

Water Resources Authority

Athi Basin Area

MANAGEMENT GUIDELINES FOR GAZETTEMMENT OF MANGUO SWAMP

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Final Version



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To all we say thank you.

Basin Area Coordinator

Athi Basin Area - Machakos

Acronyms

AEZ	-	Agro-Ecological Zone
CMS	-	Catchment Management Strategy
ABA	-	Athi Basin Area
KFS	-	Kenya Forest Service
MWRUA	-	Mweteta Water Resources Users Association
m.a.s.l	-	Meters Above Sea Level
MoA	-	Ministry of Agriculture
MoL	-	Ministry of Lands
NGAO	-	National Government Administration Officers
NLC	-	National Land Commission
NEMA	-	National Environment Management Authority
RGS	-	Regular Gauging Station
SoK	-	Survey of Kenya
ToR	-	Terms of Reference
WDC	-	WRUA Development Cycle
WRM	-	Water Resources Management
WRA	-	Water Resources Authority
WRUA	-	Water Resources Users Association

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1 Introduction and Background Information

1.1 Introduction

A catchment area is defined as the land from which water naturally flows into a water course. The status and conditions of a catchment determines the reliability, quantity and quality of its water yields. A catchment area acts like a water storage facility where during the rains, the vegetation cover allows the water ample time to percolate deep down and move as a sub-surface flow to recharge the rivers, springs and ground water storage in both shallow and deep aquifers. This sub-surface flow is slow resulting in rivers from a well-maintained catchment having higher base flows even during the dry season as well as good water yield from boreholes in the vicinity. In poorly maintained and degraded catchment, the rainfall results in the rapid surface run-off which is channelled into the river courses, resulting in flash-floods and high volumes of suspended solids. Since there is little storage in such a catchment, the rivers originating from such catchment will not be able to sustain their base flows during the dry season.

Catchment areas are thus a vital component in water resource management and they should be formally delineated, gazetted, protected from encroachment and pollution and managed sustainably to maintain their ecological integrity.

1.1.1 Legal Framework for Catchment Protection:

Because of its nature, environmental management and protection in general and catchment protection and management in particular falls within the mandate of many institutions. Catchment protection is therefore, a cross-cutting issue which is spread over several legislations, which have a bearing on the environment and/or natural resources management. These legislations include:

i). ***Constitution of Kenya.***

Section 66 deals with land and provides that the State may regulate the use of any land, or any interest in or right over any land, in the public interest.

Section 69 deals with the environment and natural resources including the sustainable exploitation, utilisation, management and conservation and the equitable sharing of the accruing benefits. It is also the duty of every person to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

The Section 70 deals with the enforcement of environmental rights by any person.

ii). ***Water Act 2016***

Section 22 provides that where the Authority is satisfied that special measures are necessary to protect catchment area or part thereof, it may, with the approval of the Minister, by order published in the Gazette declare such an area to be a protected area.

The Authority may impose such requirements, and regulate or prohibit such conduct or activities, in or in relation to a protected area that the Authority may think necessary to impose, regulate or prohibit for the protection of the area and its water resources.

Under Sections 23 of the Act, the Authority may identify a catchment area, part of a catchment area or water resource to be identified as areas to be Protected or designated as Groundwater Conservation Areas if the Authority is satisfied that doing so is necessary for the protection of the water resource and its multiple uses. The Authority shall, in conjunction with relevant institutions and stakeholders, establish management rules or plans that shall apply to each Protected Area or Groundwater Conservation Area.

iii). ***Water Resources Management Rules 2007***

Part IX section 116 - 120 provides for the determination of the riparian land, which as defined in Part I of these rules does not imply a change of ownership but imposes management controls on land use for water resource quality as defined in these rules.

This part deals extensively with the management of the riparian land including its management, activities that are allowed or proscribed within the riparian land.

The Authority shall undertake Public Consultation with respect to the establishment of areas to be Protected or designated as Groundwater Conservation Areas and the management rules or plans that shall apply with respect to these Areas.

iv). Relevant Sustainable Development Goals (SDGs)

Target 6b. Support and strengthen the participation of local communities in improving water and sanitation management

Target 6.3 - By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

Target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

1.1.2 Background information on Manguo Swamp:

The Manguo Swamp (here after referred to as the “wetland”) is located within Kamirithu sub location of Limuru location within Kiambu County. The land under question measuring approximately 0.334 square kilometres (33.4 hectares), had been sub divided into several plots and issued with title deeds. The swamp is not spread over all the plots and its boundaries will be surveyed and demarcated.

