

# SUB-CATCHMENT MANAGEMENT PLAN(SCMP)

## VERSION: 2



Republic of Kenya

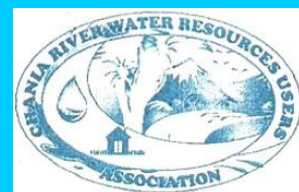
**BASIN:** TANA BASIN  
**SUB REGION:** UPPER TANA SUB REGION  
**NAME OF WRUA:** CHANIA RIVER WATER RESOURCES USERS ASSOCIATION



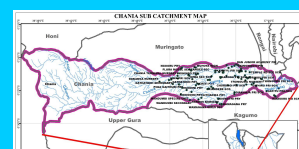
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**OCTOBER, 2019**



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## ACKNOWLEDGEMENTS

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This Sub Catchment Management Plan (SCMP) was first developed within the year 2009 with an implementation period of five (5) years. After the lapse of five years, need arose for the review of the sub catchment management plan. Wetlands International Eastern Africa through a Critical Ecosystem Partnership Fund (CEPF) collaborated with Water Resources Authority (WRA) Upper Tana Sub Regional Office and Chania River Water Resources User Association (WRUA) to review Chania SCMP. We take this opportunity to thank the stakeholders who took part in the review of the SCMP, just to mention a few; Kenya Forest Service (KFS), CocaCola, Coffee Green Growers, Nyeri County Ministry of Water, NEMA, and Ministry of Health. Our utmost appreciation goes to the WRUA members who provided priceless input and contribution towards the review of the sub catchment management plan.

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## EXECUTIVE SUMMARY

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Chania River Sub-Catchment Management Plan (SCMP) was reviewed to facilitate the management of Chania sub-catchment located within the Upper Tana in Tana basin following the lapse of the sub catchment management plan that had been developed in the year 2009. The development of the Plan is the implementation of the provisions of the following policy and legal documents; Water Act 2016, Water Resources Management Rules 2007, and WRUA (Water Resources Users Association) Development Cycle 2014 (WDC) all which provide for the regulation and management of water resources.

Chania Sub catchment occupies an area coverage of 277.79SqKm with most of the Upper section occupying a gazetted area within the Aberdare forest. The middle and lower section of the sub catchment supports subsistence and commercial activities, the sub catchment is home to the Nyeri County headquarters a factor that has contributed to the presence of diverse stakeholders with various interest within the sub catchment.

Administratively, the sub catchment falls under the Upper Tana sub regional office whose office is located in Murang'a. The Water Act 2016 provides that the Water Resources Authority (WRA) mandate is to regulate the use and management while the County government in this case Nyeri County shall facilitate the management of resources. During the review of the sub catchment management plan, various challenges with regard to the use and management of water resources within the sub catchment were identified. While these challenges have been discussed, some of the challenges include; Non-compliance, Water Pollution, Inadequate institutional capacity to run WRUA activities, Siltation, Inadequate capacity on alternative livelihood activities, Inadequate water infrastructure and inadequate capacity to mobilize resources among other challenges identified during the focused group discussion from the workshop.

Through problem analysis during the workshop, participants evaluated challenges that should be prioritised as follows; capacity building the community through the WRUA on alternative livelihood activities, capacity building the WRUA on resource mobilization, improving WRUAs institutional capacity to run the WRUA and Institution of strategies to reduce riparian and wetland encroachment. In order to implement the strategies identified to reduce further degradation of Chania River Sub catchment and related soil and water resources, a work plan was formulated during the stakeholder engagement whose estimated budget was found to be totalling to Kshs **117,292,000** throughout the **10 year** implementation period.

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## ABBREVIATIONS

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%	Percentage
°C	Degrees Celsius
AIDS	Acquired Immuno Deficiency Syndrome
APS	Abstraction and Pollution Survey
ASAL	Arid and Semi-Arid Lands
ASL	Above Sea Level
BH	Borehole
BHN	Basic Human Need
BWRC	Basin Water Resource Committee
CBOs	Community Based Organizations
CIDP	County Integrated Development Plan
CMS	Catchment Management Strategy
CMU	Catchment Management Unit
CoK	Constitution of Kenya
EC	Electrolytic Conductivity
EDCP	Effluent Discharge Control Plan
HIV	Human Immunodeficiency Virus
i.e.	‘that is’
IWRM	Integrated Water Resources Management
KARLO	Kenya Agricultural and Livestock Research Organization
KFS	Kenya Forest Service
KM <sup>2</sup>	Kilometers Squared
KMD	Kenya Meteorological Department
m <sup>3</sup> /day	Cubic Meters per Day
MCM	Million Cubic Meters
MCM/yr.	Million Cubic Meters per Year
MoA	Ministry of Agriculture
MoH	Ministry of Health
MWI	Ministry of Water and Irrigation (currently Ministry of Water and Sanitation)
NEMA	National Environmental Management Authority
NIB	National Irrigation Board

NGOs	Non-Governmental Organizations
NWRMS	National Water Resource Management Strategy
p.a	Per Annum
PDB	Permit Data Base
PM	Procedure Manual
QMS	Quality Management System
RGS	Regular Gauging Station
RQO	Resource Quality Objective
SCMP	Sub Catchment Management Plan
SWOT	Strengths, Weaknesses, Opportunities, and Threats
USGS	United States Geological Survey
WAP	Water Allocation Plan
WDC	WRUA Development Cycle
WRA	Water Resources Authority
WRM	Water Resources Management
WRUA	Water Resource Users Association

## GLOSSARY

TERM	DESCRIPTION
<b>Annual sustainable yield</b>	It is defined as the average amount of ground water that can be pumped without adversely affecting the quantity or quality of ground water in a year.
<b>Aquifer</b>	An underground geological formation able to store and yield water.
<b>Available water</b>	This refers to the surface and ground water potential within the sub-catchment that can meet basic human needs
<b>Ecosystem Services</b>	These refer to varied benefits from the properly functioning natural environment.
<b>Erosivity</b>	It is the measure of the potential ability of soil to be eroded by rain or surface runoff.
<b>Ground water -</b>	Means the water of underground streams, channels, artesian basins, reservoirs, lakes and other bodies of water in the ground, and includes water in interstices below the water table.
<b>Mean Annual Precipitation</b>	It is the average rainfall for a given year.
<b>Naturalized flow</b>	It is the measured river flow adjusted to take account of net abstractions and discharges upstream of the gauging station.
<b>Non-point Pollution</b>	This refers to water pollution that is caused by widely dispersed sources of pollutants such as runoff from agricultural areas draining into a river.
<b>Permit</b>	It is an official document giving someone authorization to abstract water under Water Act, 2016.
<b>Pollution</b>	It is the direct or indirect alteration of chemical, physical and biological properties of water rendering it harmful or potentially harmful
<b>Ground Water Recharge</b>	Refers to the process where water moves downward from surface water to groundwater.
<b>Reserve</b>	This is the amount needed to satisfy the environmental and basic human needs (Downstream)
<b>Resource Quality</b>	It refers to the total condition of the water body which includes all aspects of the water body including chemical, physical, and biological characteristics.
<b>Resource Quality Objective</b>	This is a description of the desired state of a water body with respect to all aspects of the resource quality ( <i>see Resource Quality</i> ).
<b>SCMP Investment</b>	In this context, it refers to the financial resources or capital costs required to enable the WRUA undertake specific projects outlined in the Sub-Catchment Management Plan.
<b>Transfers</b>	It is the amount of water being conveyed for use in another catchment
<b>Water Allocation Plan</b>	Refers to a document that sets out the rules for water use within a sub-catchment for long term resource sustainability
<b>Water Demand</b>	This is the established current and future water needs in the sub catchment
<b>Water Resource Management</b>	Refers to the conservation, protection, development and utilization of water resources.
<b>Water user</b>	Refers to a person using water from a water resource
<b>WRUA</b>	It is an association of water users, riparian land owners, or other stakeholders who have formally and voluntarily associated for the purposes of cooperatively sharing, managing and conserving a common water resource
<b>WRUA Development Cycle</b>	This is a guideline that provides an overall framework for channelling investment into water resource management at the local level, mainly through WRUAs.

