# NGARELEN SPRINGS CATCHMENT AREA MANAGEMENT PLAN

# (FINAL DRAFT)

March 2021

## Foreword

Generally, the main problems and concerns relate to accommodating increasing water demands on the springs while maintaining and protecting the ability of the springs to support human and environmental needs in a sustainable manner. The unprotected catchment makes the springs highly vulnerable to contamination from sources such as, but not limited to effluent from solid waste, animal droppings, agro-chemicals used in farming and silt as a result of agricultural activities. Loss of vegetation cover over it may lead to higher evaporation rates compromising the spring's storage.

The management plan as presented encompasses four plans that are further expounded in the document to achieve the goals of sustainability of the Ngarelen springs catchment; Water Use Plan, Monitoring Plan, Springs Protection Plan, Conservation/Protection Plan and Monitoring Plan.

## Acronyms

| | | |
|---|---|---|
| AEZ | - | Agro-Ecological Zone |
| CMS | - | Catchment Management Strategy |
| ACA | - | Athi Catchment Area |
| KFS | - | Kenya Forest Service |
| 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 watercourse. 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.

## 1.2 Legal Background

### (i) Constitution of Kenya

COK 2010 Constitution of Kenya 2010 recognizes water as a human right and confers to every person the right to clean and safe water in adequate quantities in a clean and healthy environment. Consequently, water resources has drawn national attention where it has been recognized as being essential in making the country become industrialized in accordance to the Kenya's Vision 2030, a blue print for the national development agenda for Kenya.

Article 66 of the constitution 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, utilization, management and conservation and the equitable sharing of

the accruing benefits. It is also the duty of every person to co-operate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

**(ii) Water Act, 2016**

**Section 22(1)**

Provides that where the Authority is satisfied that in order to conserve a vulnerable water resource, special measures are necessary for the protection of catchment area or part thereof, it may, by order published in the Gazette declare such a catchment area to be a protected area.

**Section 22(2)**

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

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

Part X1 section 123-126 provides for protected areas and groundwater conservation areas including management guidelines related to a protected area or a ground water conservation area.

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

**Relevant Sustainable Development Goals (SDGs)**

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

**Target 6.4**: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

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

**SDG 13**: Target 13.1 -Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

**Target 13.3**- Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

**Target 6.4** -By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

**Target 6.1**-By 2030, achieve universal and equitable access to safe and affordable drinking water for all

## *1.3 Location and Size of Area to be gazetted*

Rombo is sparsely populated and is entirely considered to be in a rural set up. The Ngarelen Springs mainly serve the residents of Rombo and Njukini sub locations in Rombo Location. The total population in the two sub locations is 10,728 people (KNBS Census Data). The springs are the sole source of water for the residents of the area for domestic use, livestock watering and subsistence and commercial irrigation. Due to livestock grazing and the residents drawing water directly from the springs, there has been degradation on the riparian areas. Currently the springs are tapped via intakes to support irrigation agriculture, which is the main economic mainstay of the community in Rombo. Encroachment of the spring's area for settlement and agricultural activities has led to the general degradation of the catchment area.

This proposal for the gazettement of the Ngarelen Springs catchment area will entail clear delineation of the boundaries of the catchment and preparation of a catchment protection plan among other activities. This will prevent encroachment of the catchment area by the residents. The encroachment of the spring catchment area has paved way for settlement, grazing on the catchment and cutting down trees for charcoal burning. Prevention of further degradation of the springs catchment will guarantee enough and reliable water for both irrigation and domestic use throughout the year. This can be achieved through gazettement of the catchment.

The Management Plan Goals are to ensure springs protection and conservation as well as sustainable use of the water resources.

Ngarelen Springs are located within Nalepo WRUA Sub Catchment in Rombo Location, Rombo Division of Loitoktok Sub County in Kajiado County, about five

hundred (500) metres from Rombo Township. The spring forms parts of the tributary of Rombo and Tsavo Rivers and is part of the 3G Drainage Area. The spring catchment area of approximately 15 acres (60,703m²) is public land. However the land is not demarcated and there are individuals who have encroached into the land and put up structures and carried out agricultural activities. Livestock also regularly encroaches into the catchment when grazing and in need for water.

