



# Water Resources Authority

## *Tana Catchment Area*

### **MANAGEMENT PLAN FOR LAKE KENYATTA SUB CATCHMENT**

*MARCH 2021*

Final Draft

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To all we say thank you.

**Regional Manager**

**Tana Catchment Area - Embu**

## Acronyms

BMU	Beach Management Unit
CBOs	Community Based Organizations
CEO	County Environmental Officers
CFAs	Community Forest Associations
CSOs	Civil Society Organizations
DRSRS	Department of Resource Surveys and Remote Sensing
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
FD	Fisheries Development
GoK	Government of Kenya
ha	hectares
HWC	Human Wildlife Conflict
IBA	Important Bird Area
IBECA	Indigenous Biodiversity Environmental Conservation Association
ICRAF	World Agroforestry Centre
IGAs	Income Generating Activities
IMP	Integrated Management Plan
KARI	Kenya Agricultural Research Institute
KFS	Kenya Forest Service
M&E	Monitoring and Evaluation
M.C.N	Municipal Council of Mpeketoni
masl	Metres above sea level
mbgl	Metres below ground level
MEAs	Multilateral Environmental Agreements
mg/l	Milligram/litre
MoA	Department of Agriculture
MoCD	Department of Cooperative Development
MoE	Department of Education
MoEMR	Department of Environment and Natural Resources
MoGCSD	Department of Gender, Children and Social Development
MoH	Department of Health
MoL	Department of Labour
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 various 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, 2010.*

Article 62(3) of the Constitution vests these categories of public land on the National Government in trust for the people of Kenya- all rivers, lakes and other water bodies, the territorial sea, the exclusive economic zone, the sea bed, the continental shelf and any land between the high and low water marks. Article 66(1) further provides that the State may regulate the use of any land, or any interest in or right over any land, in the public interest.

Additionally, Article 69 obligates the State to ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources 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 Article 43(1) (d) of the Constitution guarantees every person the right to clean and safe water in adequate quantities. In order to ensure orderly delivery of this right, the Constitution has distributed water resources functions to the National Government under the Fourth Schedule. This is resultant from the provisions of Article 186 which classifies the functions assigned to each level of government as exclusive, concurrent or residual.

*ii). Water Act 2016*

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

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

Under Sections 23 of the Act, where the Authority considers it necessary that special measures are necessary for the conservation of ground water are necessary in the public interest, it may by public order published in the Gazette, declare the area to be a groundwater conservation area and impose requirements or prohibit certain activities in relation to a groundwater conservation . The Authority, 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*

Rule 124 and Part D of the Sixth Schedule to the Water Resources Management Rules 2007, sets out the contents of Management Plans related to a protected area to include:

- i.) Procedures to be applied for the management of the Protected Area or Groundwater Conservation Area;
- ii.) Prohibited activities;
- iii.) Any measures required to be undertaken for water resource conservation and protection;
- iv.) The timeframe for implementation of required measures;
- v.) Any other conditions that the Authority may consider relevant

Rules 116 to 120 of the Water Resources Management Rules 2007 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.

### **1.1.2 Background information on *Lake Kenyatta catchment*:**

Lake Kenyatta is a fresh water Lake found within Mpeketoni Division of Lamu West Sub County, Lamu County, located 60km to the south west of Lamu Island and 230 km north of Malindi town. The sub catchment covers an area of 496km<sup>2</sup>. The sub catchment is under the management of Lake Kenyatta WRUA.

The sub catchment comprises of natural forest as well as the Lake Kenyatta settlement scheme, a resettlement programme initiated by the Government in the 1970's in an area with high agricultural potential.

Lake Kenyatta is partly fed by rainfall, sub-surface flow and occasionally receives water from Tana River during flood flows. Water is mainly abstracted through shallow wells and boreholes and is used for domestic and agricultural purposes. Further, the Lake is considered a vital ground water recharge area which is important for sustaining the livelihoods of the community in the area.

### **1.1.3 Rationale for Catchment Protection through Gazettement;**

Lake Kenyatta, one of Kenyan's oldest natural fresh water Lakes, began drying up in 2016, threatening human and wildlife populations that have for ages depended on it for water supply. Within a period of one month alone, 15 hippos died and their carcasses were spread

on the drying Lake. The lake has run close to dry in recent years, and dried up completely in 1956 (National Environment Secretariat, 1985).

At some point, the Lake was completely dry and dotted with shells of millions of dead snails. The key contributor to the Lake drying up was increased human settlement around the Lake. The water ways which used to feed the Lake have been interfered with by human activity.

A management plan is therefore critical for the conservation and protection of Lake Kenyatta catchment area and the aquifers. This will tackle poor land use practices and restoration of the destroyed catchment area. The management plan will include a catchment investment plan for the sustainable management of the water resources.

