



Water Resources Authority

Athi Basin Area

MANAGEMENT PLAN FOR DIK DIK GARDENS WETLAND

JULY 2020

Final Draft

Acknowledgement

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To all we say thank you.

Regional Manager

Athi Basin Area - Machakos

Acronyms

AEZ	-	Agro-Ecological Zone
CMS	-	Catchment Management Strategy
ABA	-	Athi Basin Area
KFS	-	Kenya Forest Service
KiWRUA	-	Kirichwa 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). ***The Agriculture (Basic Land Usage) Rules No 6.***

Part - of the rules provide for the protection of water course. Any person who, except with written permission of an authorised officer, cultivates or destroy the soil, or cuts down any vegetation or depastures any livestock, on any land laying within 2 metres of a water course, or, in any case of a water course more than 2 meters wide, within a distance equal to the width of that watercourse to a maximum of 30 metres, shall be guilty of an offence.

v). ***The Forest Act 2005***

Section 26 states that upon the recommendation of the board, the Minister may, by order published in gazette, declare any local authority forest or private forest, which in the opinion of the board is mismanaged or neglected, to be a provisional forest.

The declaration envisaged under this section shall only be made where the forest is:

- An important catchment area or a source of water springs;

- Is rich in biodiversity and contains rare ,threatened or endangered species;
- Is of cultural or scientific significance; or
- Supports an important industry and is a source of livelihood for the surrounding communities; and
- The owner has failed to undertake specific sivilculture practices to improve the forest, or the forest owner is unable to undertake the specified practice as directed by the Director of Kenya Forest Service.

vi). **Survey Act (Survey Regulations)**

Part XII sections 110 – 114 deals with the survey of Government Land. Specifically, section 111 deals with the aspect of riparian land as it relates to the rivers

On all tidal rivers a reservation of not less than 30 metres in width above high-water mark shall be made for Government purposes. However, the Minister may direct that the width of this reservation shall be less than 30 metres in special cases.

vii). **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 Dik Dik Gardens Wetland:

The Dik Dik Catchment (here after referred to as the “wetland”) is located within Kileleshwa sub location of Kilimani location within Nairobi City County. The land under question measuring approximately 7 acres (2.8 hectares), had been sub divided into 17 plots and issued with Land Reference Numbers: 209/11609/1, 209/11609/2, 209/11609/3, 209/11609/4, 209/11609/5, 209/11609/6, 209/11609/7, 209/11609/8, 209/11609/9, 209/11609/10, 209/11609/11, 209/11609/, 209/11609/, 209/11609/13, 209/11609/14, 209/11609/15, 209/11609/16. 209/11609/17. The wetland 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 part of the Nairobi river sub drainage. The land under question is in the form of a basin-like depression with an outlet to the south-east into Kirichwa Ndogo River. The major parts of three plots have wetland-like features with a very shallow water table and evidence of water coming onto the surface and flowing in a south-easterly direction to

drain into the Kirichwa Ndogo River approximately 500 meters downstream of the wetland. An analysis of the drainage system in the neighbourhood confirmed the area is one of the main sources of Kirichwa Ndogo River, a tributary of Nairobi River.

1.1.3 Rationale for Catchment Protection through Gazettement;

Dik Dik Gardens wetland constitute one of the main sources of water for Kirichwa Ndogo River. The wetland 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 for public use as a water catchment but was later alienated as private land. The Dik Dik Gardens community has severally complained of the ongoing destruction resulting in diminishing water flows and environmental degradation. The complaints have been addressed by WRA, Judiciary, Ministry of Tourism and Wildlife, 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 02/02/2021 to build consensus on the way forward. The Dik Dik Gardens community has expressed their willingness and intentions to have the wetland 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 wetlands 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 wetland to ensure environmental sustainability;
- Development of an action plan to protect the catchment and their rehabilitation;
- Participatory mapping of the protection zones around the wetlands with the community;
- Apply the law to protect wetland (enforcement for wetlands/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 Dik Dik Gardens wetland.