The springs are located as shown below.

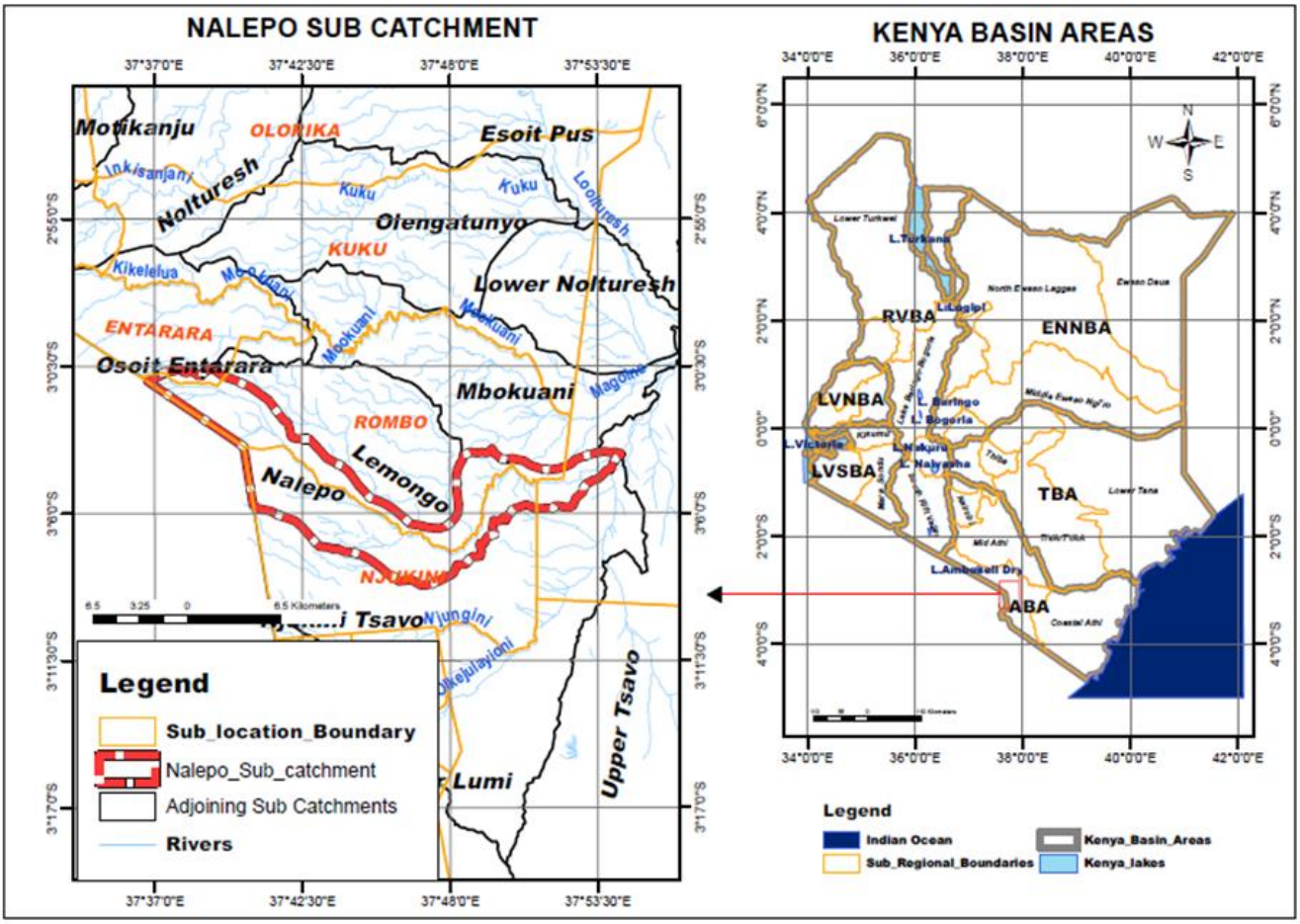


*Fig.1. Location Map of Nalepo Sub Catchment (Ngarelen Spring is located in the sub*