The area lies within the 3BA sub basin and is the source of the Ithanji river, a tributary of Tigon river. The land under question is in the form of a basin-like depression with an outlet to the south-east into Ithanji River. The swamp is currently partially covered by water in the southern part while the northern part has a very shallow water table and evidence of water coming onto the surface and flowing in a south-easterly direction to drain into the Ithanji River. An

analysis of the drainage system in the neighbourhood confirmed the area is one of the main sources of Ithanji River, a tributary of Tigoni River.

1.1.3 Rationale for Catchment Protection through Gazettement;

Manguo Swamp constitute one of the main recharge zones for the Nairobi Aquifer Suite, a strategic aquifer for Nairobi County and parts of Kiambu County. The swamp is threatened with destruction after it was surveyed and demarcated into plots whose owners hold Title Deeds for it and intends to develop structures on them. Initially, the area had been set aside as a water catchment but was later alienated as private land. The neighbouring community has severally complained of the ongoing destruction that includes dumping of soils, resulting in diminishing water flows and environmental degradation. The complaints have been addressed by WRA, and other stakeholders within the catchment without success mainly because the land owners has title deeds. To ensure proper conservation and protection of the wetland, WRA, community and other key stake-holders recognised the need for Gazettement of the land. In this regard, a stakeholders' meeting was convened on 22/11/2021 to build consensus on the way forward. The neighbouring community has expressed their willingness and intentions to have the swamp protected and conserved a top priority in order to assure the riparian community and other stakeholders of adequate and sustainable water resource availability.

ABA's CMS (2014 - 2022) has recognised the need to protect the swamps and increase their environmental functions. This will be achieved through the implementation of the following strategies:

- Sensitization of the local community on the need to protect the swamps to ensure environmental sustainability;
- Development of an action plan to protect the swamp catchment and their rehabilitation;

- Participatory mapping of the protection zones around the swamp with the community;
- Apply the law to protect swamps (enforcement for swamps/riparian/springs protection);

In addition, Part XI of WRM Rules section 123 - 125 sets out the process and procedure for the identification of an area as a protected or groundwater conservation area. This is the procedure used in coming up with this Gazettement document for the Manguo Swamp.

1.2 Location and size of area to be gazetted

The area identified for Gazettement is commonly known as Manguo (Kiboko) Swamp and is located in Kamirithu sub location of Limuru location, Limuru Sub County, Kiambu County and within the 3BA sub basin of Athi Basin Area. The land area to be protected is approximately 0.334 km² (33.4 Hectares). The boundaries of the swamp will be demarcated and beacons placed in line with the pegging carried out by Water Resources Authority.

1.2.1 Watershed area;

The area that contributes surface run-off into the swamp has been delineated through the use of ArcSWAT software. The area measures 0.028 square kilometres (2.8 hectares) out of the 5.3 km² catchment area of the Ithanji River as shown in Fig 1 below:

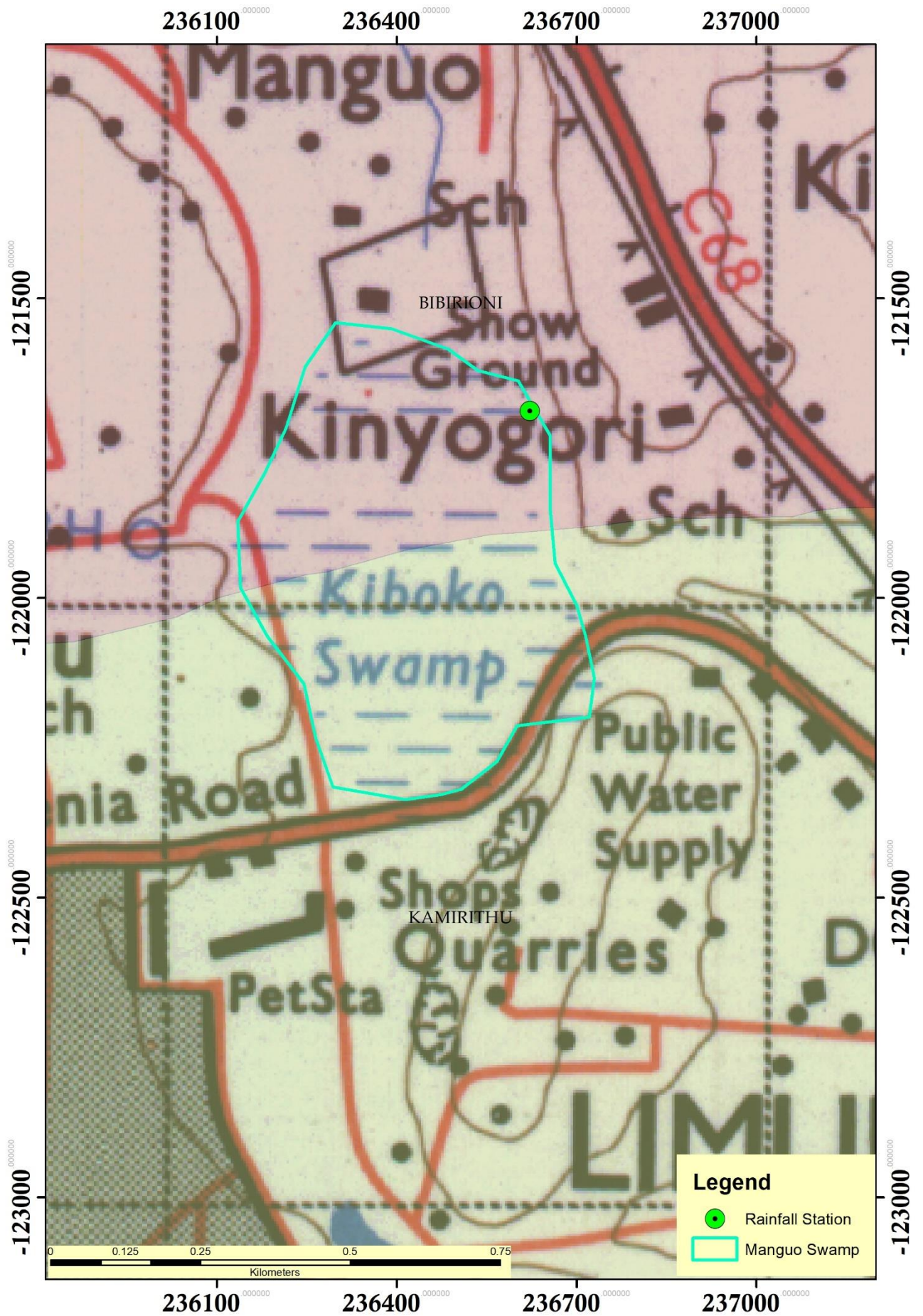


Fig.1. Location of Manguo Swamp catchment within Ithanji river catchment

1.2.2 Physiography, climate and rainfall;

a) *Physiography*

The Ithanji river catchment area elevation ranges from a low of 2260 m.a.s.l near the river's confluence with Tigoni River to a high of 2280 m.a.s.l at the outlet from the swamp. The catchment is oval shaped and extends upstream in north south direction with a length of 746 metres (see the map above).

The slope ranges between 1.2% to 8% with the steeper slopes found on the upstream part of the catchment. The catchment drains in an easterly direction, where it joins with the Tigoni River at the foot of the sub-catchment.

b) *Climate*

The mean monthly temperatures range between a low of 16.7°C in July to a high of 20.7°C in March.

The Tigoni sub catchment lies within the agro ecological zones (AEZ) IV that corresponds to woodland, it is either deciduous in subzone with unimodal rainfall as towards West Kenya and in Tanzania, or hard-leaved evergreen in bimodal rainfall subzones with two dry seasons as in East Kenya, where plants have hard or hairy leaves to avoid shedding them off twice a year. Generally, the area is characterized by moderate rainfall with annual rainfall of 1002.3 mm (Limuru DO's Office Rainfall Station No. 9136161). April to June and October to December are wet or rainy seasons with maximas occurring in April and November respectively and with continental rains which are low occurring in between the two maximas. The table and figure below represent the mean monthly rainfall at Limuru DO's Office Rainfall station:

Table.1. Mean Monthly Rainfall at Limuru DO's Office Rainfall Station

<i>Month</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Total</i>
<i>Rainfall (mm)</i>	67.8	71.1	118.4	297.5	237.8	69.8	33.2	30.8	26.7	100.9	214	118.9	1386.9