TCA's CMS (2014 - 2022) recognised the need to protect the lake and increase its environmental functions. This is anticipated to 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 Lake with the community;
- Apply the law to protect wetland (enforcement for wetlands/riparian/springs protection);

In addition, Part XI of WRM Rules 2007, Rules 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 Lake Kenyatta Sub Catchment.

### *1.2 Location and size of area to be gazetted*

The area identified for Gazettement is found within Mpeketoni division of Lamu West sub county, Lamu County, located 60km to the south west from Lamu Island and 230 km north of Malindi town. The sub catchment covers an area of 41km<sup>2</sup> and is within the 4KB-sub basin of Tana Basin Area.



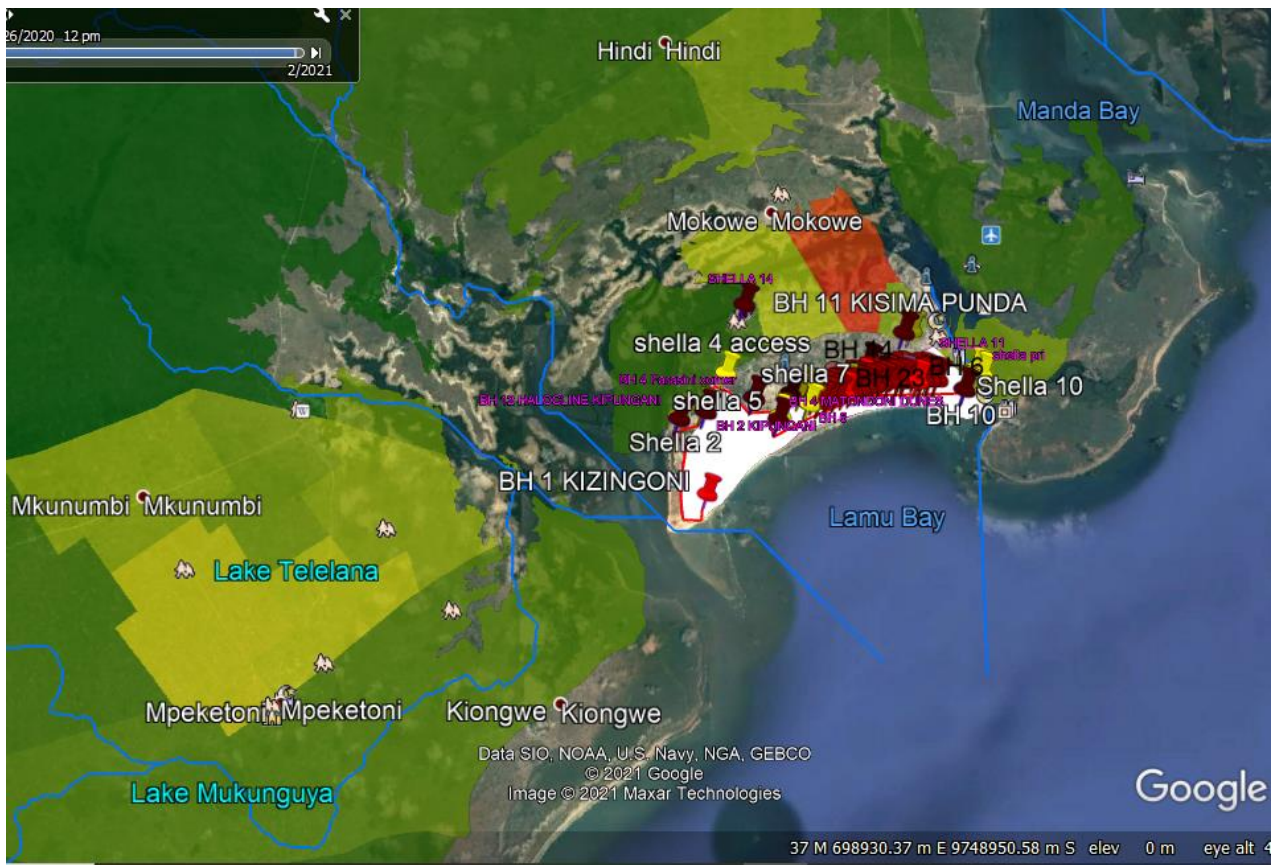


Figure 1: Location of Lake Kenyatta (Formally Lake Mukunguya)

### 1.2.1 Watershed area;

Lake Kenyatta is partly fed by rainfall, sub-surface flow and occasionally receives water from Tana River during flood flows. The area that contributes surface run-off into the Lake has been delineated through the use of a GIS software. The area measures 413.5 square kilometres out of the 10,962.3 km<sup>2</sup> catchment area of the whole 4KB sub basin as shown in Fig 1 below