TERM	DESCRIPTION																																
<b>WRUA operational budget</b>	Refers to expenses and revenues associated with the WRUA undertaking its normal operations such as holding meetings and running their day to day office operations.																																
<b>Sub catchment Demand classification</b>	<p>Three types of demands are recognized as; ecological, livelihood and commercial. Each type of demand is sub-divided into three classes of importance: high (1), medium (2) and low (3) as shown in below.</p>																																
<b>Sub Catchment Resource Status Classification</b>	<p>Each sub-catchment or aquifer can be described as one of three states, alarm, alert or satisfactory, where alarm denotes a state that requires careful attention and satisfactory denotes a state that does not currently experience stress.</p> <table border="1"> <tr> <td>Category</td><td>State of the resource</td></tr> <tr> <td>Category 1</td><td>ALARM</td></tr> <tr> <td>Surface Water</td><td>Resource is periodically scarce Water reserve threatened</td></tr> <tr> <td>Groundwater</td><td>WQ or levels declining</td></tr> <tr> <td>Water Quality</td><td>Catchment severely degraded Pollution levels high Risk to human life is high</td></tr> <tr> <td>Conflicts</td><td>Potential for conflicts is high</td></tr> <tr> <td>Category 2</td><td>ALERT</td></tr> <tr> <td>Surface Water</td><td>Trend is towards scarcity</td></tr> <tr> <td>Groundwater</td><td>Trend is towards over abstraction</td></tr> <tr> <td>Water Quality</td><td>Declining trend in water quality</td></tr> <tr> <td>Conflicts</td><td>Ingredients for conflicts, e.g. ethnic, religious, language divisions</td></tr> <tr> <td>Category 3</td><td>SATISFACTORY</td></tr> <tr> <td>Surface Water</td><td>Water resource sufficient in quantity &amp; quality</td></tr> <tr> <td>Groundwater</td><td>No measured impacts</td></tr> <tr> <td>Water Quality</td><td>WQ adequate, low risk</td></tr> <tr> <td>Conflicts</td><td>Low risk of conflict</td></tr> </table>	Category	State of the resource	Category 1	ALARM	Surface Water	Resource is periodically scarce Water reserve threatened	Groundwater	WQ or levels declining	Water Quality	Catchment severely degraded Pollution levels high Risk to human life is high	Conflicts	Potential for conflicts is high	Category 2	ALERT	Surface Water	Trend is towards scarcity	Groundwater	Trend is towards over abstraction	Water Quality	Declining trend in water quality	Conflicts	Ingredients for conflicts, e.g. ethnic, religious, language divisions	Category 3	SATISFACTORY	Surface Water	Water resource sufficient in quantity & quality	Groundwater	No measured impacts	Water Quality	WQ adequate, low risk	Conflicts	Low risk of conflict
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## **1 INTRODUCTION**

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### **1.1 SCMP Development**

Sub-Catchment Management Plan (SCMP) is a tool developed to support protection, conservation and management of water resources and related natural resources within the sub-catchment to ensure sustainable and balanced water resources utilization for both socio-economic benefits and ecosystem management. SCMP is developed through a consultative process with key stakeholders to gather consensus on strategy and framework for water resources and catchment conservation and management at the sub-catchment level to ensure sustainable use of the available water resources.

SCMP focuses on problems related to protection, conservation and management of water resources, ecosystem and other related natural resources including socio-economic activities that majorly depend on natural resources within the sub-catchment. It presents analysis of the problems and identifies sustainable solution strategies for proper management of water resources (quantity and quality), improvement of catchment conditions and enhancement of livelihoods. In addition, it analyses institutional capacity for effective and efficient implementation of the identified sustainable solution strategies.

The SCMP provides a framework for which various stakeholders can participate in a coordinated integrated water resources management activity.

### **1.2 Policy and Legislative Framework**

Kenya's Vision 2030 adopted in 2006 has 5-year plans that were aligned towards achieving the out-phased Millennium Development Goals (MDG) and now the Sustainable Development Goals set by the United Nations General Assembly in 2015. Among the 17 Goals is the attainment of clean water and sanitation (GOAL 6). Water resources management has been specifically addressed by Article 42 of the Constitution of Kenya (CoK), confers on every person a right to a clean and healthy environment which includes the right to have the environment protected for the benefit of present and future generations. Article 191 (1) c of the CoK directs the role of National government to be that of providing national legislation that are necessary for the protection of the environment. The Water Act, 2002 initiated the start of water sector reforms which have been and are still being implemented across the water sector. Key among the requirements of the reform was to devolve water service provision and resource management to the lowest level of the economy. This has been achieved through the creation

of institutions that have cascaded well-coordinated roles from the national to the regional level. The establishment of Water Resources Management Authority (WRMA) in 2005, which later was renamed to Water Resources Authority (WRA) in the dispensation of the Water Act 2016 and the acknowledgement of the WRUA as legal entities in the management of water resources confirms the efforts in place to achieve the goals of the reforms. Section 6, of the Act directs the regulation of use and management of water resources to be a responsibility of the WRA as an agent of the national government. Article 61 (1) d of the CoK provides for the involvement of the public in the management, protection and conservation of the environment.

The legal framework was also established with the enactment of the Water Act which gives the legal provisions and the Water Resources Management (WRM) rules, 2007 which outlines the rules that govern the use and management of water resources in all its diversity. The Fourth Schedule Part ii (10) of the CoK confers to the county governments the function of implementing specific national policies pertaining natural resource and environment conservation which include soil and water conservation also forestry. Section 29(1) of the Act provides for the possibility of establishing a Water resource users association (WRUA) which shall be a community-based association for collaborative management of water resources and conflict resolution. A Sub-Catchment Management Plan (SCMP) is a tool that has been adopted by the government and implemented through the WRUA to facilitate the lowest public participatory implementation of the mandate of managing water resources. More essential to the structure is the establishment of WRUA which has now been widely adopted across the country and about half have developed SCMPs. It is within this clarity that this plan is developed and implemented for the benefit of implementing national plans for the benefit of all citizens.

### **1.3 SCMP Objectives**

The overall objective of this SCMP is to balance water resource utilization and conservation by enabling the water resource to be protected, enhanced and where appropriate restored through a participatory agreed platform for planning and implementation.

### **1.4 Timeframe for the SCMP**

This SCMP is valid to a maximum period of 10 years of implementation from the date of adoption. A SCMP shall be reviewed at any time of compelling need especially when sub catchment dynamics are changed by some intrinsic or external variables such as introduction of high impacting projects that adversely change the state of sub catchment with regard to water resources and livelihoods of the residents.

### **1.5 SCMP Implementation Strategy**

The SCMP will be implemented in a collaborative approach with key stakeholders. Roles and obligations of each stakeholder has been defined in the activity plan. However, it is expected that implementation of activities will be through the WRUA with technical support from partners, donors and the relevant government departments. The implementation process shall be participatory and shall consider inclusion of the marginalized groups like women, youths, vulnerable groups and children and will deliberately encourage and support their involvement through strategic inclusion, support and capacity building. Capacity building will be a continuous process during project implementation. However, focus committees shall be established within the WRUA to lead in implementation and coordination of the plan.

### **1.6 SCMP development process**

This SCMP was reviewed on 30/09/2019 through a consultative process with key stakeholders. The process started with planning phase in which the SCMP development methodology was defined and stakeholder identification carried out. The planning phase was followed by data and information gathering and analysis. This step was to provide an overview of the sub-catchment and help on situation analysis before further engagements with the stakeholders. The third step was stakeholder engagements which was carried out from 30/09/2019 to 04/10/2019. The main objective of this step was to identify additional information on major water resources related problems, possible sustainable solutions to the identified problems and carry out problem analysis in order establish priority activities. Data analysis was then carried out and results used in preparation of a draft Sub-Catchment Management Plan. The draft SCMP was then discussed with a wide range of stakeholders and thereafter adopted as the plan to be implemented by the WRUA in collaboration with other stakeholders. The stakeholders included WRUA members, Nyeri County Government, CocaCola Company, Kenya Forest Service. The SCMP development process was financed under the Kenya Water Security and Climate Resilience Project.

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## **2 OVERVIEW OF THE SUB CATCHMENT**

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The chapter presents; stakeholders affected by water issues in the sub catchment, all the problems identified in the sub catchment, their causes, effects and possible solutions.

### **2.1 Problems identified**

- Non Compliance on water use
- Lack of water allocation plan
- Water Pollution
- Siltation
- Poor enforcement of laws & regulation
- Inadequate water infrastructure
- Inadequate capacity to undertake WRUA roles and responsibility
- Unfavourable condition to access clean, safe and adequate water
- Riparian/wetland encroachment
- Water Scarcity
- Inadequate capacity on alternative livelihood activities
- Inadequate
- Inadequate capacity to mobilise resources
- Inadequate institutional development capacity to run WRUA
- Landslides
- Lack of Transparency and Accountability

## 2.2 Problem Ranking

Table 1 Problem Analysis Matrix

Problems identified	Code	NCO	LWAP	WP	PELR	S	IWI	ICUW	UCA	IIF	RWE	WS	LCB	ICMR	IID	L	LTA
Non Compliance on water use	<b>NCO</b>		1	1	0	0	0	1	0	0	1	0	1	0	0	0	0
Lack of water allocation plan	<b>LWAP</b>	0		1	1	0	1	1	0	1	1	0	1	1	1	0	1
Water Pollution	<b>WP</b>	0	0		1	0	0	1	0	0	1	0	1	1	1	0	0
Poor enforcement of laws & regulation	<b>PELR</b>	1	0	0		0	0	1	0	1	0	0	1	1	1	0	0
Siltation	<b>S</b>	1	1	1	1		1	1	0	1	1	0	1	1	1	0	0
Inadequate water infrastructure	<b>IWI</b>	1	0	1	1	0		1	0	1	1	0	1	1	1	0	0
Inadequate capacity to undertake WRUA roles and responsibility	<b>ICUW</b>	0	0	0	0	0	0		0	1	1	0	1	1	0	0	0
Unfavourable condition to access clean, safe and adequate water	<b>UCA</b>	1	1	1	1	1	1	1		1	1	0	1	1	1	0	1
Inadequate Information Facility & Information Management		1	0	1	0	0	0	0	0		1	0	1	1	1	0	0
Riparian/wetland encroachment	<b>RWE</b>	0	0	0	1	0	0	0	0	0		0	1	1	1	0	0
Water Scarcity	<b>WS</b>	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1
Inadequate capacity on alternative livelihood activities	<b>LCB</b>	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0
Inadequate capacity to mobilize resources	<b>ICMR</b>	1	0	0	0	0	0	0	0	0	0	0	1		0	0	0
Inadequate institutional development capacity to run WRUA	<b>IID</b>	1	0	0	0	0	0	1	0	0	0	0	1	1		0	0
Landslides	<b>L</b>	1	1	1	1	1	1	1	1	1	1	0	1	1	1		1
Lack of Transparency and Accountability	<b>LTA</b>	1	0	1	1	1	1	1	0	1	1	0	1	1	1	0	
	<b>COUNT</b>	<b>10</b>	<b>5</b>	<b>9</b>	<b>9</b>	<b>4</b>	<b>6</b>	<b>11</b>	<b>2</b>	<b>9</b>	<b>11</b>	<b>0</b>	<b>15</b>	<b>13</b>	<b>11</b>	<b>1</b>	<b>4</b>
	<b>RANK</b>	<b>4</b>	<b>7</b>	<b>5</b>	<b>5</b>	<b>8</b>	<b>6</b>	<b>3</b>	<b>9</b>	<b>5</b>	<b>3</b>	<b>11</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>10</b>	<b>8</b>