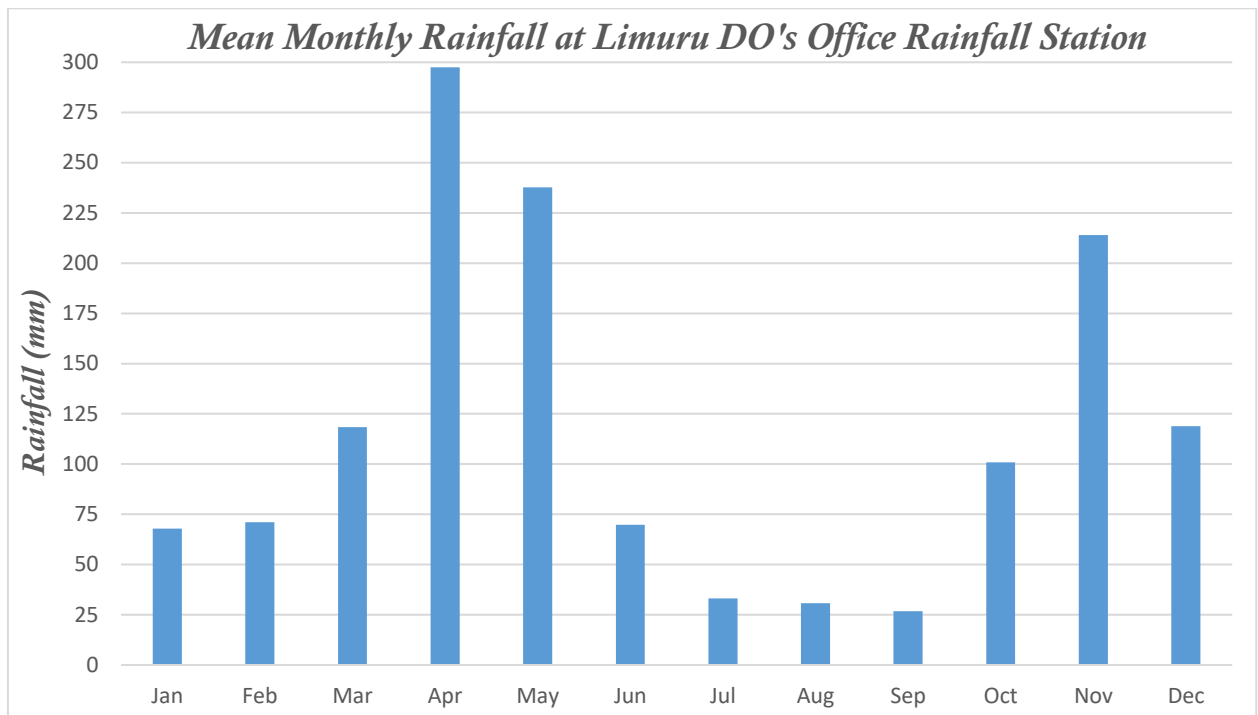


Fig.1. Mean Monthly Rainfall at Limuru DO's Office Rainfall Station

c) Vegetation;

The Tigoni catchment in which the Manguo Swamp catchment lies exhibits is within an agricultural area with changed vegetation. The area is predominantly tea growing zone and the vegetation is adapted.

d) Current land use and its adverse impacts,

The Tigoni sub catchment is within the jurisdiction of Kiambu County in a rural setting. The main land use in the area to the east of the swamp is large scale farming with the growing of tea being the main activity. Within the Limuru town, the main land use is commercial and residential development with minimal industrial activities. To the north of the swamp, the main land use is small scale holding practicing mixed farming with tea and subsistence crops and dairy farming being practiced.

The construction of buildings and an increase in the impermeable surfaces has resulted in an increased surface run-off which ends up in the swamp as well as into the rivers channels. The run-off carries pollutants from the surface as well as sediments which are deposited in the swamp thus affecting its functions as well as water quality.

Mushrooming of these structures will impact negatively on the ecosystem health of the wetland which will eventually result into its death and subsequent loss of ecosystem services.

2 Current Situation Analysis

2.1 The vulnerability of the water resource

Tigoni River has a Regular Gauging Station 3BA17 located at coordinates E036.724444, S01.158333 (37M 0246722, 9871868) at an elevation of 1890 m.a.s.l and approximately 13 km downstream of the Manguo Swamp. The station is rated and has daily discharge data for the period from 1939 upto 1991 though with gaps in between.

In terms of geology, the area is covered by the Kerichwa Valley Tuffs which are well exposed in the Tigoni stream that flows through the area (Gregory, 1921p 164) and were designated by Shackleton (1945) to include a group of trachytic tuffs and agglomerates in the Nairobi area younger than the Nairobi Trachyte. These tuffs overlie the Nairobi Trachyte.