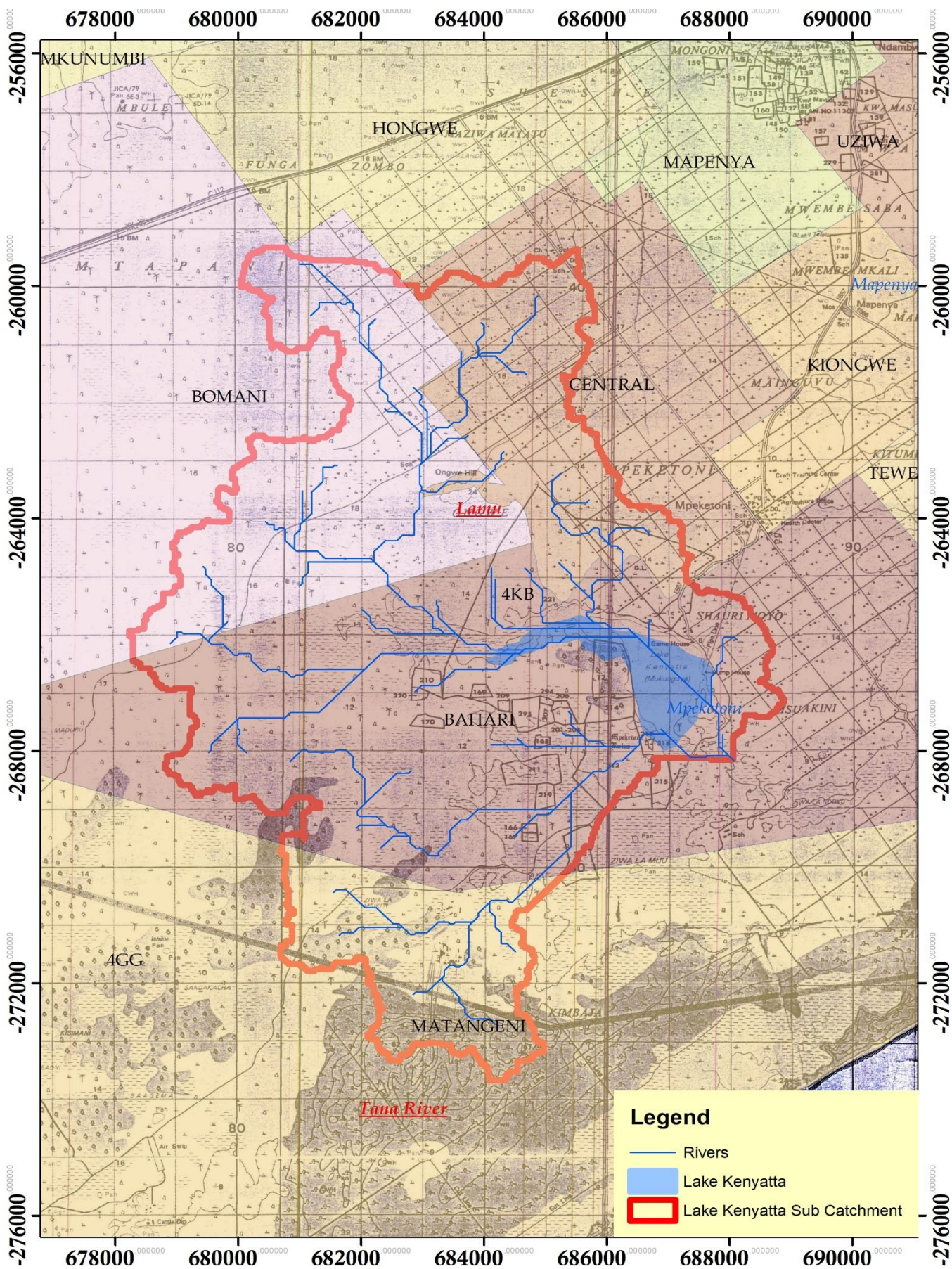


Fig.2. Location of Lake Kenyatta sub catchment within 4KB sub basin

## 1.2.2 Physiography, climate and rainfall;

### a) *Physiography*

Mpeketoni area is gently flat from 51ft asl to 5 ft asl towards the shore. Along the shore there is sand dune ranging from 15 meters asl to 45 meters asl. The chart below shows cross sectional topography of Mpeketoni area.



### b) *Geology*

The Kenyan coastal environments are set in a passive continental margin, the evolution of which was initiated by the break-up of the mega continent Gondwanaland in the Lower Mesozoic. The initial opening of the Indian Ocean was preceded by doming, extensive faulting and down warping similar to that observed in the modern Great Rift Valley of East Africa. These tectonic movements formed a North-South trending depositional basin. During the Mesozoic, this basin was exposed to numerous marine incursions and by the Jurassic, purely marine conditions are thought to have existed.

Geology of the area reflects predominantly quaternary history of marine influence with numerous transgressions and regressions and associated sedimentary features. It is characterized by lagoonal deposits, Aeolian accumulation and fossil coral reefs, occasionally dissected by alluvial sediments.