1.2 Location and size of area to be gazetted

The area identified for Gazettement is commonly known as Dik Dik Gardens wetland. It is located in Kileleshwa sub location of Kilimani location, Westlands Sub County, Nairobi City County and within the 3BA sub basin of Athi Basin Area. The land area to be protected is approximately 7 acres

(2.8 Hectares). The boundaries of the wetland 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 wetlands 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 Kirichwa Ndogo River as shown in Fig 1 below:



Fig.1. Location of Dik Dik Gardens Wetland catchment within Kirichwa Ndogo river catchment

1.2.2 Physiography, climate and rainfall;

a) *Physiography*

The Kirichwa Ndogo river catchment area elevation ranges from a low of 1714 m.a.s.l near the river's confluence with Kirichwa Kubwa River to a high of 1807 m.a.s.l to the south west of the catchment. The catchment is leaf shaped and extends upstream in north easterly direction with a length of 4.7 kilometres (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 a north-easterly direction, where it joins with the Kirichwa Kubwa River at the foot of the sub-catchment.

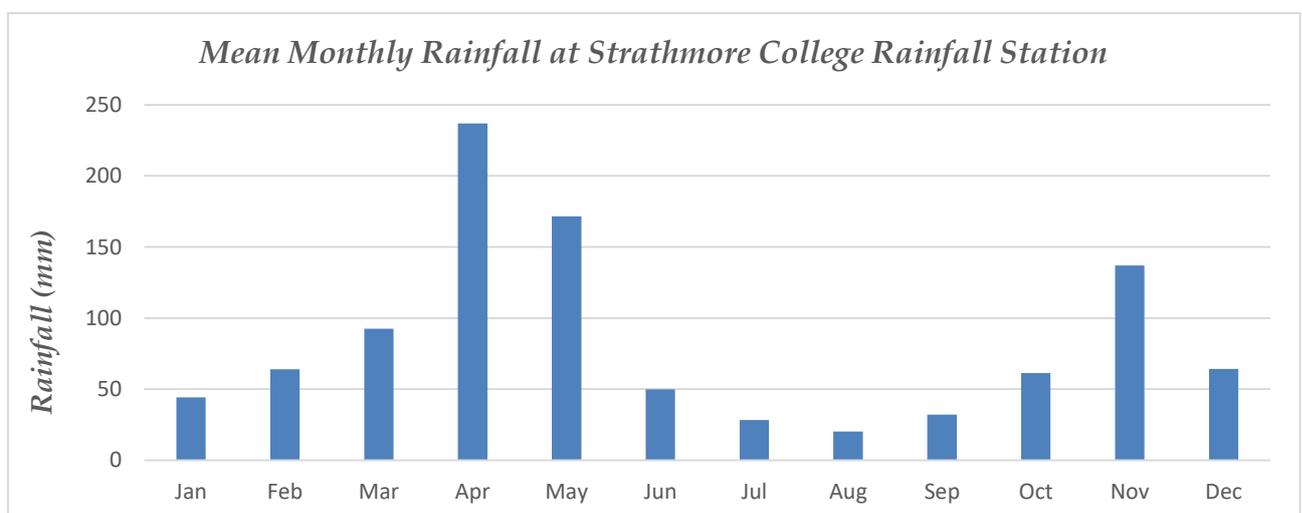
b) *Climate*

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

The Kirichwa Ndogo sub catchment lies within the agro ecological zones (AEZ) IV UM. In general the area is characterized by moderate rainfall with annual rainfall of 1002.3 mm (Strathmore College Rainfall Station No. 9136199). 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 Strathmore College Rainfall station:

Table.1. Mean Monthly Rainfall at Strathmore College Rainfall Station

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rainfall (mm)	44.3	64.1	92.5	236.9	171.5	49.8	28.2	20.2	32.2	61.4	137	64.2	1002.3



Mean Monthly Rainfall at Strathmore College Rainfall Station

c) *Vegetation;*

The Kirichwa Ndogo catchment in which the Dik Dik Gardens wetland catchment lies exhibits is within a settled area with changed vegetation.

d) *Current land use and its adverse impacts,*

The Kirichwa Ndogo sub catchment is within the jurisdiction of Nairobi City County in an urban setting. The main land use in the area is low density residential housing area but with upcoming high density commercial cum residential buildings. The construction of buildings and an increase in the impermeable surfaces has resulted in an increased surface run-off which ends up in the wetlands as well as into the rivers channels. The run-off carries pollutants from the surface as well as sediments which are deposited in the wetland 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*

Kirichwa Ndogo River has a Regular Gauging Station 3BA41 located at coordinates E036.800000, S01.272778 (37M 0255194.5, 9859215) at an elevation of 1705 m.a.s.l and approximately 2.4 km downstream of the Dik Dik Gardens wetland but the station has no available daily water levels or discharge data.