The ground water system feeds into the surface drainage system of the Tigoni River through the numerous springs that exist in the area.

The encroachment on the Manguo Swamp riparian and catchment land through construction of buildings and the planting of exotic tree species has resulted into reduced recharge into the ground, lowering of the water table and a possible decrease in the discharge of the Tigoni River.

In order to have a clear understanding of the water resources availability in the Tigoni catchment, the available data has been used and collated with the existing daily discharge data of 3BA17 gauging station within the 3BA sub basin.

The table below shows the flow duration analysis for Tigoni river at RGS 3BA17

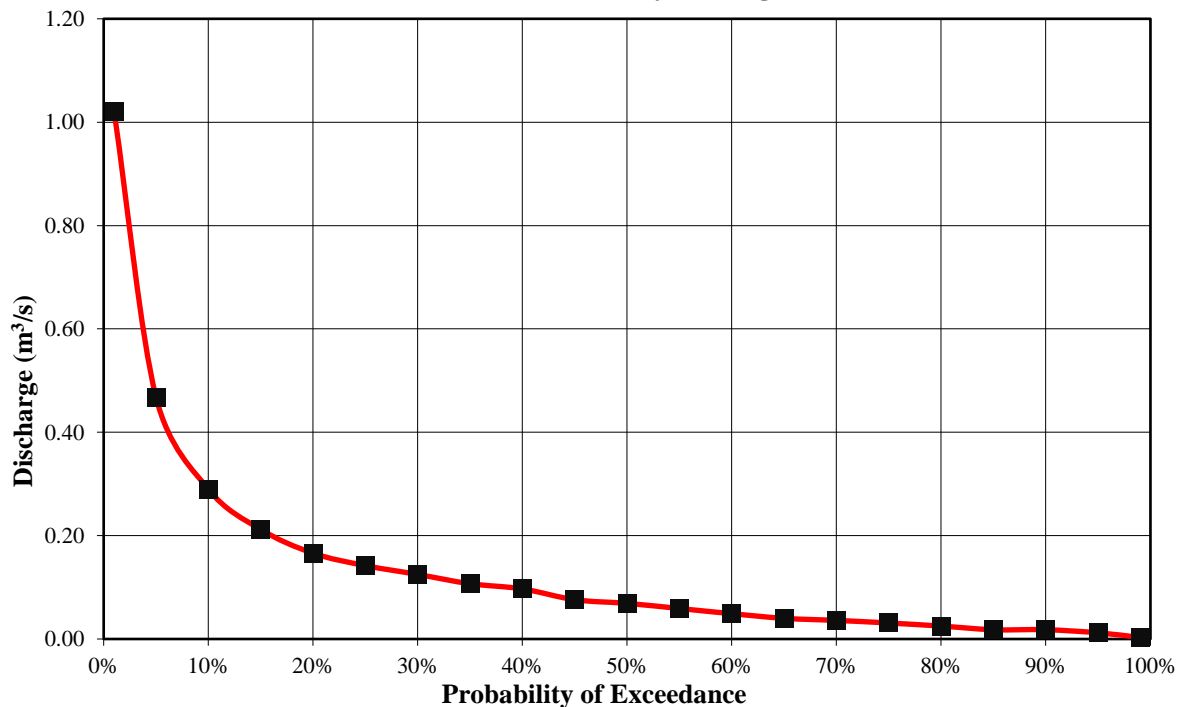
Table.2. Surface water availability for Tigoni river

		Allocation	Allocated	Balance
Q95	Reserve	1,037	0	1,037
Q80	Normal Flow	1,123		1,123
Q50	Flood Flow	3,802		3,802