### c) *Hydrogeology*

Groundwater forms the main water supply source of fresh water under the Lake Kenyatta Water Users Association (LAKWUA) for Mpeketoni Town/settlement. The fresh water aquifer is mainly found in the fossil coral reefs which are present under most of the area. The aquifer is recharged by both deep rainwater percolation and inflow from Lake Kenyatta.

The lateral extent of the fresh water body has been found to be at least 10km<sup>2</sup>, including fresh water below the Lake bottom and some below the southern western bank. The depth to the saline/freshwater interface varies between 20 and 40 metres below surface. The average thickness of the fresh water body is 20 metres. The fresh water aquifer is mainly found in the fossil coral reefs which are present under most of the area.

The boreholes depths range between 15-18 m depth. Ground Water Survey (K) LTD (1987, 1992) inferred that the depth to the saline/fresh water interface in Mpeketoni area varies

between 20 and 40 metres below the surface. Within Mpeketoni and its surrounding areas, each household has a well. Most of these wells have motorized pumps.

#### *d) Soils*

The soils are composed of coral limestone overlain by a thin layer of loamy sandy soils.

The Red Loam Soils have the following characteristics:

- Fair organic matter content (humus) in top soil
- Well aerated soils which can hold water for the plants (little leaching)
- Roots do not penetrate so deeply into this soil as in the sandy soils (especially trees)
- Medium fertile soils which respond well to fertilizer applications (can hold nutrients well)
- Due to the high clay content, rain infiltrates the soil slowly (water logging). Heavy shows can cause local run-off
- Best soils for annual crops like cotton, maize, etc.

The humus of the top soil will disappear if no organic matter (plant residues, fallow crop, etc.) is added to the soil. This will lead to a hard, compacted soil surface which is difficult to cultivate when dry. The hard soil crust does not permit light showers to enter the soil and the water evaporates quickly on the surface. The soil loses its fertility if no organic matter is added.

#### **The Sandy Soils**

These have the following characteristics:

- Well-drained soils, sometimes excessively drained (leaching of nutrients)
- Low fertility, depending on the organic matter content of the top soil
- Soil (top layer) cannot hold water for the plants
- Soil is easy to cultivate

In most of these soils the clay content increases with increasing depth. That is of advantage for deep rooting plants like cotton or tree crops during dry spells or insufficient rain. The moisture is stored in or above the layer with the higher clay content and the deep rooting plants can extract water from there.

#### *e) Hydrology*

Lake Kenyatta Sub-Catchment falls under sub basin 4KB which is served by Mukuru River (seasonal), Lakes Kenyatta and Amu and numerous wetlands which include Pangani, Zebra, Majiglass and Witho.

Mukuru streams drains into Lake Kenyatta however, it has no monitoring station. To estimate the discharge empirical methods can be used to estimate the discharge. The Lake Kenyatta catchment is estimated at 41km<sup>2</sup> with an estimated annual rainfall of 1000 mm (1m).

Therefore, the annual discharge is:

$$\text{Discharge} = \text{area} * \text{rainfall per/yr}$$

Taking runoff as 10% of the total precipitation, then

$$Q = 41 \text{ km}^2 * (1000 * 0.1) \text{ mm} * e \text{ where } e = \text{drainage coefficient}$$

$$Q = 41 * 10^6 \text{ m}^2 * (1 * 0.1) \text{ m}$$

$$Q = 4.1 \text{ m}^3 \text{ per/yr}$$

$$\text{Therefore, } Q \text{ per month} = 4.1 \text{ m}^3 / 12 = 0.342 \text{ m}^3 / \text{Month}$$

#### *f) Climate*

Lake Kenyatta sub catchment area lies in the hot tropical region where the weather is influenced by the great monsoon winds of the Indian Ocean. Climate and weather systems on the Kenyan coast are dominated by the large scale pressure systems of the western Indian Ocean and the two distinct monsoon periods.

From November/December to early March, the Kenyan weather, particularly at the Coast, is dominated by the Northeast Monsoon (Kazikazi) which is comparatively dry. During March and April, the monsoon winds blow in an east to south-easterly direction (Kusi) with strong incursions of maritime air from the Indian Ocean bringing heavy rains. During the months of May, June, July and August, the South-easterly Monsoon influence gradually sets in and the weather becomes more stable with dull and comparatively cooler temperatures. Between September and November, the Northeast Monsoon gradually re-establishes itself and by December the northern influence is dominant once again.