Due to degradation of the spring catchment, protection works was carried by Water Resources Authority in 2019. This involved the construction of a masonry wall around the spring eye, placement of gabions on the upstream of the spring and planting of suitable tree seedlings within the spring catchment. This resulted in an increase in the yield of the spring. Pollution of the source by livestock watering from the spring source has also been eliminated. Gazettement of the catchment will lead to further

improvements. Prior to this, the average daily gauge height at RGS 3GA02 was 0.12 m. After the construction of the masonry wall, this figure has steadily increased to 0.20m. The final available discharge value available is 0.151 $m^3/s$ on 3rd May 2019.

To ensure proper conservation and protection of the Ngarelen Spring Catchment, WRA, community and other key stakeholders recognised the need for Gazettement of the land.

ACA's CMS (2014 - 2022) has recognised the need to protect the catchment areas 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 catchment areas to ensure environmental sustainability;
- Development of an action plan to protect the catchment and their rehabilitation;
- Participatory mapping of the protection zones around the water catchments with the community;
- Apply the law to protect catchment areas (enforcement for wetlands/riparian/springs protection);

In addition, Part XI of WRM Rules, Rules 123 - 125 sets out the process and procedure for the identification of an area as a protected or groundwater conservation area. This procedure will be used in coming up with the Gazettement documents for the Ngarelen Springs Catchment.

## *Climate*

The area belongs to the sub-tropical semi-arid climatic zone. The average annual temperature is 22.7°C, with the lowest in the months of July – August (20.4°C) and the highest in the month of March (24.9°C). The annual rain distribution shows two pronounced rainy seasons, namely the long rains from March to May and the short rains from November to December. The mean annual rainfall is about 526 mm. The highest mean monthly precipitation occurs in April (122.1 mm) and the lowest is in July (2.7mm).

### *Geology and Physiography*

The soils of the area are primarily developed from undifferentiated volcanic rocks (predominantly pumice) of the Rombo series of the Tertiary age. Physiographically, the area forms part of the general and extensive piedmont plain, which extends from the foot slopes of Mt. Kilimanjaro, to the Pare Mountains in the South East. The area is generally flat (slope 1-2%) but is studded with numerous small parasitic cones (hills) and plugs, which rise above the general level of the plain.

### *Hydrology*

Ngarelen Springs are among a number of springs in the sub catchment that flow into tributaries that form Rombo River and finally flow into Tsavo River.

