigumo Sub-county. The water treated at Kinyona Treatment Works is diverted from Irati River via an intake constructed deep inside the Aberdares forest. From Mariira tank water will be transmitted to the supply area through existing distribution mains.

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**Figure 2: Project Routing**



The project will not lead to **economic** and **physical displacement** of PAPs because the pipeline routing is within the Right of Way (ROW) which is not encroached and free from any encumbrances. As such the project will not acquire any new land or displace PAPs.

### 2.2 Identification of the Project Potential Impacts

The relative potential impact of the project activities is described in the sub-sections that follow.

#### (a) Impact of construction and laying of water supply system

The major project activities will be construction of 2No. Sedimentation basins and Rehabilitation of existing utility buildings and laying of 8 km transmission main from Kinyona T/Works traversing Kinyona and Kagundu area and shall be connected to the 10km pipeline being implemented by MUSWASCO traversing Karinga – Ikumbi to Mariira tank.

The project impact on kiosks/sheds and stalls housing informal economic enterprises along the road reserves will be temporary in the sense that the PAHs may be allowed to rebuild the structures after the construction and laying of the pipeline is complete. There will be (no) impact on crops and trees because based on the survey and inventory of assets, there were no crops or trees to be affected. With respect to livelihood restoration, therefore, compensation for temporary loss of livelihood income has been considered as part of the 15 per cent livelihood/disturbance allowance, calculated in addition to the cost and/or replacement of the affected property.

### **2.3 Extent of Project Impact on Property and Livelihoods**

The proposed project will not have any displacement impacts (physical or economic) due to the fact that the pipeline route is within the ROW which has been found during the RAP study to be free from any encroachment.

### **2.4 Impact on Structures**

There will be no impact on structures (residential or commercial)

### **2.5 Impact on Public and Community Infrastructure**





The project will not lead to the displacement of any public or community assets and infrastructure.

### **2.6 Impact on Cultural Sites**

There will be no impact on cultural sites

### 3 APPENDIX

#### 3.1 PHOTOGRAPH PLATES

	
<p>Sample Housing Characteristics in the project area</p>	<p>Public consultation in Kinyona</p>
	
<p>An overview of Kinyona Water Treatment Plant</p>	<p>A section of the routing in Kahumbu area</p>