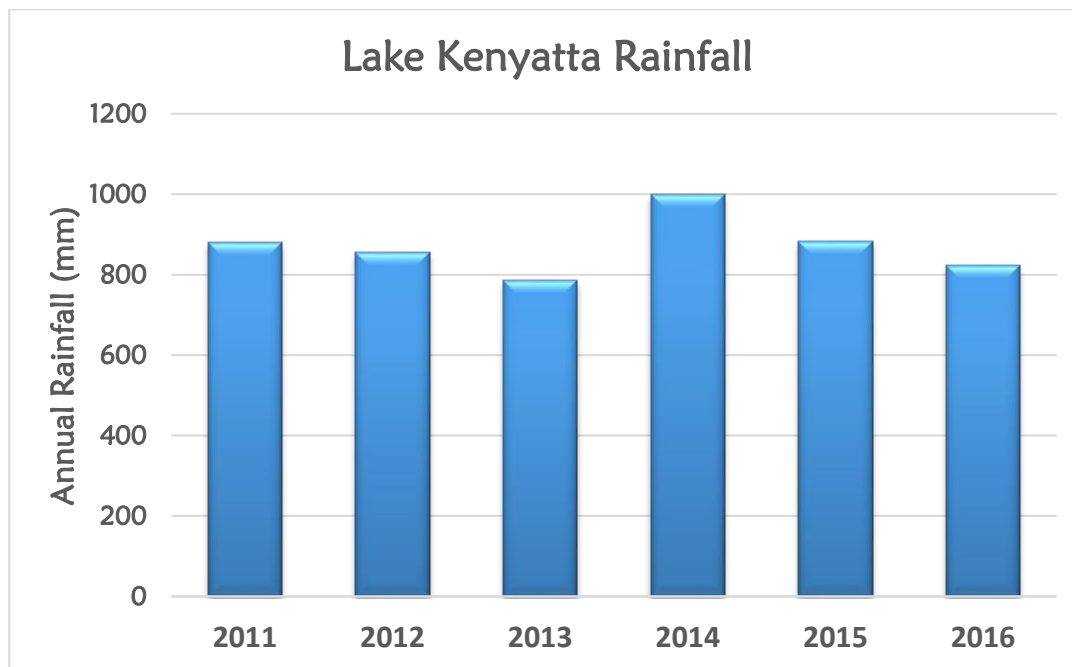
The area experiences bimodal rainfall pattern. The long rains come between late March and early June decreasing from August. Short rain occurs between October and November but decreases rapidly from December to February. Mean annual total rainfall ranges from 850-1000 mm. Relative humidity is comparatively high all the year round, reaching its peak during the wet months of April to July. The mean minimum and maximum temperature are 22° and 30°c respectively with potential evaporation ranging between 2200 and 2400 mm/year (any rainfall station with data?)

Annual rainfall data for the station at Mpeketoni Agricultural Training Centre is shown in the figure below. As can be seen the annual rainfall amounts are generally lower than 1000 mm. The annual rainfall amounts generally depicts a declining trend. The year 2014 had slightly higher amounts than the rest of the years analysed.

The climate in the area is characterized by two rainy seasons and are distinct dry season from January to March.

The long rain (march/april-july/august) are followed by occasional coastal showers in august/September which become heavier during October and head to the short rains in November/December.

The average annual rainfall varies within the sub catchment between 1000-1100 mm/year in Mpeketoni area.



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

The land in the sub catchment is mainly used for farming and settlement purposes. In addition, agro forestry is in practice.

Subsistence farming include crops like maize, peas, sweet potatoes, cassava, tomatoes and Kales, cashew nuts, cotton, bananas, coconut, bixa, simsim, mangoes.

The forest coverage in the sub catchment is about 3% which is below the set national standard of 10%, composed of tree species.

The sub catchment is also characterized by urban settlement which highly depend on ground water exploitation for water supply for both domestic and irrigation purposes. This water supply is under threat of pollution from Sea water intrusion, tourism by-products, effluent from pit latrines, car washing as well as domestic washing.

Primary forests (coastal rainforests) covering present day Lamu west Sub County remained virtually intact until the Arabs, Portuguese, Germans and British arrived.

Primary forests consist of mangroves along the coast and further inland, valuable indigenous tree species can be found, such as:

- Afzelia quanzensis (Mbamba kofi)

- *Brachylaena hutchinsii* (Muhugu)
- *Chlorophora excels* (Mvule)
- *Dalbergia melanoxylon* (Mpingo).

Like other parts of the coast, that time the area was rich with indigeneous trees including fruit trees such as *Zizyphus mauritiana* (Mkunazi) and *Dialium orientale* (Mpepeta).

It is important to preserve the remnants of the indigenous forests and at the same time plant new trees and forests. All relevant departments and concerned institutions have to join forces and collaborate in creating awareness and training of students, local leaders and farmers on subjects such as:

- The dangers and consequences of deforestation
- Environmental conservation and tree planting and
- Protection of valuable indigenous trees and forests

## **2 *Current Situation Analysis***

### *2.1 The vulnerability of the water resource*

Lake Kenyatta is partly fed by rainfall, sub-surface flow and occasionally receives water from Tana River during flood flows. Mukuru seasonal streams drains into Lake Kenyatta however, it has no monitoring station. The Lake is considered a vital ground water recharge area which is important for sustaining the livelihoods of the community in the area. Water is mainly abstracted through shallow wells and boreholes and is used for domestic and agricultural purposes.