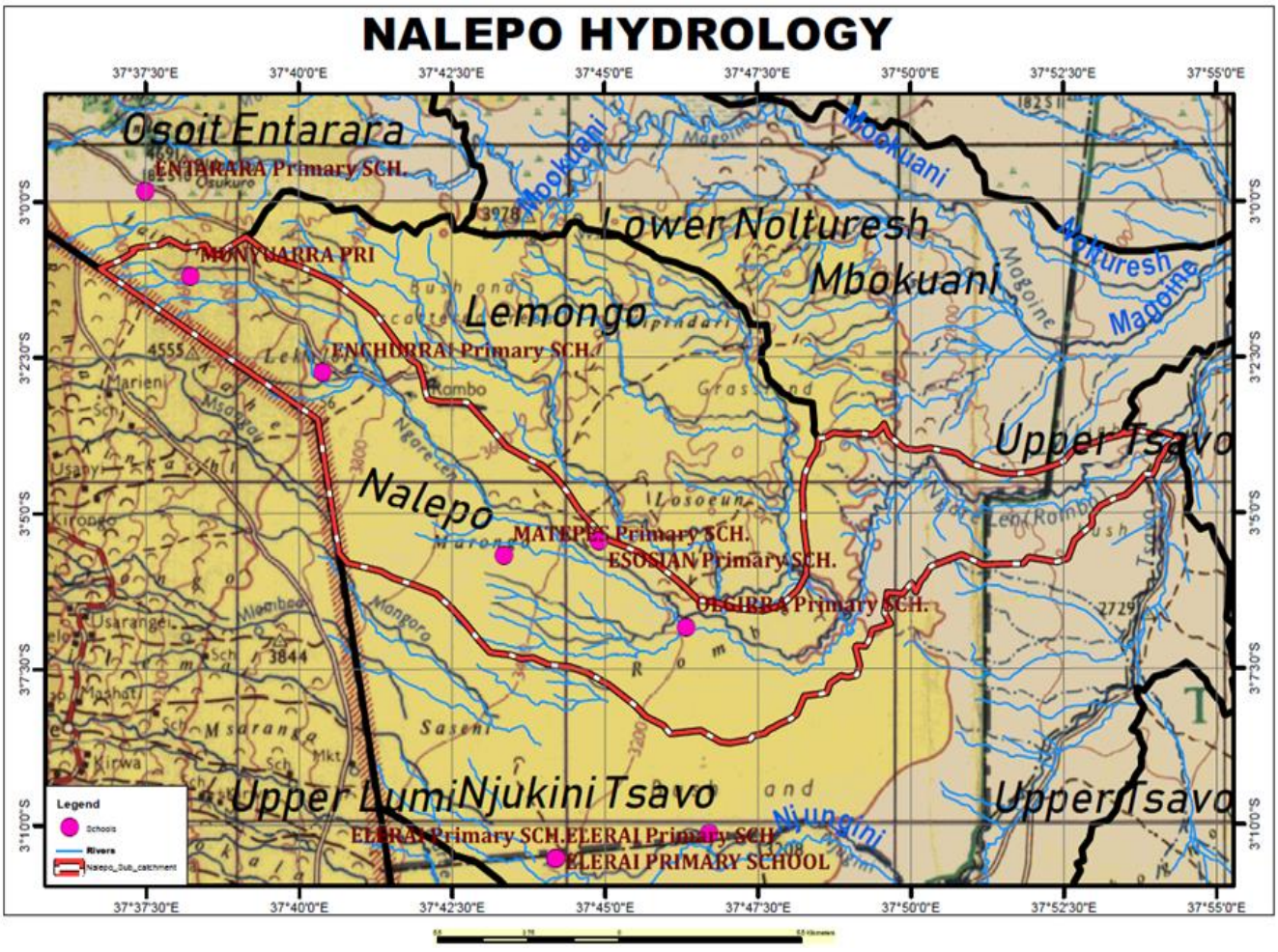


*Fig.2. River Network*

### *Vegetation*

The natural vegetation of the area is mainly wooded, bushes, grassland with acacia tree bushes and shrubs and tall perennial grasses. However, irrigated agriculture has largely replaced this natural vegetation with smallholder maize, tomatoes, and onions among the crops grown.

### *Erosion in the catchment*

A notable feature in the area is that owing to the relatively flat terrain that is mostly bare and the volcanic soils that are susceptible to erosion, several gullies have developed as the fast flowing water from the vast springs and Mt Kilimanjaro flow past the area. The soils in the sub catchment comprise of deep clay and clay whose depth is unknown. The upper and mid zones of the sub-catchment is dominated by deep clay. The lower section of the sub-catchment is characterized by clay of unknown depths

Indeed, the area upstream of Ngarelen Springs is characterized by a deep gulley that was initially transporting loads of silt to the spring's area. For this reason, protective gabions were constructed on the upstream side of the spring with funds from WRA.

### *Springs water quality*

The quality of water from Ngarelen springs can be described as good. According to analysis of water samples from the springs by the WRA Central Water Testing Laboratory in September 2019, the water was considered as chemically fit for domestic use. However, there is danger of contaminating the spring's waters due the human activities currently being undertaken within the catchment area, if intervention measures are not implemented immediately.

### *Catchment Issues/ Challenges*

The main problems and concerns relate to accommodating increasing water demands on the springs while maintaining and protecting the ability of the springs to support human and environmental needs in a sustainable manner. The unprotected catchment makes the springs highly vulnerable to contamination from sources such as, but not

limited to effluent from solid waste, animal droppings and silt as a result of agricultural activities. Loss of vegetation cover over it may lead to higher evaporation rates compromising the spring's storage.