## 2.3 Problem analysis

Table 2 Detailed causal flow of problems identified

PROBLEM	CAUSE	EFFECT	SOLUTION
<b>Non-Compliance to water regulation on water allocation and use</b>	<ul style="list-style-type: none"> <li>• Lack of awareness</li> <li>• Impunity(You know but do not want to comply)</li> </ul>	<ul style="list-style-type: none"> <li>• Illegal abstraction reduces water levels</li> </ul>	<ul style="list-style-type: none"> <li>• Creation of awareness</li> <li>• Proper enforcement of the law</li> </ul>
<b>Lack of water Allocation plan</b>	<ul style="list-style-type: none"> <li>• Lack of capacity to develop a WAP</li> </ul>	<ul style="list-style-type: none"> <li>• Unregulated water use</li> <li>• Reduced water availability</li> <li>• Water use conflict</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a WAP</li> <li>• Capacity building WRUA on water management and Regulation (WRUA and Stakeholder involvement)</li> </ul>
<b>Water Pollution</b>	<ul style="list-style-type: none"> <li>• Poverty</li> <li>• Poor Farming methods</li> <li>• Poor planning of storm water drainages</li> <li>• Poor Infrastructural Development (Roads)</li> </ul>	<ul style="list-style-type: none"> <li>• Water Borne Diseases</li> <li>• Unnecessary cost in healthcare/Treatment</li> <li>• Reduced water quality</li> <li>• Loss of biodiversity (Flora and Fauna)</li> </ul>	<ul style="list-style-type: none"> <li>• Creating awareness</li> <li>• Enforcement of rules &amp; Regulations</li> <li>• Undertaking Pollution Survey</li> <li>• Proper Planning of drainage and settlement</li> <li>• Training WRUAs on simple water quality monitoring</li> </ul>
<b>Poor Enforcement of laws and regulations</b>	<ul style="list-style-type: none"> <li>• Conflicting regulations and acts</li> <li>• Lack of resources</li> <li>• Lack of awareness</li> <li>• Lack of Multi-agency cooperation</li> <li>• Corruption</li> <li>• Political good will/Influence</li> </ul>	<ul style="list-style-type: none"> <li>• Lawlessness (Unregulated water Use, Improper waste disposal close to water resources)</li> <li>• Lack of good leadership (Delays in development)</li> </ul>	<ul style="list-style-type: none"> <li>• Normalization of existing water acts</li> <li>• Involvement of all stakeholders</li> <li>• Creation of awareness</li> <li>• Provision of sufficient resources</li> <li>• Reporting corrupt elements</li> <li>• Bringing relevant services closer to the people</li> <li>• Political goodwill</li> </ul>

<b>Siltation</b>	<ul style="list-style-type: none"> <li>• Encroachment of riparian areas</li> <li>• Poor farming methods</li> <li>• Overgrazing</li> <li>• Deforestation</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced Water Volume</li> <li>• Pollution</li> <li>• Conflicts</li> <li>• Increased cost in water treatment (Chemicals)</li> <li>• Low food production due to erosion(Loss of nutrients)</li> </ul>	<ul style="list-style-type: none"> <li>• Create awareness on farming methods</li> <li>• Aforestation</li> <li>• Enforcement of law and regulation</li> <li>• Construction Soil and Water conservation structures</li> </ul>
<b>Inadequate Water Infrastructure Facilities</b>	<ul style="list-style-type: none"> <li>• Lack of adequate resources</li> <li>• Lack of awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Siltation</li> <li>• Inadequate water for utilization</li> <li>• Soil erosion</li> <li>• Loss of Soil fertility</li> <li>• Pollution of Water</li> <li>• Poor maintenance of existing storage facilities</li> </ul>	<ul style="list-style-type: none"> <li>• Construction of dams and water pans</li> <li>• Awareness creation</li> <li>• Resource mobilization</li> <li>• Creation of common intakes</li> <li>• Protection of springs</li> <li>• Sustainable maintenance of water storage facilities</li> </ul>
<b>Inadequate capacity to undertake WRUA roles and responsibilities</b>	<ul style="list-style-type: none"> <li>• WRUA members are unfamiliar with their roles and responsibilities</li> <li>• Lack of communication between WRUA members and the community</li> <li>• Lack of accountability and transparency</li> <li>• Members are unfamiliar with WRUA objectives</li> <li>• Ignorance and commitment lacking among WRUA members</li> <li>• Lack of involvement of members in decision making</li> </ul>	<ul style="list-style-type: none"> <li>• Dormancy of WRUA</li> <li>• Disagreement among the WRUA stakeholders &amp; community</li> <li>• Challenges in mobilizing and implementing</li> <li>• Poor management and decision making</li> </ul>	<ul style="list-style-type: none"> <li>• Create Publicity on the existence of the WRUA</li> <li>• To create sub committees per zone for easier communication and reporting</li> <li>• Timely and periodic meetings</li> <li>• Proper book keeping (Receipts, Audits)</li> <li>• Involvement of members in decision making</li> <li>• Pro-activeness of the members to understand the subcatchment</li> </ul>

	<ul style="list-style-type: none"> <li>• Lack of publicity of the WRUA</li> <li>• Unfamiliarity with the sub catchment</li> </ul>		
<b>lack of transparency and accountability.</b>	<ul style="list-style-type: none"> <li>• Selfishness</li> <li>• Failure to observe the constitution of WRUA</li> <li>• No implementation of WRUA objectives</li> </ul>	<ul style="list-style-type: none"> <li>• Collapse of WRUA.</li> <li>• Conflict with the group.</li> <li>• Lack of financial support from stake holders and members.</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building on ethical behavior, financial management, institution management.</li> <li>• Follow the constitution of WRUA.</li> </ul>
<b>Landslides</b>	<ul style="list-style-type: none"> <li>• Deforestation</li> <li>• Heavy rainfall</li> <li>• Poor farming methods</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of lives and property</li> <li>• Displacement</li> <li>• Loss of livelihood</li> <li>• Siltation of rivers (pollution )</li> </ul>	<ul style="list-style-type: none"> <li>• Afforestation</li> <li>• Terracing /gabions</li> <li>• Proper farming methods</li> <li>• Sensitization</li> </ul>
<b>Inadequate institution capacity</b>	<ul style="list-style-type: none"> <li>• Lack of funds</li> <li>• Lack of resources</li> <li>• Poor mobilization and coordination</li> <li>• Failure to understand WRUA objectives and constitution</li> <li>• Lack of transparency and accountability (poor leadership)</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of commitment</li> <li>• Collapse of institution</li> <li>• Internal conflict</li> </ul>	<ul style="list-style-type: none"> <li>• Create awareness and sensitization</li> <li>• Fiancé building on management, project management, governance and conflict resolutions</li> <li>• Recruit new members' proposal writing.</li> </ul>
<b>Lack of capacity building on alternative livelihood projects</b>	<ul style="list-style-type: none"> <li>• Inadequate funds</li> <li>• Lack of knowledge and ignorance</li> <li>• Resistance to change in activity</li> <li>• poverty</li> </ul>	<ul style="list-style-type: none"> <li>• Food insecurity</li> <li>• Poverty</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building on alternative livelihood projects</li> <li>• Implementing alternative livelihood</li> </ul>