There may be grounds for concern about over-abstraction in the Lake Kenyatta coral and sand aquifer, for abstraction of 1,411 m<sup>3</sup>/d from the aquifers. The aquifer lies close to sea level, and there is a potential risk of saltwater intrusion. The aquifer is typically 20 m thick, and the fresh-saltwater interface occurs at depths of 20 to 40 mbgl; static water levels fluctuate seasonally, but are typically <1 to three mamsl. Properly sited and constructed boreholes are capable of yields of 20 to 30 m<sup>3</sup>/hr for modest drawdowns (<1 m). Aquifer recharge is largely bank recharge from the seasonal Lake Kenyatta, which has run close to dry in recent years, and dried up completely in 1956 (National Environment Secretariat, 1985).

Lake Kenyatta aquifer is vulnerable to pollution, due to the high transmissivity of the coral limestone aquifer.

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

Section 20 of the Water Act, 2016 requires the Authority to prescribe the criteria for classifying water resources for the purposes of determining water resources quality objectives for each class of water resource.

The Tana Basin plan developed by WRA in consultation with various stakeholders, Lake Kenyatta sub-catchment can be classified as of high economic and social importance. The area has predominantly urban settlement and/or Agricultural agglomeration areas. This category targets at ensuring quality of water resources to develop economy and prosperity in urban settlement areas/agricultural centres.

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

## 2.3 *The class of the water resource*

The Lake Kenyatta sub-catchment can be classified as “Alarm” as the available water is at not of adequate quality to meet the demand. The lake Kenyatta aquifer is at the risk of pollution due encroachment of the catchment area and threat of salt water intrusion.

The table below shows the classification of the aquifer according to the Tana Basin plan.

Name	Geology/lithology	Area (km <sup>2</sup> )	Depth range (m)	Yield potential (m <sup>3</sup> /day)	Dominant flow type(s)	Typical EC (µS/cm)	Status
Lake Kenyatta	Fossilised coral limestone, with sand lenses and cavities overlaid by recent unconsolidated sands and sandy clays	22	<20	<86	Intergranular	<1 000	Alarm

## 2.4 *Land uses and their potential impact on the water resources*

The population of Mpeketoni town which is within the catchment area has been growing rapidly over the years. Being a commercial centre, people from other parts of the country have also being settling there in search of livelihood activities..

The potential impacts on the water resources as a result of human acts includes:

- a. **Encroachment:** People have encroached waterways, especially in the upper inlet and catchment along river Mukuru and also along the Lake shore;



- b. **Overexploitation of available resources:** The population in the area has been rapidly growing over the years. This leads to excessive pressure on available water resources and when abstraction from water wells exceed the recharge, sea water intrusion into the fresh water is experienced;
- c. **Catchment degradation:** Due to increased demand for sand as a building material, sand harvesting around the Lake and its catchment has increased. This affects the vegetation and loosens the soil leading to degradation of the Lake ecosystem;
- d. **Soil Erosion:** Following uncontrolled farming and other human activities, soil erosion leads to siltation of the Lake hence affecting its overall depth and water levels;
- e. **Deforestation:** The forest cover around the Lake, the immediate catchment areas as well as the wider catchment has been depleted due human activities. Forests have been cleared to give way for farmlands, settlements as well as charcoal burning and timber.
- f. **Water Pollution:** Due to excessive economic activities around the Lake, the water has been polluted. Fishermen do not have sanitation facilities within the Lake leading to open defecation. The farms in the surrounding area use agro-chemicals which eventually find their way into the Lake and leading to pollution. Other pollutants include solid waste that is washed into the Lake by runoff water during rains. There is evidence of loss of aquatic organisms. Shells of dead fresh water organisms are found all over the dry Lake floor.

### ***3 Measures for Conservation and Rehabilitation of the area***

Land within the Lake Kenyatta sub catchment and the feeder Mukuru River is legally owned by Government, local authorities and individuals and this in some instances limits the scope of conservation regimes that can be applied to the whole basin

#### ***3.1 Proscribed Activities;***

According to the applicable 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.

In the development of the management programmes, care has been taken to ensure that there are explicit and logical links between the vision statement, management objectives, and the management strategies to achieve the objectives. Each management programme is discussed in further detail in the following sections:

#### Goals

The overall goals of the management are to:

- a) Ensure sustainable management and use of water resources within the sub catchment while promoting equitable sharing of water resources
- b) Ensure the conservation of the catchment areas to improve on the water quantity and quality

#### Objectives

- i). To enhance implementation of existing regulations to protect the rights of all users
- ii). To promote water use efficiency that is hydrologically and economically beneficial to domestic, agricultural, and industrial water users and the environment.
- iii). To identify funding sources to implement water conservation programs that help to enhance water resources