Currently the main concerns affecting abstraction of water from the springs include:

- Depletion of fresh water resources
- Effects on water sources used by the local communities i.e. contamination.
- Effects on natural vegetation (forest cover) and agricultural land use.

### *Vegetation Clearing*

The vegetation clearing causes direct exposure of springs to evaporation impacting on the springs yield. In addition, vegetation slows down the rain drops as they fall to the ground, giving more time for the water to infiltrate into the ground and recharge the springs. At the same time, the vegetation cover reduces the speed and hence impact of the raindrops as they hit the ground, which loosens the soils, causing erosion. The springs need to be re-vegetated and cutting of trees in the catchment area should be stopped forth with.

### *Climate Change*

The vagaries of climate change like everywhere else has meant that there are more depressed rainfall than usual. The catchment area and the surrounding areas experience recurrent droughts leading to frequent water use conflicts among farmers and pastoralists who use water from the Ngarelen springs.

# *2 Current Situation Analysis*

## *2.1 Vulnerability of the Water Resources*

Ngarelen Springs have a Regular Gauging Station 3GA02 located at coordinates. Latitude E $037^0$ 41′ 35.5″, Longitude S $03^0$ 03′ 07.7″ at an elevation of 1157 m.a.s.l and approximately 500 m downstream of the spring. The daily water levels is available. The last discharge data available is from May 2019 (0.151$m^3$/s).

In terms of geology the area comprises a series of volcanic layers associated with Mt. Kilimanjaro namely Kijabe-type basalts and dense olivine basalts.

Groundwater occurrence in this area can be described as poor, the dense basalts, Kijabe type basalts and melanocratic basalts are massive and not faulted, this implies porosity is poor and don't support storage of groundwater. However, the areas along River Rombo present good condition for groundwater occurrence, in addition the area east of the sub catchment indicates presence of old land surface contact point between gneiss and basalts which may have productive aquifer

## *2.2 Water Resources Quality Objectives and the Status of the Water Resource*

According to the ACA CMS (2014 - 2022) Ngarelen Spring catchment area within the Nalepo sub-catchment can be classified as of medium Commercial importance. The area is predominantly rural. Economic activities include farming, livestock keeping, wildlife, and tourism. This category targets at ensuring quality of water resources to develop economy and prosperity for the residents and all other stakeholders who use the water. 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, small scale /large-scale farmers, pastoralists and wildlife safeguarded.

## *2.3 Class of the water resource*

The Ngarelen Springs catchment is located within Nalepo sub catchment and can be classified as "Alert" since the available water is at times especially during the dry season of adequate quantity to meet the demands from the various competing uses. The water quality at the source and in the upstream areas is good, however it deteriorates as the stream flows downstream due to contamination from the grazing and agricultural activities.

## *2.4 Land Uses and their potential impact on water resources*

With the influx of farming over the years, there have been significant land use changes. Large areas hitherto used as range lands were opened for farming thereby affecting land cover.

Nalepo sub catchment has witnessed extensive land use change since independence of Kenya in 1963. These changes represent the response of the population to local and exogenous opportunities and constraints. This area has experienced rapid and extensive land use change in response to a variety of economic, cultural, political,

institutional and demographic processes. The community within sub catchment is changing from livestock keeping as their main livelihood activity to irrigated agriculture. This has caused severe environmental degradation (deforestation, encroachment of riparian land) leading to pollution of water sources by agro chemicals, liquid and solid wastes.

Poor methods of water use such as open canals and flooding have caused people to shift to new areas hence, more degradation of the sub catchment. The riverine vegetation along the river channels and/or near springs and other water sources has been cleared to give way to farmlands. These changes have intensified as a result of human population growth.

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

## *3.1 Proscribed Activities;*

According to the relevant legal framework as discussed above, protected areas can be used by the neighboring 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 Water Use Plan*

The objective of this water use plan is to protect the long term water storage and supply capacity of the springs by controlling encroachment and degradation of the catchment.