In terms of geology, the area is covered by the Kerichwa Valley Tuffs which are well exposed in the Kirichwa Ndogo 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 Kirichwa Ndogo River through the numerous springs that exist in the area.

The encroachment on the Dik Dik Gardens wetland 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 decrease in the discharge of the Kirichwa Ndogo River.

In order to have a clear understanding of the water resources availability in the Kirichwa Ndogo catchment, the available data has been used and collated with the existing daily discharge data of rated gauging stations within the 3BA sub basin. Kirichwa Ndogo river has a sub catchment area of 5.3 km² compared to the catchment area of the RGS 3BA29 of 56.5 km². The RGS 3BA29 has daily

discharge data from 1961 and this has been used to estimate the probable surface water availability for the Kirichwa Ndogo river.

According to the correlation between Kirichwa Ndogo and Nairobi river sub-catchments, the following scenario on surface water availability emerges:

Table.2. Surface water availability for Kirichwa Ndogo river

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 /d	nos	Million m ³	Million m ³
99%	1%	2.358	203,770		3.65	0.74	9.5
95%	5%	0.685	59,181		18.25	1.08	8.7
90%	10%	0.324	27,953		36.50	1.02	7.6
85%	15%	0.200	17,247		54.75	0.94	6.6
80%	20%	0.120	10,350		73.00	0.76	5.7
75%	25%	0.084	7,254		91.25	0.66	4.9
70%	30%	0.055	4,725		109.50	0.52	4.3
65%	35%	0.039	3,388		127.75	0.43	3.7
60%	40%	0.030	2,561		146.00	0.37	3.3
55%	45%	0.025	2,196		164.25	0.36	2.9
50%	50%	0.021	1,848	1,037	182.50	0.34	2.6
45%	55%	0.018	1,597		200.75	0.32	2.2
40%	60%	0.016	1,362		219.00	0.30	1.9
35%	65%	0.014	1,248		237.25	0.30	1.6
30%	70%	0.012	1,037		255.50	0.27	1.3
25%	75%	0.011	940		273.75	0.26	1.1
20%	80%	0.009	810	421	292.00	0.24	0.8
15%	85%	0.008	681		310.25	0.21	0.6
10%	90%	0.006	527		328.50	0.17	0.3
5%	95%	0.005	389	0.000	346.75	0.13	0.2
1%	99%	0.001	105		361.35	0.04	0.0

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

According to the ABA CMS (2014 - 2022) Kirichwa Ndogo 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 Kirichwa Ndogo 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

Kirichwa Ndogo river sub catchment is located within an area with predominantly formal low to medium density human settlement. Due to the development pressure, more high-rise buildings are coming up, replacing the existing single 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:

- Demarcate the wetland and its riparian zone and fence it off;*
- Gazette the Dik Dik Gardens Wetland as a protected water catchment area;*

- *Enforce the Dik Dik Gardens wetland 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 privately held title deeds and acquire a title deed (in trust) for the wetland	3 Months	500,000	WRA, NLC
	Fence off the demarcated area	1 Month	3,000,000	WRA, KiWRUA
	Place signs and notices to warn the public that this is a protected area	Continuous	250,000	WRA, KiWRUA
Gazette the Dik Dik Gardens Wetland as a protected water catchment area	Assess the status of Dik Dik Gardens Wetland	1 month	300,000	WRA
	Create awareness on the status of the wetland	Continuous	500,000	WRA, WRUA
	Develop guidelines and conservation plan through stakeholders engagement	2020	2,500,000	WRA with all stakeholders
	Submit gazette instrument to the Cabinet Secretary in charge of water	2020	200,000	WRA
Enforce the Dik Dik Gardens wetland guidelines	Create awareness to stakeholders the wetland guidelines and conservation plan	2021	500,000	WRA
	Enforce Dik Dik Gardens wetland protected area guidelines, management plan and relevant legislations	continuous	0	WRA, National Govt
Sub Total			9,500,000	

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 wetland 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, KiWRUA
	Exotic species control	Continuous	200,000	WRA, KiWRUA
Re-vegetation of the wetland with water friendly/native species of trees and vegetation	Establish indigenous plants nursery	Continuous	2,000,000	KiWRUA, WRA
	Grow live fence on the boundary of the wetland	Continuous	1,000,000	WRA, KFS, KiWRUA
	Planting and growing of propagated seedlings (Watering and tending)	1 year	540,000	KiWRUA
Sub Total			4,040,000	