Mean	6.265
Standard deviation	14.215

Probability of non-exceedance	Probability of exceedance	Flow	Flow	Available for allocation	Days	Total volume	Volume per year
%	%	m ³ /s	m ³ /day	m ³ /s	nos	Million m ³	Million m ³
99%	1%	1.020	88,128		3.65	0.32	17.3
95%	5%	0.468	40,435		18.25	0.74	17.0
90%	10%	0.290	25,056		36.50	0.91	16.2
85%	15%	0.212	18,317		54.75	1.00	15.3
80%	20%	0.166	14,342		73.00	1.05	14.3
75%	25%	0.142	12,269		91.25	1.12	13.2
70%	30%	0.125	10,800		109.50	1.18	12.1
65%	35%	0.107	9,245		127.75	1.18	10.9
60%	40%	0.097	8,381		146.00	1.22	9.8
55%	45%	0.076	6,566		164.25	1.08	8.5
50%	50%	0.069	5,962	3,802	182.50	1.09	7.5
45%	55%	0.059	5,098		200.75	1.02	6.4
40%	60%	0.049	4,234		219.00	0.93	5.4
35%	65%	0.040	3,456		237.25	0.82	4.4
30%	70%	0.036	3,110		255.50	0.79	3.6
25%	75%	0.031	2,678		273.75	0.73	2.8
20%	80%	0.025	2,160	1,123	292.00	0.63	2.1
15%	85%	0.018	1,555		310.25	0.48	1.4
10%	90%	0.018	1,555		328.50	0.51	1.0
5%	95%	0.012	1,037	0.000	346.75	0.36	0.5
1%	99%	0.003	259		361.35	0.09	0.1

Flow Duration Curve Station 3BA17 (Daily discharge data from 1939 to 1991)



Flow Duration Analysis for 3BA17

2.2 The water resource quality objectives and the current status of the water resource

According to the ABA CMS (2014 - 2022) Tigoni sub-catchment can be classified as of high Commercial importance. The area has predominantly urban and/or industrial agglomeration areas including their peripheral areas, which could be commercial. This category targets at ensuring quality of water resources to develop economy and prosperity in urban areas/industrial centres.

Sustainable water resources management in the sub catchment will focus on cooperation with the commercial stakeholders, hence the need to have the interests of residents, industrialists and business community safeguarded.

2.3 The class of the water resource

The Tigoni sub-catchment can be classified as “Alert” as the available water is at times not of adequate quality to meet the demand. The water is of relatively good quality in the upper parts of the river but deteriorates as the river flows downstream due to pollution.

2.4 Land uses and their potential impact on the water resources

2.4.1 Human settlement

Tigoni river sub catchment is located within an area with predominantly rural setting and low to medium commercial activities. However, and due to the development pressure, more commercial and residential buildings are coming up, replacing the existing rural family units. This will put more pressure on the existing infrastructures and utilities, including water and sewerage services. This will have a major adverse impact on the water quality as it has been observed that where the sewerage infrastructure is not developed in pace with other developments, sewer leaks and bursts have resulted from the overwhelmed lines, polluting the water resources.

The development of more buildings will also result in an increase in the paved surfaces which are impermeable. This will generate more surface run-off resulting in water pollution and flooding as the existing storm water facilities may be inadequate to evacuate the resultant run-off.

2.4.2 Exotic Species of Plants

There exist numerous exotic species of trees which are unsuitable in a water catchment area, especially near wetland, which include the eucalyptus trees.

3 Measures for Conservation and Rehabilitation of the area

3.1 Proscribed Activities;

According to the relevant legal framework as discussed in Sub-Section 1.1.1 above, protected areas can be used by the neighbouring community in a sustainable manner. The activities to be undertaken within the protected area are those with zero impact on its ecological status and integrity. The following activities are specifically proscribed in a protected area:

- i). Tillage or cultivation
- ii). Clearing of indigenous trees or vegetation
- iii). Building of permanent structures (especially boreholes and houses)
- iv). Disposal of any form of waste
- v). Excavation of soil or development of quarries
- vi). Planting of exotic species that may have adverse effect to the water resource

3.2 Conservation Plan

The objective of the conservation plan is to protect the long-term environmental sustainability of the catchment for enhanced water resources yield and maintain its ecological functions in terms of flora and fauna. This will be achieved through:

- ***Demarcation of the swamp and its riparian zone and fence it off;***
- ***Gazettement of the Manguo Swamp as a protected water catchment area;***
- ***Enforcement of the Manguo Swamp guidelines;***

<i>Activity</i>	<i>Sub-activity</i>	<i>Timeframe</i>	<i>Cost</i>	<i>Responsibility</i>
Demarcate the wetland and its riparian zone	Undertake cadastral survey of the area and place beacons along the boundary	1 Month	750,000	WRA, SoK
	Develop the PDP for the demarcated wetland area	1 month	1,000,000	NCC, MoLS, WRA
	Liaise with NLC for the revocation of any irregularly issued title deeds for the wetland	3 Months	1,000,000	WRA, NLC
	Fence off the demarcated area	1 Month	3,000,000	WRA, MWRUA