**Actions**

- Establish the water balance.
- Develop water allocation plan for the Ngarelen springs.
- Improve Water use efficiency (introduction of technologies)

| 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<br>Demonstration on efficient water use technology | Continuous | 8,000,000 | WRA, WRUA, County Government |
| | | | **21,000,000** | |

### *3.3 Springs Protection Plan*

The objective of the protection plan is to protect Ngarelen springs by encouraging activities that enhance both water quality and quantity while discouraging activities that cause the spring's catchment to deteriorate.

| Activity | Sub-activity | Timeframe | Cost | Responsibility |
|---|---|---|---|---|
| Gazettement of GCA | Delineate & survey the spring's catchment area. | 2021 | 200,000 | WRA, WRUA, Kajiado County Lands & Survey Team |
| | Develop the Part Development Plan for the spring catchment | 2021 | 500,000 | WRA, SoK, County Government of Kajiado |
| | Create awareness on the status of the spring's catchment area. | Continuous | 300,000 | WRA, KWS, WRUA, NEMA, County Government, |

| | | | | |
|---|---|---|---|---|
| | | | | Irrigation Canals. |
| | Develop guidelines and conservation/protection plan through stakeholders engagement | 2021 | 500,000 | WRA with all stakeholders |
| | Submit gazettement instrument to the AG | 2021 | 500,000 | WRA |
| Enforcement of Ngarelen springs catchment guidelines and other legislations | Enforce Ngarelen springs catchment guidelines, management plan and relevant legislations | continuous | 5,000,000 | WRA, County, Govt, NEMA, KWS. |
| | **Total** | | **7,000,000** | |

### *3.4 Conservation/Protection Plan*

The objective of the conservation plan is to maximize the yield of Ngarelen springs by promoting beneficial land and water management practices.

**Actions**

The conservation/protection plan proposes the following activities:

- 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 | Responsibility |
|---|---|---|---|---|
| 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 |
| **Sub-Total** | | | **10,500,000** | |
| Rain water storage enhancement. | Installation of 20 10m$^3$ Rain water harvesting tanks in public institutions/public land | Continuous | 4,000,000 | WRA, County Government and WRUA |
| | Construction of 2No. 10,000m$^3$ water pans | Continuous | 10,000,000 | WRA, County Government and WRUA. |
| **Sub-Total** | | | **14,000,000** | |
| 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 & washing clothes near the springs. | 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 |
| **Sub-Total** | | | **11,800,000** | |
| Controlling encroachment | Review legality of titles and resolving | Continuous | 5,000,000 | NLC, WRA, County Government. |

| Activity | Sub-activity | Timeframe | Cost | Responsibility |
|---|---|---|---|---|
| and review of grants | | | | |
| **Sub-Total** | | | **5,000,000** | |
| | **TOTAL** | | **31,850,000** | |

### *3.5 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 samples and taking to the lab in NRB. | 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 |
| | **Total** | | **5,700,000** | |

### *3.6 Establishment and operationalization of management structure*

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

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

| *Activity* | *Sub-activity* | *Timeframe* | *Cost* | *Responsibility* |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Setting up the management structure | Appoint 1No. Member from each of the following stakeholders:<br>1. Kenya Forest Service<br>2. National Environment Mgt Authority<br>3. National Government Administration in Kajiado South Sub County;<br>4. Kenya Wildlife Service;<br>5. Ministry of Agriculture;<br>6. Nalepo WRUA; | 3 months | 250,000 | WRA |
| | Terms of References (ToR) will include but not limited to:<br>▪ To manage the catchment prudently on behalf of other stakeholders<br>▪ To submit quarterly reports to WRA - ACA on all planned and implemented activities ;<br>▪ To develop by - laws and submit a copy to WRA – ACA for approval before implementation | Continuous | 0 | WRA, Nalepo WRUA |
| | Mandate and responsibilities:<br>▪ Promote the conservation and | Continuous | 0 | Nalepo WRUA, WRA |

| | | | | |
|---|---|---|---|---|
| | protection of the catchment<br>▪ Promote equitable distribution of the resources within the catchment<br>▪ Promote socio-economic and environmental sustainability of the catchment | | | |
| | The sources of funds for the committee may include:<br>▪ Bee keeping<br>▪ Tree Nursery;<br>▪ Eco-tourism;<br>▪ Well-wishers/Donors<br>▪ WRA/WRUA - (WDC) | Continuous | 5,000,000 | WRA |
| 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.