Activity	Sub-activity	Timeframe	Cost	Responsibility
Establish the water balance	Assess demand and availability	2021	1,000,000	WRA, County Government, WRUA, KWS
Develop water allocation plan for the Ngarelen springs.	Develop Water allocation Plan	2021	2,000,000	WRUA, WRA, KWS, County Government, Irrigation Canals.
	Implement water allocation plan	continuous	5,000,000	WRA, WRUA, NEMA, County Government
	Enforce permit conditions	continuous	5,000,000	WRA, WRUA,

Enhance Water use efficiency (introduction of technologies)	Sensitization and model water use units - irrigation, domestic Demonstration on efficient water use technology	Continuous	8,000,000	WRA, WRUA, County Government
			<b>21,000,000</b>	

### 3.3 Catchment Protection Plan

The objective of the protection plan is to protect Lake Kenyatta catchment by encouraging activities that enhance both water quality and quantity while discouraging activities that cause the catchment degradation and promoting beneficial land and water management practices.

#### Actions

- Sensitization on catchment management
- Revegetation of the catchment area
  - Native Plant Propagation
  - Exotic species control
- Water storage enhancement to ease pressure on use of springs water
  - Rain water harvesting tanks
  - Water pans
- Regulating activities that may lead to pollution and destruction of the eco-system (Charcoal burning, grazing, cultivation)
- Controlling abstraction limits and observing of safe yields
- Controlling encroachment and cancellation of illegal titles

Activity	Sub-activity	Timeframe	Cost(Ksh)	Responsibility
Gazettement of Lake Kenyatta Catchment as a protected area	Delineate & survey the lake's catchment area.	2021	200,000	WRA, WRUA, Lamu County Lands & Survey Team
	Develop the Part Development Plan for the lake catchment	2021	500,000	WRA, SoK, County Government of Lamu

	Create awareness on the status of the lake's catchment area.	Continuous	300,000	WRA, KWS, WRUA, NEMA, County Government,
	Develop guidelines and conservation/protection plan through stakeholders engagement	2021	500,000	WRA with all stakeholders
	Submit gazette instrument to the AG	2021	500,000	WRA
Enforcement of Lake Kenyatta catchment guidelines and other legislations	Enforce Lake Kenyatta catchment guidelines, management plan and relevant legislations	continuous	5,000,000	WRA, County, Govt, NEMA, KWS.
Re-vegetation of the catchment area	Establish native Plant Propagation	Continuous	2,000,000	WRUA, WRA, KFS
	Grow live fence on the boundary of the catchment.	Continuous	3,000,000	WRA, KFS, WRUA
	Planting and growing of propagated seedlings (Watering and tending)	Continuous	5,000,000	WRUA
	Exotic species control	Continuous	500,000	WRUA
Rain water storage enhancement.	Installation of 20 10m <sup>3</sup> Rain water harvesting tanks in public institutions/public land	Continuous	4,000,000	WRA, County Government and WRUA
	Construction of 2No. 10,000m <sup>3</sup> water pans	Continuous	10,000,000	WRA, County Government and WRUA.
Restricting activities that may lead to pollution and destruction of the catchment.	Public awareness creation	Annually	1,000,000	WRA, County Government, KWS, KFS, WRUA.
	Controls/restrictions on charcoal burning, grazing, bathing and farming near sensitive areas.	Continuous	300,000	WRA, County Govt, KWS, KFS, WRUA.

	Enforcement	Quarterly	500,000	County Commissioner, KWS, WRA, KFS, NEMA, WRUA.
Alternative livelihood activities	Promote bee keeping, poultry farming and butterfly keeping.	Continuous	10,000,000	WRA, KWS, WRUA, Agriculture and livestock
Controlling encroachment and review of grants	Review legality of titles and resolving	Continuous	5,000,000	NLC, WRA, County Government.
<b>TOTAL</b>			<b>48,300,000</b>	

### 3.4 Monitoring Plan

The objective of the monitoring plan is to collect water resources data and maintain a comprehensive database on the Ngarelen springs that provides information on water levels and quality of the spring's water.

#### Actions

- Establish a water quality and pollution control plan.
- Water sampling and analysis
- Establish a water resources database

Action	Sub Activities	Time frame	Costs	Responsible
Water sampling and analysis	Collecting water resources samples.	Continuous	200,000	WRA
	Conduct analysis of biological and physico-chemical parameters	Continuous	500,000	WRA
Capacity Building	Capacity building on data collection and monitoring	Continuous	1,000,000	stakeholders and WRA
Water resources monitoring	Install water level gauges	1 year	400,000	WRA, WRUA
<b>Total</b>			<b>2,100,000</b>	