<b>Inadequate information facility and information management</b>	<ul style="list-style-type: none"> <li>• Lack of resources</li> <li>• Lack of skills</li> <li>• Poor maintenance of monitoring facility and equipment's</li> <li>• Lack of commitment</li> <li>• Vandalism of equipment due to lack of security and knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• Unreliable data</li> <li>• Inadequate data and poor information sharing</li> <li>• Poor catchment development</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Create awareness</li> <li>• Establishment of water resources and monitoring equipment</li> <li>• Establish mechanism of information sharing</li> </ul>
<b>Unfavorable condition to access clean, safe and adequate water.</b>	<ul style="list-style-type: none"> <li>• Lack of awareness and ignorance of the community</li> <li>• Lack of and facilities to access water</li> <li>• Lack of proper management of the available water resources.</li> <li>• Poverty level.</li> <li>• Poor readership.</li> </ul>	<ul style="list-style-type: none"> <li>• Pollution</li> <li>• Water borne diseases.</li> <li>• Collapse of the targeted institution.</li> <li>• Exploitation of venerable groups</li> <li>• Conflict</li> <li>• Poor standard of living.</li> </ul>	<ul style="list-style-type: none"> <li>• Creating awareness building.</li> <li>• Enforcement of the law</li> <li>• Capacity building on Governance and project management.</li> <li>• Conflict resolutions.</li> <li>• Provision of storage facilities to venerable group</li> </ul>
<b>Inadequate capacity to mobilize resources</b>	<ul style="list-style-type: none"> <li>• Lack of commitment to support the WRUA constitution.</li> <li>• Lack of skills to write proposals.</li> <li>• Lack of awareness of WRUA objectives within the catchment.</li> </ul>	<ul style="list-style-type: none"> <li>• No implementation of WRUA objectives.</li> </ul>	<ul style="list-style-type: none"> <li>• Sensitization and mobilization of WRUA members.</li> <li>• Capacity building of WRUA member's management to write a proposal that can attract funding.</li> <li>• Carry out WRUA needs assessment.</li> </ul>

### **3.1 Introduction**

This chapter provides a baseline information of Chania sub catchment with regards to climate (Rainfall, Temperature etc), hydrology, hydrogeology, soils and demography. A special focus has also been given to anthropogenic activities within the sub catchment as well as the availability of stakeholders within the sub catchment outlining their interest in water resources as well as their linkage with the Chania River WRUA.

### **3.2 Location**

Chania Sub catchment, located at the heart of Aberdare ranges is one of the most strategic sub catchment in terms of ecosystem conservation. Its contribution to the water resources cannot be ignored owing to the abundance and quality of water resources within the catchment.

Hydrologically, the sub catchment occupies approximately **277.79Km<sup>2</sup>** within Sub basin **4AC** in **Tana Basin area**. Under Water Resources Authority (WRA) administrative coordination, Chania sub catchment is administered by **Upper Tana Sub region office**, through a MoU signed by Upper Tana Sub Regional office and Chania River Water Resources User Association (WRUA), however, Chania WRUA has their offices in Kamakwa, Nyeri town. Chania WRUA TWWDAs' offices in Kamakwa. Some of the most notable sub catchments that boarder Chania sub catchment area; Upper Gura and Kagumo to the South, Muringato and Honi to its North and Mid Sagana and Rongai to its North East. Chania sub catchment found within Tana Basin borders Rift valley basin from the West of Rift Valley basin.

Administratively, the sub catchment is located within Nyeri County bordering Nyandarua County from the Western side of Chania sub catchment. Chania Sub Catchment intersects 3 constituencies namely; Kieni, Tetu and Nyeri Town. On the other hand, the sub catchment intersects a total number of 8 Wards namely; Mweiga, Gatitu/Muruguru, Kamakwa/Mukaro, Kiganjo/Mathari, Ruring'u, Rware, Dedan Kimathi and Wamagana.

A total number of 32 sub locations intersects Chania sub catchment namely; Aberdare Forest, Chorongi, Forest, Gachika, Gathuthi, Gatitu, Gatumbiro, Gitathini, Githiru, Ichagachiru, Ihururu, Karunaini, Kamakwa, Karaihu, Karia, Kianjogu, Kigogo-ini, Kihatha, Kinunga, Kirurumi, Kiriti, Majengo, Marua, Mathari, Mununga-ini, Muruguru, Muthua-ini, Ngaini, Ngooru, Riamukurwe, Ruringu and Thunguma.