	Place signs and notices to warn the public that this is a protected area	Continuous	250,000	WRA, MWRUA
Gazette the Manguo Swamp as a protected water catchment area	Assess the status of Manguo Swamp	1 month	300,000	WRA
	Create awareness on the status of the wetland	Continuous	500,000	WRA, MWRUA
	Develop guidelines and conservation plan through stakeholders' engagement	2020	2,000,000	WRA with all stakeholders
	Submit gazette instrument to the Cabinet Secretary in charge of water	2020	200,000	WRA
Enforce the Manguo Swamp guidelines	Create awareness to stakeholders on the wetland guidelines and conservation plan	2021	1,000,000	WRA
	Enforce Manguo Swamp protected area guidelines, management plan and relevant legislations	continuous	1,000,000	WRA, National Govt
Sub Total			11,000,000	

3.3 Rehabilitation Plan

The objective of the rehabilitation plan is to ensure the wetland achieves its optimal performance level. This will be achieved through:

- **Removal of all inappropriate/invasive species of plants;**
- **Re-vegetation of the riparian zone with water friendly/native species of trees and vegetation;**

<i>Activity</i>	<i>Sub-activity</i>	<i>Timeframe</i>	<i>Cost</i>	<i>Responsibility</i>
Removal of all inappropriate/invasive species of plants	Identify and remove inappropriate and invasive tree species from the wetland	3 months	300,000	WRA, KFS, NGAO, MWRUA
	Exotic species control	Continuous	200,000	WRA, MWRUA
Re-vegetation of the riparian zone of the wetland with water	Establish indigenous plants nursery	Continuous	2,000,000	MWRUA, WRA
	Grow live fence on the boundary of the wetland	Continuous	1,000,000	WRA, KFS, MWRUA

friendly/native species of trees and vegetation	Planting and growing of propagated seedlings (Watering and tending)	1 year	540,000	MWRUA
Sub Total			4,040,000	

3.4 Catchment and Water Resources Monitoring

The objective of the monitoring plan is to collect and analyse Manguo Swamp catchment and water resources data to provide information on water discharge, water quality and catchment health as a response to human activities within the neighbourhood. This will be achieved through:

- *Re-establish the regular gauging station 3BA17 on Tigoni river to monitor water quantity and quality;*
- *Re-establish a full hydro-meteorological station within the Tigoni river sub-catchment (Limuru DO's Office – Station No. 9136161) to monitor precipitation, evaporation, humidity and temperature;*

<i>Activity</i>	<i>Sub-activity</i>	<i>Timeframe</i>	<i>Cost</i>	<i>Responsibility</i>
Re-establish RGS3BA17 on Tigoni river	Identify an appropriate site and install station	3 months	200,000	WRA
	Identify, train and engage a gauge reader	Continuous	600,000	WRA, MWRUA
Establish a full hydro-meteorological station	Identify an appropriate site to install station	Continuous	0	MWRUA, WRA
	Procure, install and commission the equipment	Continuous	1,000,000	WRA
	Collect and analyse hydromet data	Continuous	0	WRA
Sub Total			1,800,000	

3.5 Establishment and operationalization of management structure

The objective of the management structure is to ensure that the Manguo Swamp catchment protected area is managed in a sustainable manner with the involvement of all stakeholders under the leadership and coordination of WRA - ABA. This will be achieved through:

• *Setting up the management structure with defined ToRs and mandates;*

<i>Activity</i>	<i>Sub-activity</i>	<i>Timeframe</i>	<i>Cost</i>	<i>Responsibility</i>
Setting up the management structure	Appoint 1No. Member from each of the following stakeholders: <ol style="list-style-type: none"> 1. Kenya Forest Service 2. Public Health Department, Kiambu County; 3. National Government Administration in Kiambu County; 4. National Environmental Management Authority; 5. Ministry of Agriculture; 6. Mweteta WRUA; 	3 months	300,000	WRA
	Terms of References (ToR) will include but not limited to: <ul style="list-style-type: none"> ▪ To manage the catchment prudently on behalf of other stakeholders ▪ To submit quarterly reports to WRA - ABA on all planned and implemented activities; ▪ To develop by - laws and submit a copy to WRA – ABA for approval before implementation 	Continuous	0	WRA, MWRUA
	Mandate and responsibilities: <ul style="list-style-type: none"> ▪ Promote the conservation and protection of the catchment ▪ Promote equitable distribution of the resources within the catchment ▪ Promote socio-economic and environmental sustainability of the catchment 	Continuous	0	MWRUA, WRA

	The sources of funds for the committee may include: <ul style="list-style-type: none"> ▪ Bee keeping ▪ Tree Nursery; ▪ Eco-tourism; ▪ Well-wishers/Donors ▪ WRA/WRUA - (WDC) 	Continuous	5,000,000	WRA
Sub Total			5,300,000	

WRA as the agent of the National Government in the regulation of use and management of water resources, will be the coordinator of the committee. The members appointed to the Management Committee will serve on honorary basis as this will be a non-profit, non-commercial venture. The Committee will be required to solicit for funding from well-wishers and other sources to supplement the income that may be derived from activities permitted in a protected area.