### 3.5 Establishment and operationalization of management structure

The objective of the management structure is to ensure that the Lake Kenyatta catchment protected area is managed in a sustainable manner with the involvement of all stakeholders under the leadership and coordination of WRA - TBA. 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"> <li>1. Kenya Forest Service</li> <li>2. National Environment Mgt Authority</li> <li>3. National Government Administration in Kajiado South Sub County;</li> <li>4. Kenya Wildlife Service;</li> <li>5. Ministry of Agriculture;</li> <li>6. Lake Kenyatta WRUA;</li> </ol>	3 months	250,000	WRA
	Terms of References (ToR) will include but not limited to: <ul style="list-style-type: none"> <li>▪ To manage the catchment prudently on behalf of other stakeholders</li> <li>▪ To submit quarterly reports to WRA - ABA on all planned and implemented activities ;</li> <li>▪ To develop by - laws and submit a copy to WRA - ABA for approval before implementation</li> </ul>	Continuous	0	WRA, Nalepo WRUA
	Mandate and responsibilities: <ul style="list-style-type: none"> <li>▪ Promote the conservation and protection of the catchment</li> <li>▪ Promote equitable distribution of the resources within the catchment</li> <li>▪ Promote socio-economic and environmental sustainability of the catchment</li> </ul>	Continuous	0	Lake Kenyatta WRUA, WRA
	The sources of funds for the committee may include: <ul style="list-style-type: none"> <li>▪ Bee keeping</li> <li>▪ Tree Nursery;</li> </ul>	Continuous	5,000,000	WRA

	<ul style="list-style-type: none"> <li>▪ Eco-tourism;</li> <li>▪ Well-wishers/Donors</li> <li>▪ WRA/WRUA - (WDC)</li> </ul>			
Sub Total			5,250,000	

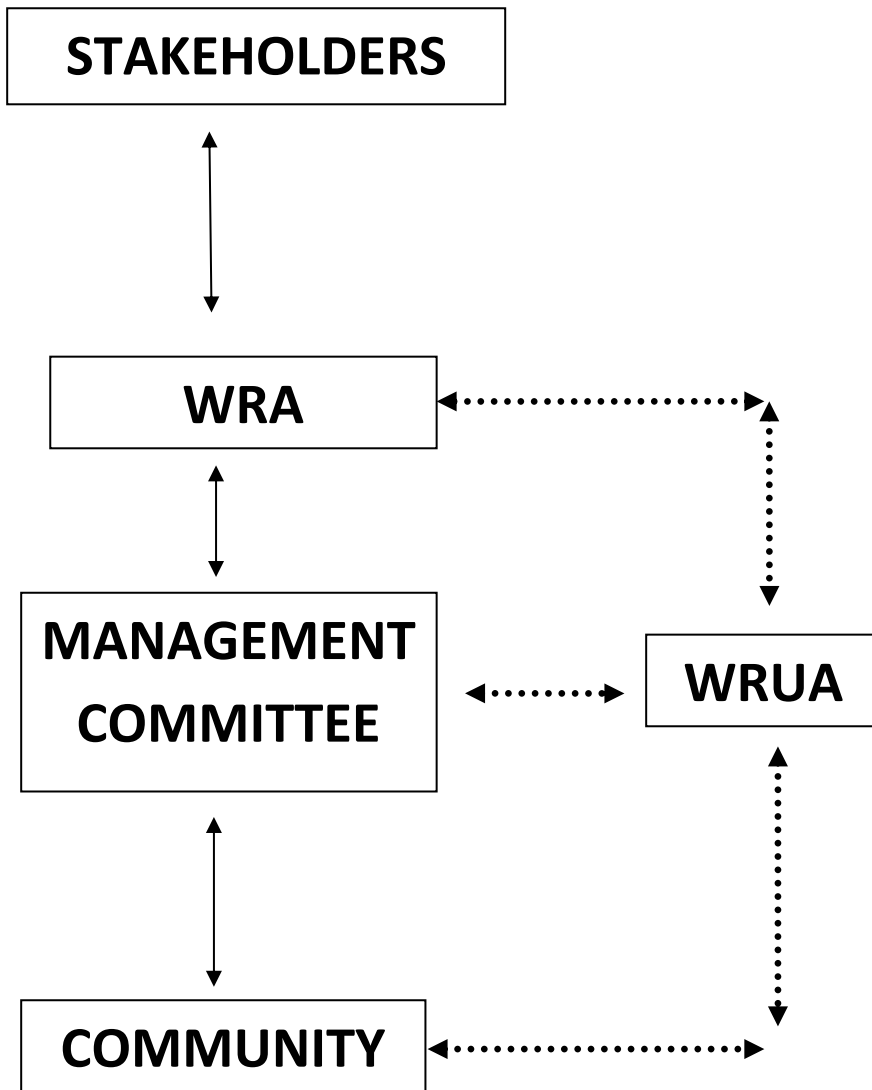
WRA as the agent of the National Government in the regulation of use and management of water resources, will be the Coordinator of the committee. The members appointed to the Management Committee will serve on honorary basis as this will be a non-profit, non-commercial venture. The Committee will be 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.

### ***3.6 Catchment and Water Resources Monitoring***

The objective of the monitoring plan is to collect and analyse Lake Kenyatta 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:

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.3. 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.1. 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						