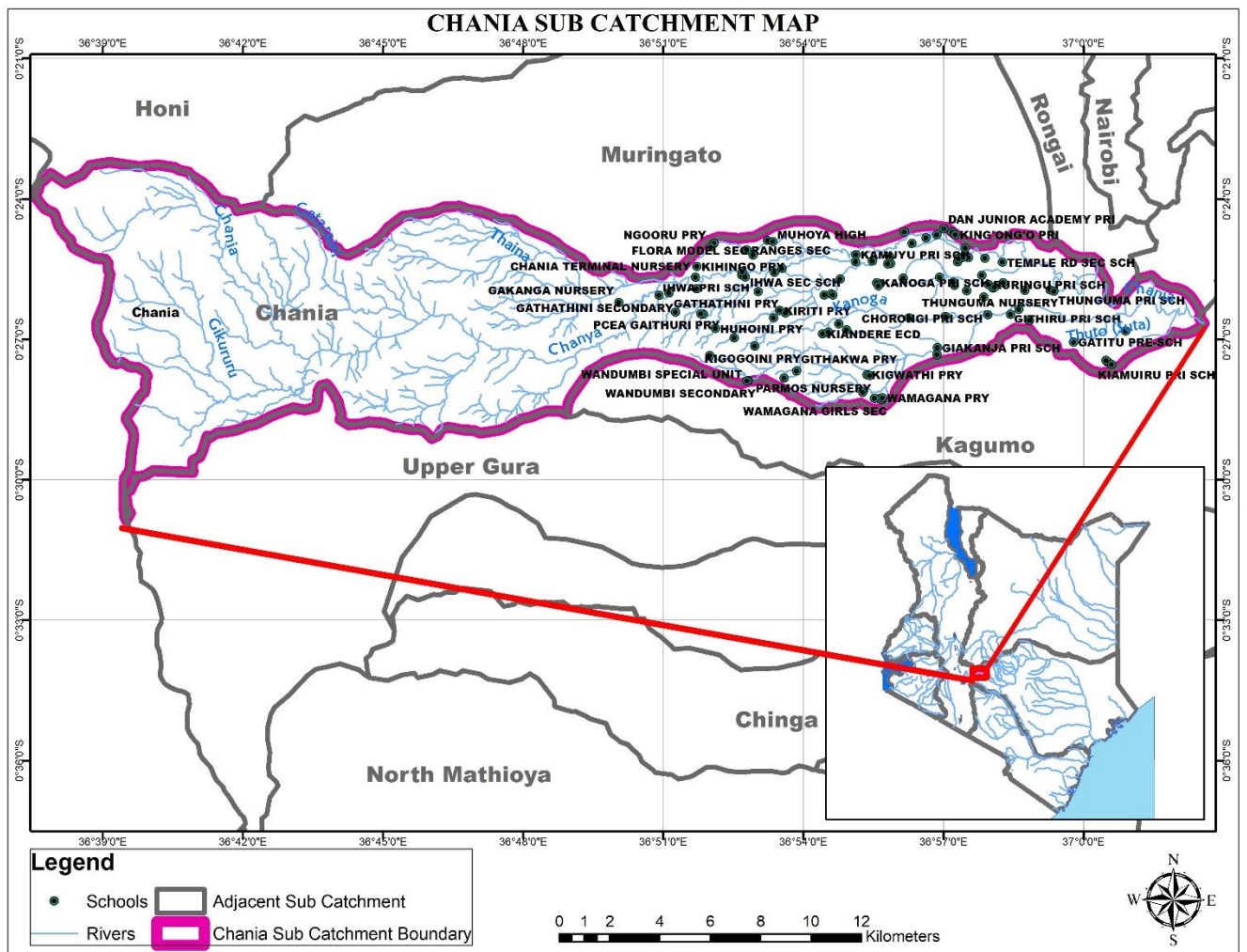


Figure 1 Chania Sub catchment map

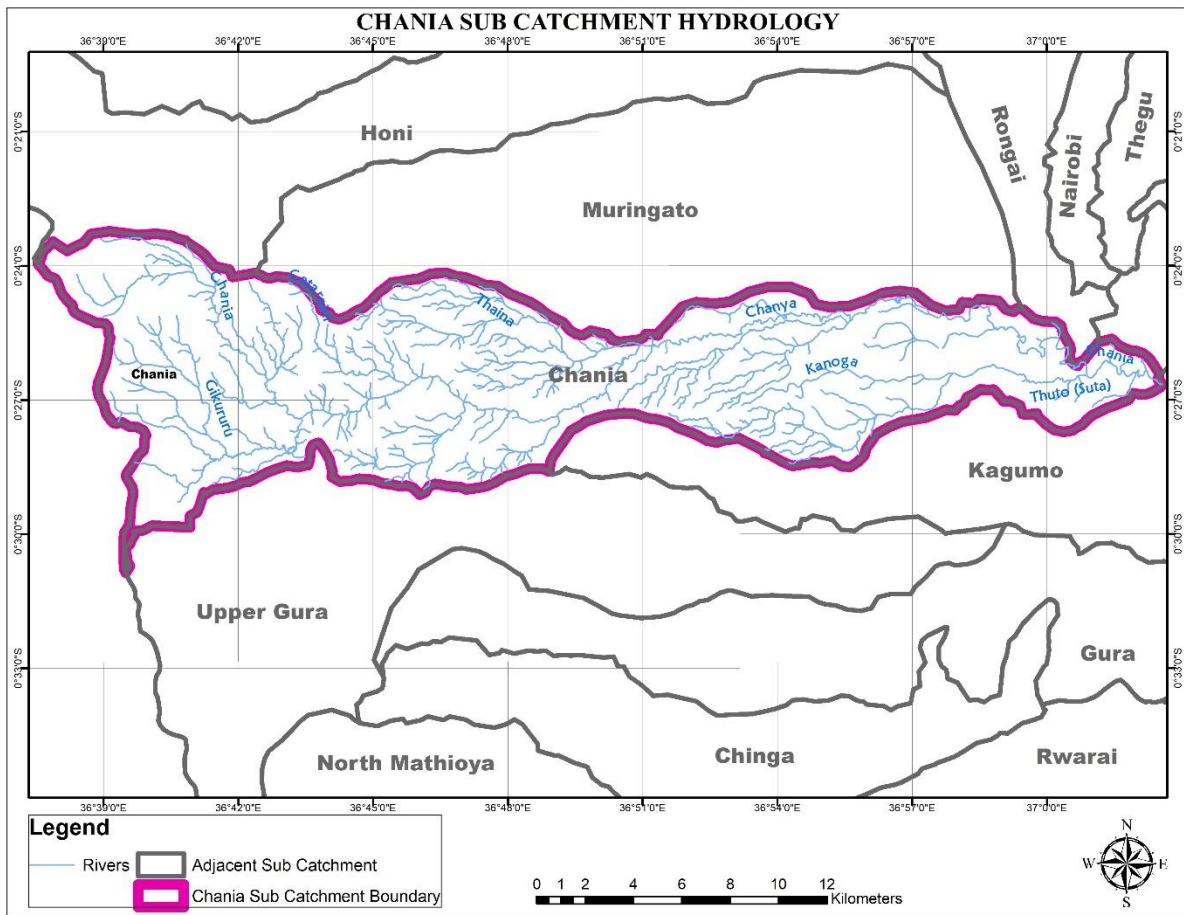
### 3.3 Climate

The rainfall pattern in Chania Sub-Catchment has changed in the recent past with years recording less than the mean annual rainfall becoming more frequent. The rainfall is bimodal in nature with the long rains occurring from April to July and short rains from September to December.

### 3.4 Hydrology

#### 3.4.1 Rivers

The sub catchment's major river is Chania which emanates from Aberdare forest to Sagana River, a stream length of approximately 73Km where it discharges all the river water from the other tributaries. Some of the notable tributaries within the sub catchment include; Zaina, Thuta, Kanoga, Gikururu, Gichi, Honi, Muthakame and Gataraini.



### 3.4.2 Springs

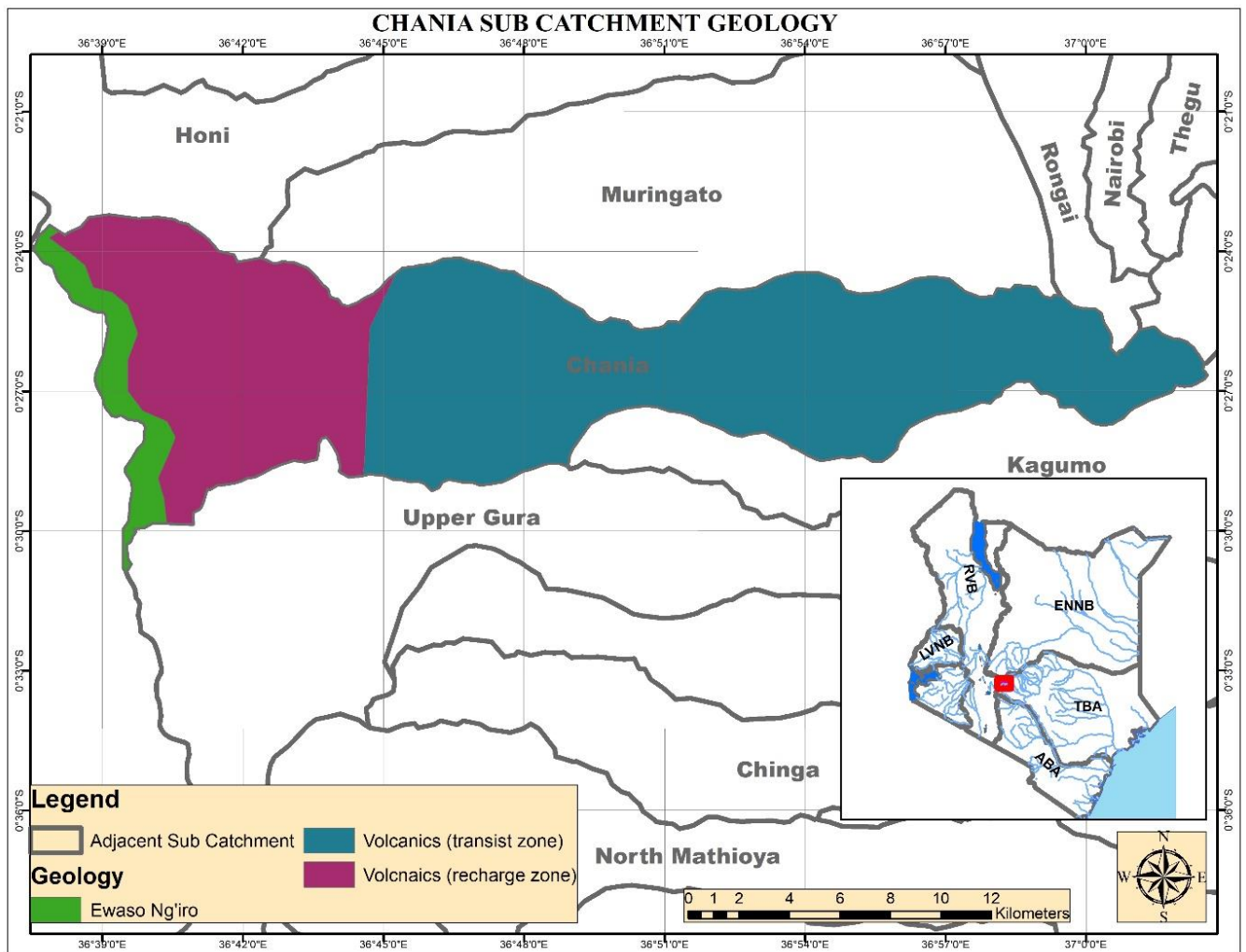
There are several springs within the sub catchment especially within the upper zone of the catchment where most rivers emanate. Some of the notable springs within the areas include Gatuuri, Ikeu, Nyakahiti, Gataro and Githiga,; however, there is a lot that need to be done in terms of baseline survey and water resource mapping within the sub catchment.

### 3.4.3 Wetlands

A great number of wetlands were identified during the stakeholder engagement, however, it was noted that these wetlands are at great risk due to encroachment. Some of the notable wetlands include Gakanga, Kiunyu, Machungwaine and Githwariga Figure below is a map of identified wetlands during the stakeholder engagement, however, more needs to be done in order to ensure establishment of baseline information on all the wetlands within the sub catchment.