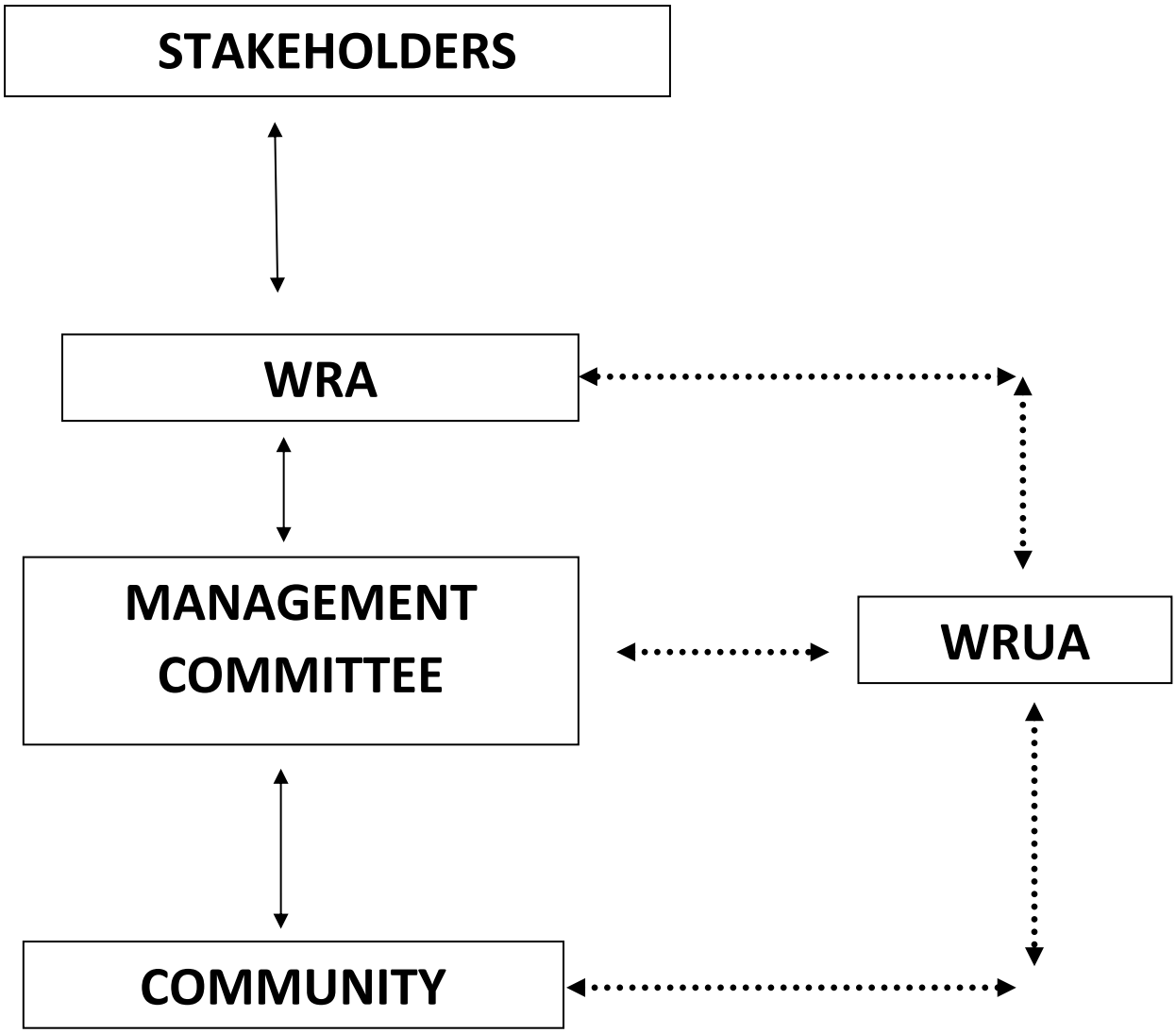


*Fig.3. Reporting Linkages for the Management Committee*

## *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 | | | | | | |
| | | | | | | | | |