3.4 Catchment and Water Resources Monitoring

The objective of the monitoring plan is to collect and analyse Dik Dik Gardens wetland 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 3BA41 on Kirichwa Ndogo river to monitor water quantity and quality;*
- *Establish a full hydro-meteorological station within the Kirichwa Ndogo river sub-catchment 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 RGS3BA41 on Kirichwa Ndogo river	Identify an appropriate site and install station	3 months	200,000	WRA
	Identify, train and engage a gauge reader	Continuous	600,000	WRA, KiWRUA
Establish a full hydro-meteorological station	Identify an appropriate site to install station	Continuous	0	KiWRUA, 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	
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3.5 Establishment and operationalization of management structure

The objective of the management structure is to ensure that the Dik Dik Gardens wetland 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, Nairobi City County; 3. National Government Administration in Nairobi City County; 4. National Environmental Management Authority; 5. Ministry of Agriculture; 6. The Kirichwa WRUA; 7. Dik Dik Gardens Residents Association 	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, KiWRUA

	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	KiWRUA, 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.

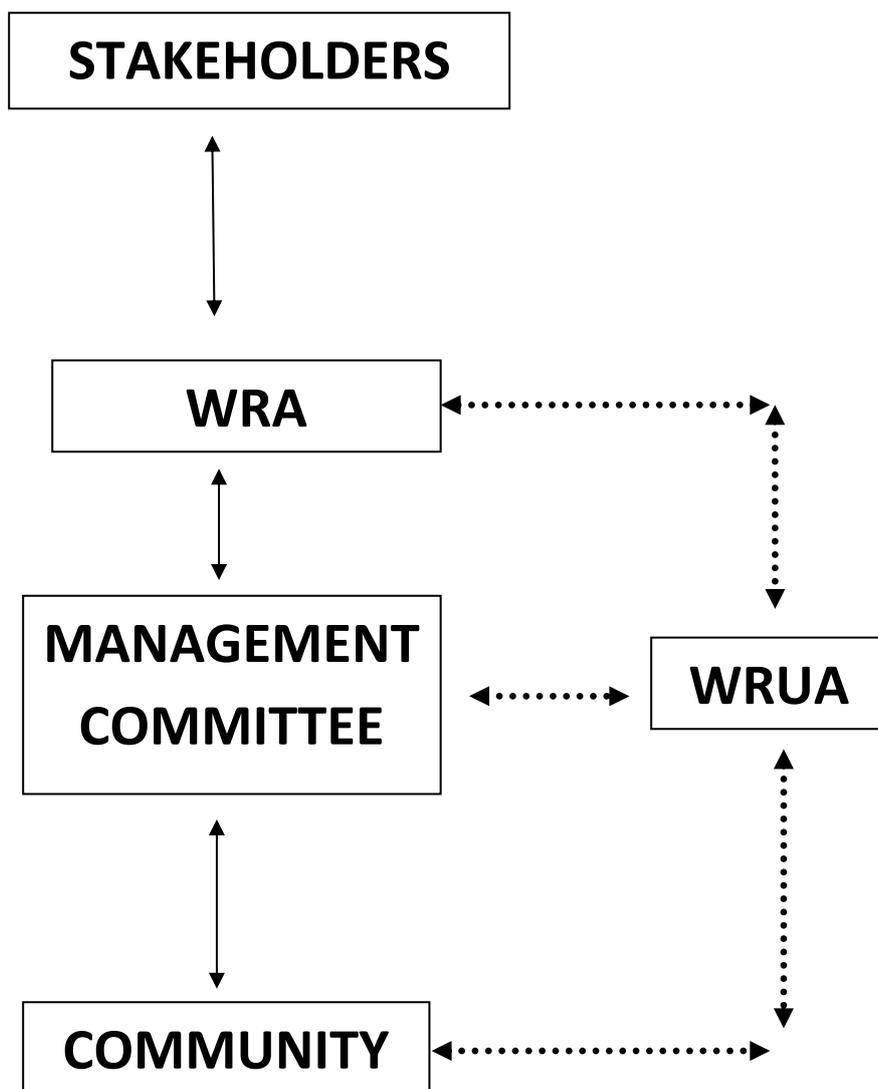


Fig.2. Reporting Linkages for the Management Committee

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						