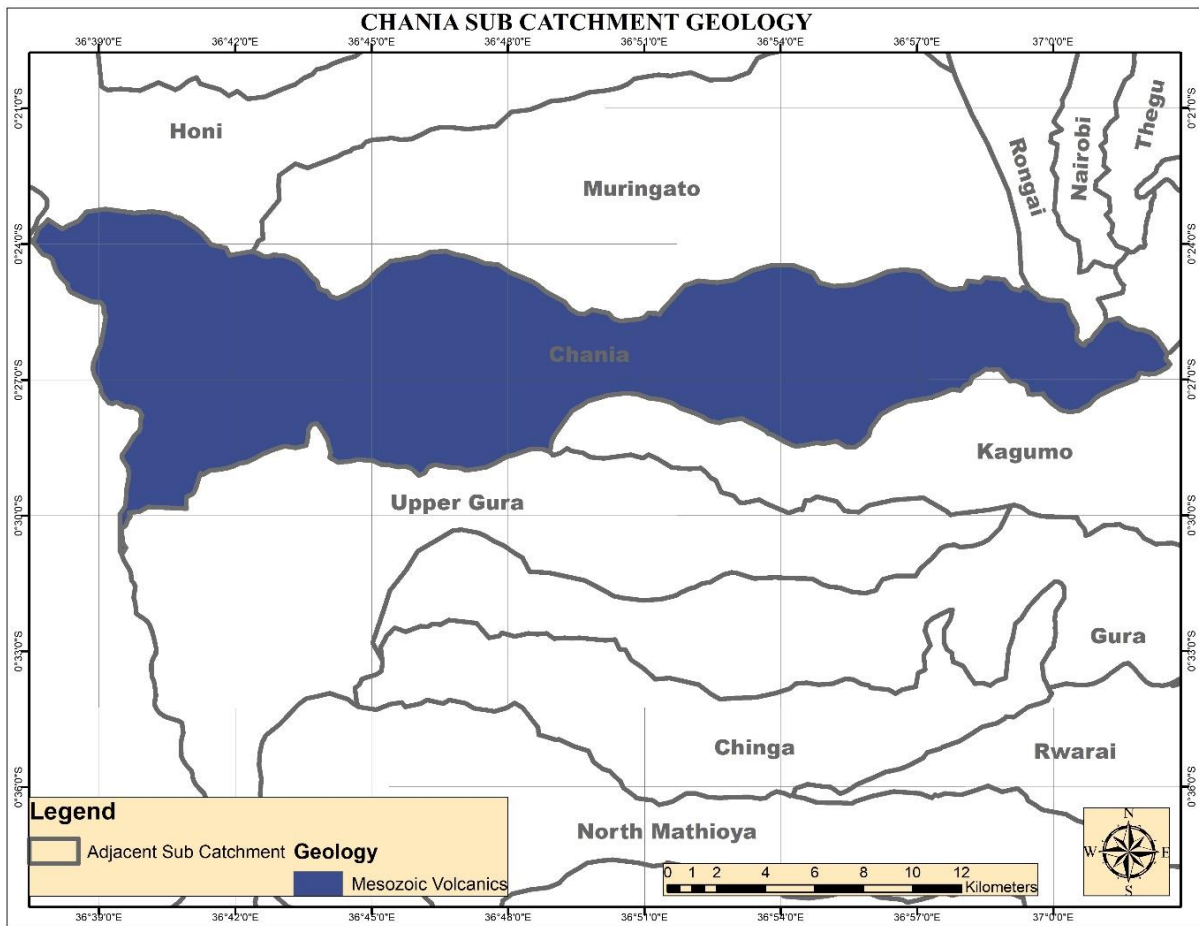
### 3.5 Ground Water

Based on a desk study on existing documentation such as the NWMP 2030, there exists great potential on groundwater within the sub catchment. However, due to the abundance and accessibility of surface water, groundwater has not been exploited to its full potential within the sub catchment with very few individuals sinking boreholes as identified from WRA's permit database.



### 3.6 Geology

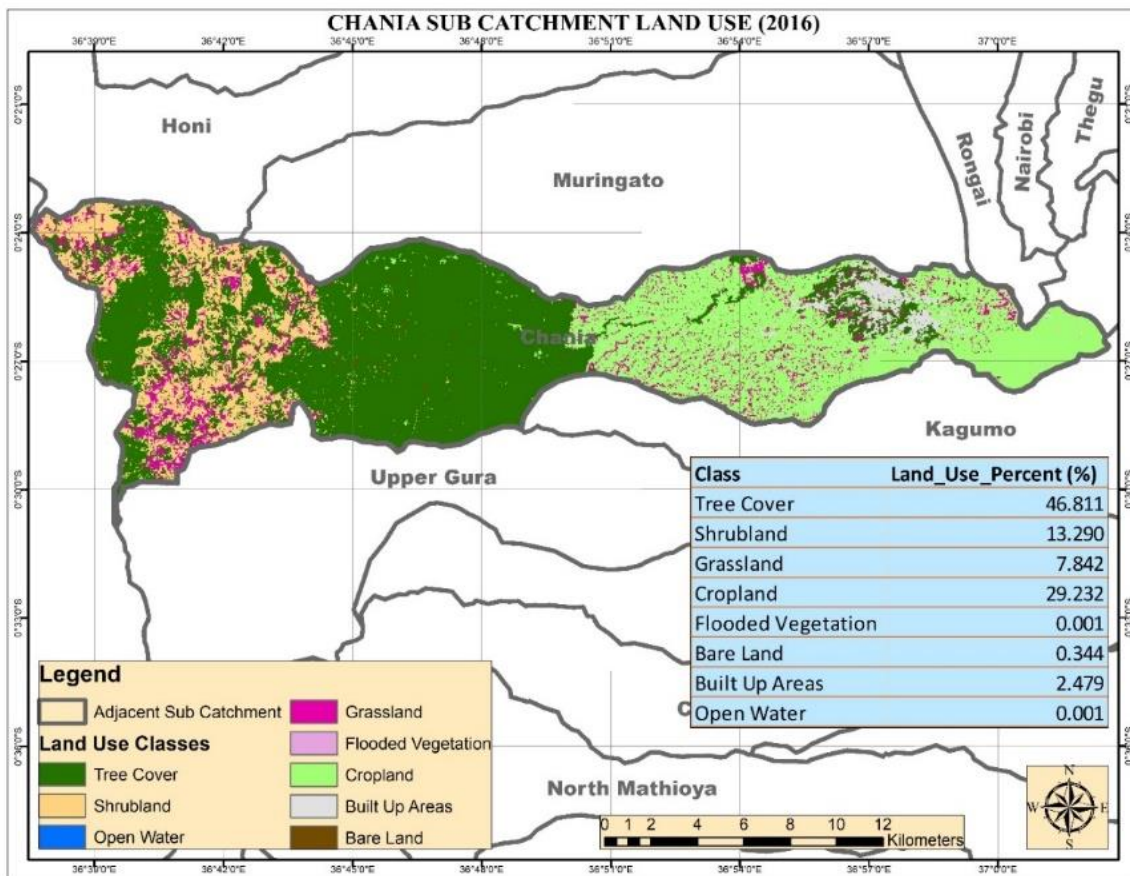
The sub catchment intersects on geologic formation namely Mesozoic Volcanic. The geologic formation is attributed to the volcanic eruptions. The Aberdare ranges are essentially the product of fissure volcanic eruptions but with their inner halves having been incorporated into the downthrown sides of the faulting activities that formed the Rift Valley in this area (KFS, 2019).



### 3.7 Land Use

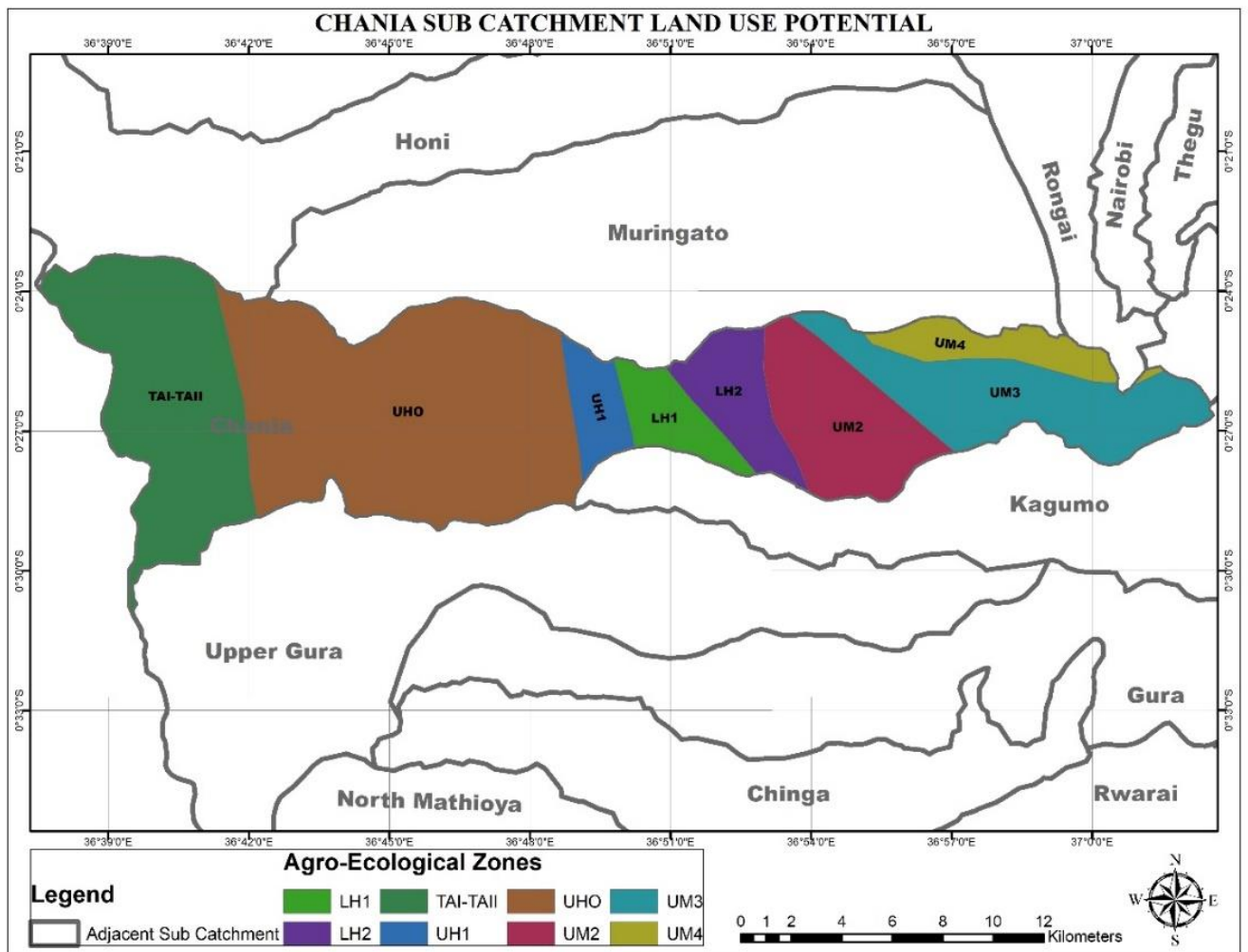
Based on land use developed for the period 2016, the land use is largely made up of forest cover (46.81%) within the upper zone of the catchment, cultivated land (29.2%) within the middle and lower zones and shrub land (13.3%) within the upper most zone of the sub catchment. Forested area is gazetted hence little human interference except by the herders who are authorised by the Kenya Forest Service (KFS) to graze their livestock with pasture found within the forest.