The following are the proposed linkages between various stakeholders. The arrows indicate the direction of flow of information. The dotted lines indicate WRUA can also communicate directly to communities and vice versa.

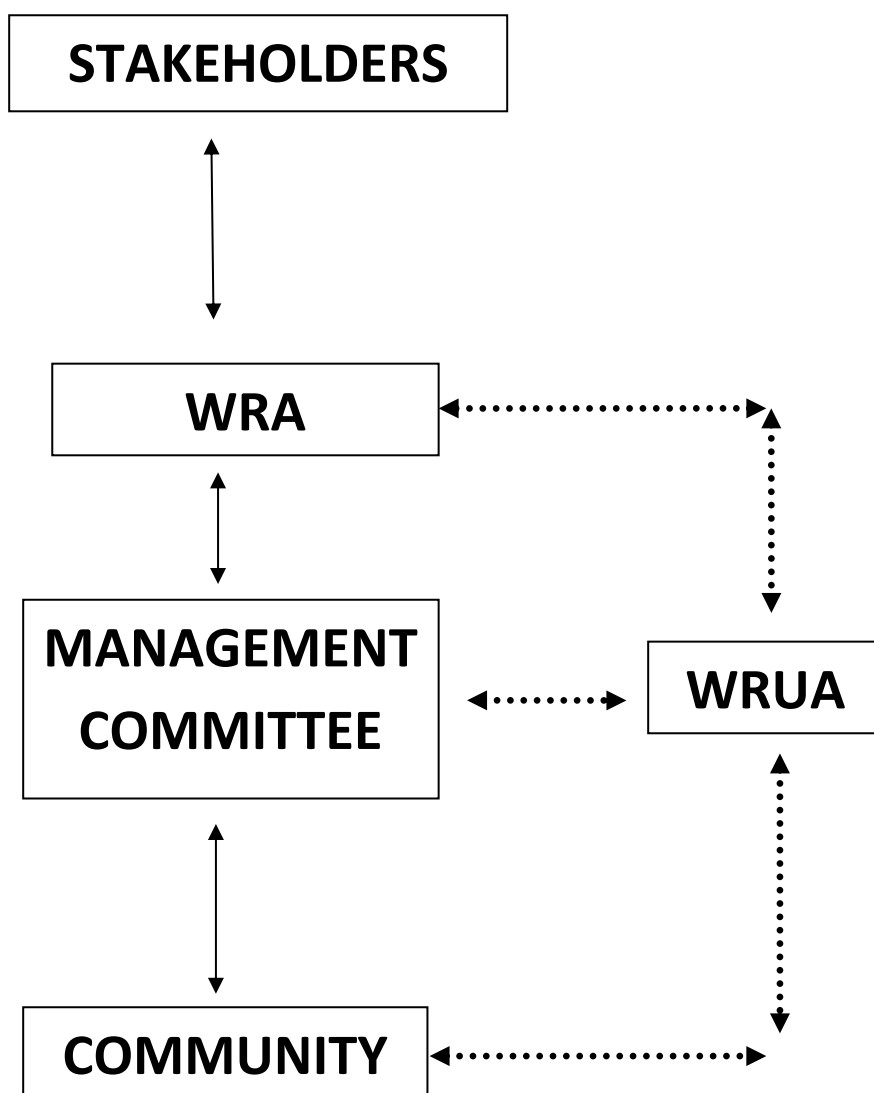


Fig.2. Reporting Linkages for the Management Committee

4 Monitoring and Evaluation Matrix

The following matrix will be used for Monitoring and Evaluation to capture detail of the progress of implementation of the planned activities.

Table.3. Monitoring and Evaluation template

Activities	Implementation Schedule		Status (% completion)	Planned Cost Ksh.	Total expenditure to date	Source of funds	Output	Comments
	start date	End date						