### 3.8 Land use potential

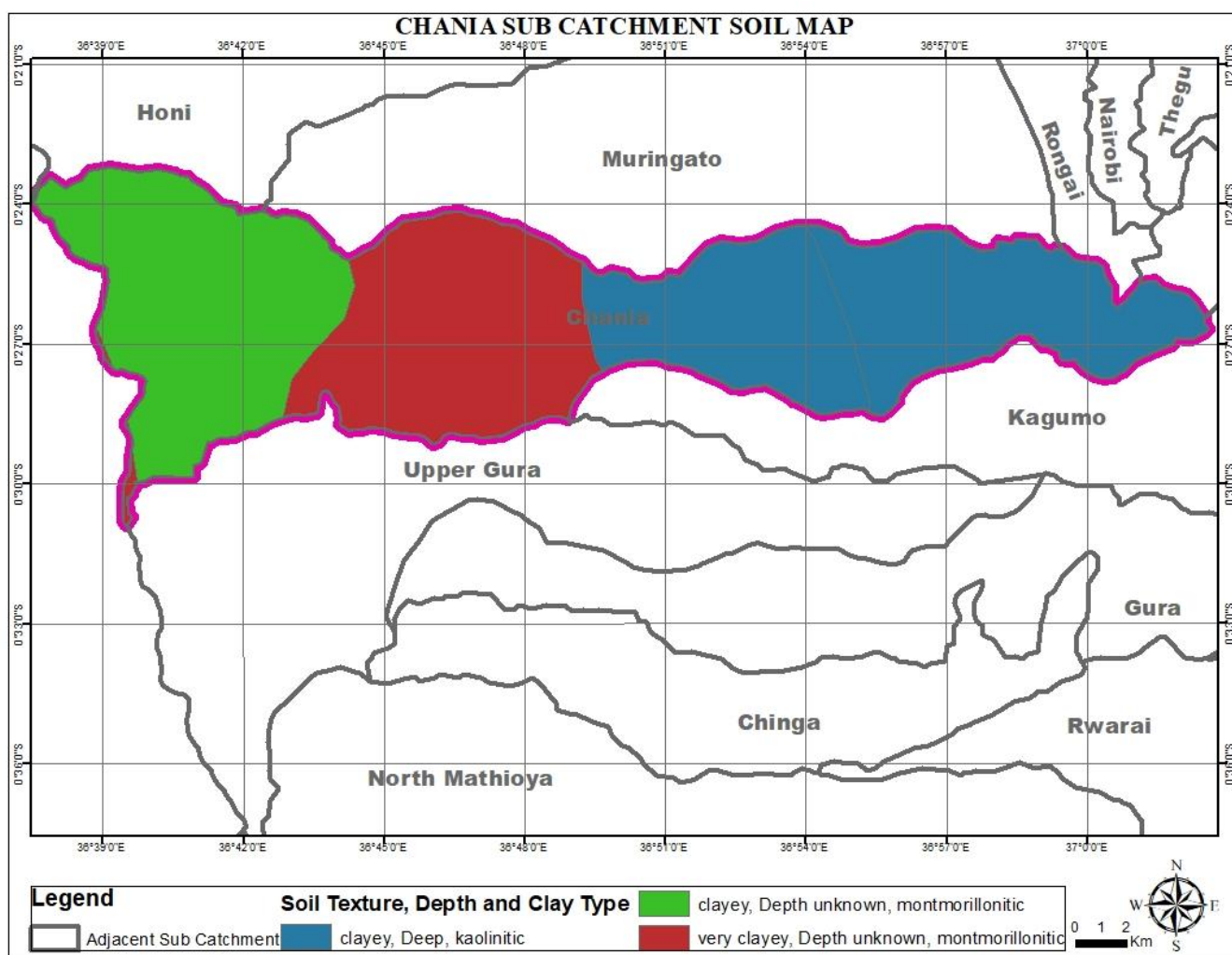
The land use potential within Chania sub catchment is demarcated into four (4) major zones namely; per humid, humid, sub humid, semi-humid and transitional zone, an indication that the area is found within a high potential area. The regions are further segregated into eight (8) agro-ecological regions namely; LH1, LH2, UH1, TAI-TA2, UM2, UH0, UM and UM4.



### 3.9 Soils

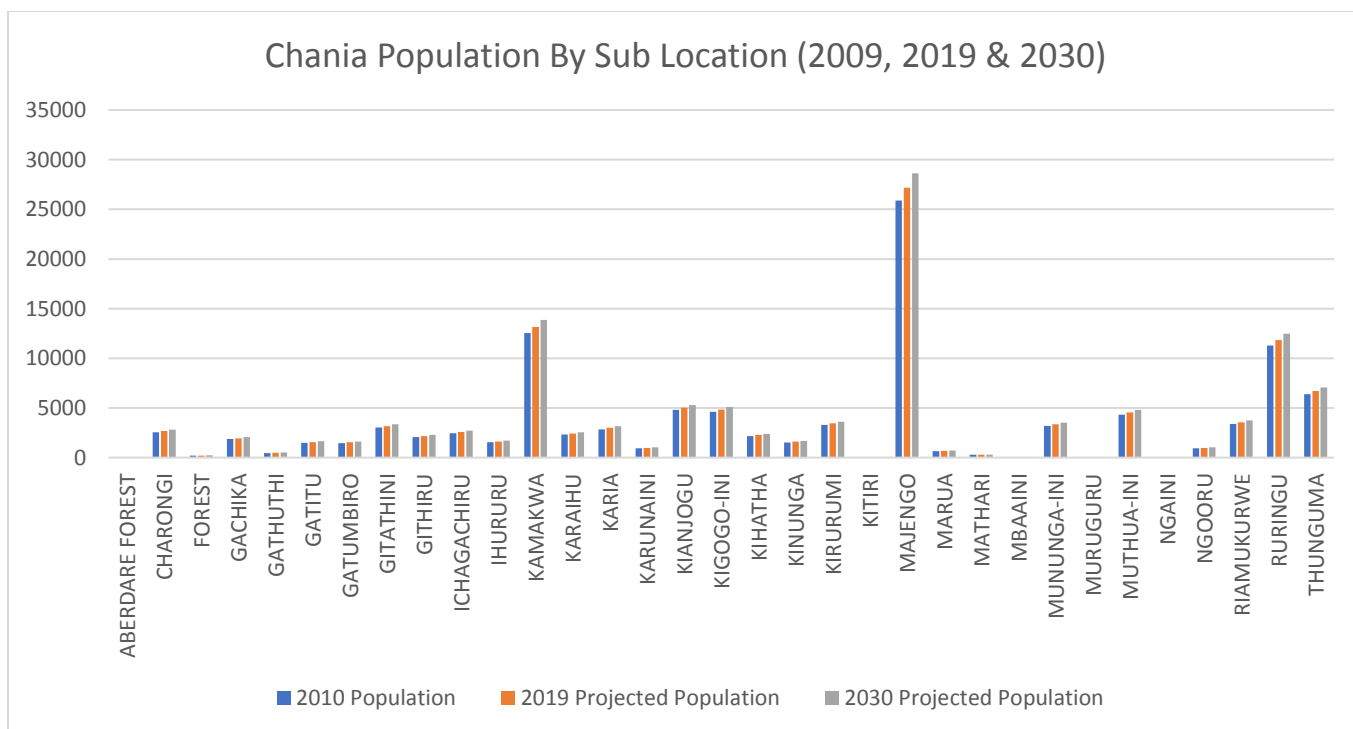
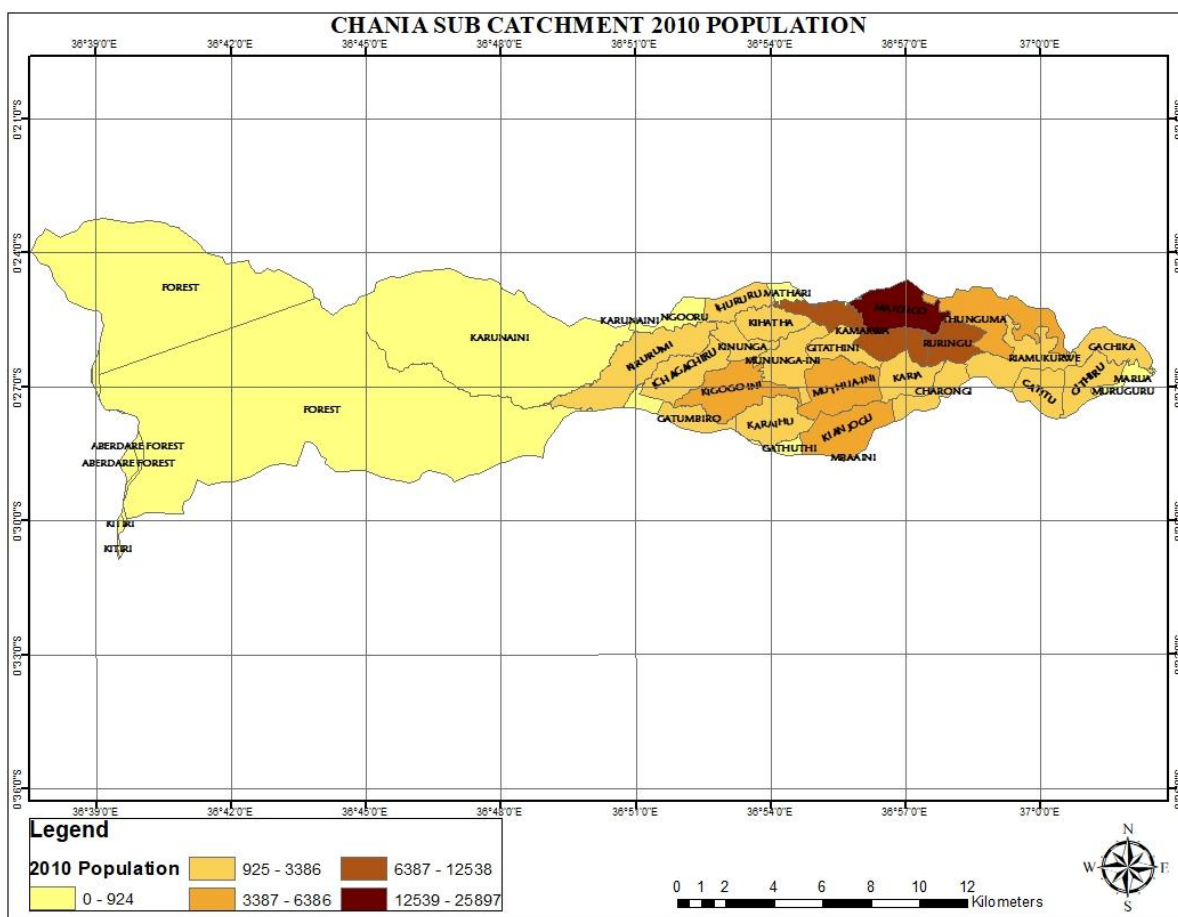
The soils within the sub catchment is comprised of clayey well drained soils, a factor that has contributed to proliferation of crops within the region. Owing to the fact that the soils are well drained, the soils have low susceptibility to erosion, however, areas that have a steep gradient are highly susceptible to soil erosion. Within the middle section of the sub catchment, the soils have been classified as very clayey owing to the location and extent of parts of Aberdare forest. The portion under the very clayey section of the sub catchment comprises the *montmorillonitic* clay type while the rest of the clay type of soil is comprised of *kaolinitic* type of clay. Figure below illustrates the soil types within the sub catchment.





### 3.10 Demographics

Chania Sub catchment enjoys a relatively high population with regards to its adjacent sub catchments. This is to several aspects not limited to devolution and proliferation of economic activities within Nyeri town, the county headquarters of Nyeri County. The middle section of the sub catchment where the Nyeri town is located enjoys the highest population in comparison to other sections within Chania sub catchment. Based on the national census undertaken in the year 2009, Chania sub catchment had an estimated population of approximately 108,546 personnel. However, 2019 and 2030 population projection estimates the population at 113,873 and 120,037 people respectively. Figure below illustrates population by sub location as estimated from the 2009 population census.



### 3.11 Stakeholder Mapping and Analysis

#### 3.11.1 Stakeholder mapping

Nyeri town, the county headquarters of Nyeri County is found within Chania sub catchment whereby many of the stakeholder's offices are based. On the other hand, proximity of Chania sub catchment to the Aberdare ecosystem has influenced the presence of some of the stakeholders as it was identified through a public participation workshop while developing the sub catchment management plan.

A sector based stakeholder mapping was undertaken through the SCMP development workshop in order to identify the role and or potential role they can play on aspects water resource use and management. Based on this, the following sector based categories of stakeholders were outlined;

- Faith Based Organisations
- Private Institutions
- Government stakeholders/State Organs (National and County)
- Non-governmental Organizations
- Self Help Groups
- Learning Institutions

Based on the above mentioned clusters, the WRUA members together with the stakeholders present identified the specific stakeholders under each cluster, this is as elaborated from the table below;

STATE ORGANS	FAITH BASED ORGANISATIONS	SELF HELP GROUPS
<ul style="list-style-type: none"> <li>• Water Resources Authority</li> <li>• Kenya Forest Service</li> <li>• National Environment Management Authority</li> <li>• Kenya Wildlife Service</li> <li>• Kenya Prisons (King'ong'o)</li> <li>• KENGEN</li> <li>• Disaster Management</li> <li>• KURA</li> <li>• KERRA</li> <li>• Nyayo Tea Zone</li> <li>• Ministry of Health</li> <li>• County Government (Dept of Agriculture, Water, Environment, Health and Sanitation)</li> <li>• NG-CDF</li> </ul>	<ul style="list-style-type: none"> <li>• Deliverance Church</li> <li>• Nyeri Muslim Association</li> <li>• Catholic Churches</li> <li>• Presbyterian Church of Eastern Africa (PCEA)</li> <li>• Barandia Muslim Association</li> <li>• Full Gospel Churches</li> <li>• Methodist Church</li> <li>• PEFA</li> <li>• AIPCA</li> <li>• ACK</li> <li>• SDA</li> <li>• Church of God</li> <li>• KAG</li> <li>• Jehovah Witness</li> </ul>	<ul style="list-style-type: none"> <li>• Mugunda Garbage Collectors</li> <li>• Nyeri Chania Divers</li> <li>• Chania Fish Farmers</li> <li>• St. Lawrence Self Help Group</li> <li>• Gatitu Goat Keepers Association</li> <li>• Mazingira Dancers</li> <li>• Kagongo Lower Estate</li> </ul>

<ul style="list-style-type: none"> <li>Ministry of Interior Coordination</li> </ul>		<ul style="list-style-type: none"> <li>City of Motherland Tree and Nurseries</li> <li>Gatitu Dairy Cow Group</li> <li>IHWA Springs</li> </ul>
<b>WATER SERVICE PROVIDERS</b>	<b>COMMERCIAL ENTITIES</b>	<b>HOTELS</b>
<ul style="list-style-type: none"> <li>Nyewasco</li> <li>TEAWasco</li> <li>Zamua (Zaina Muhoya Association Water Project)</li> </ul> Trans-catchment Water Providers (Abstracts from Gura but Irrigation projects in Chania) <ul style="list-style-type: none"> <li>Githiru Irrigation Water Project</li> </ul>	<ul style="list-style-type: none"> <li>CocaCola</li> <li>Highland Mineral Water</li> <li>Trout Garden Conservation Limited</li> <li>Trout Valley</li> <li>Coffee Farms and Factories (Several)</li> <li>Nyeri Golf Club</li> </ul>	<ul style="list-style-type: none"> <li>Westwood Hotel</li> <li>Central Hotel</li> <li>White Rhino Hotel</li> <li>Outspan Hotel</li> <li>Green Hills Hotel</li> <li>Batian Grand Hotel</li> <li>Eland Hotel</li> <li>Ilbis</li> <li>Whispers Hotel</li> </ul>
<b>HEALTH FACILITIES</b>	<b>NON-GOVERNMENTAL ORGANIZATIONS</b>	<b>LEARNING INSTITUTIONS</b>
<ul style="list-style-type: none"> <li>Outspan Hospital</li> <li>Nyeri County Referral</li> <li>Mt. Kenya Hospital</li> <li>Nyeri Medical Health</li> <li>Karen Hospital –Nyeri Branch</li> <li>Aga Khan Hospital – Nyeri Branch</li> <li>AAR</li> <li>Bliss hospital</li> <li>Nyeri Hospice</li> </ul>	<ul style="list-style-type: none"> <li>Green Belt Movement</li> <li>African Green Revolution</li> <li>Dedan Kimathi Foundation</li> </ul>	<ul style="list-style-type: none"> <li>Shama Academy</li> <li>Outspan Medical College</li> <li>Siema Academy</li> <li>Mt. Kenya Academy</li> <li>Good Shephard Primary</li> <li>Dedan Kimathi University – Town Campus</li> <li>Nyeri National Polytechnic College</li> <li>Kenya Institute of Agriculture – Wambugu Fram</li> </ul>

### 3.11.2 Stakeholder Analysis on Influence and Level on Interest

Centred on identified stakeholders, further analysis was done on all the stakeholders based on interest of stakeholders on water resources within the sub catchment and level of linkage with Chania WRUA. The analysis sought to identify at least two levels on linkages (High Linkage & Low Linkage) and interest (High Interest and Low Interest). Based on this a matrix was generated analysing the overlaps through the combination of the two categories for each level, this is as illustrated below;

**A: High Linkage and High Interest** – These are stakeholders who have an existing relationship/engagement/interaction with the WRUA and have high interest in water resources e.g. WRA, NEMA, KFS, and WSPs among others.

**B: Low Linkage and High Interest:** This comprises of stakeholders who have no existing relationship/engagement/interaction with the WRUA but have a high interest in water resource issues in the sub-catchment. They include Kenya Wildlife Service, KENGEN among other primary water users.

**C: Low Linkage and Low Interest:** These are stakeholders with no existing relationship with the WRUA and have no interest in water resource issues For instance some of the identified stakeholders under this cluster include; NG-CDF, King'ong'o Prisons, KURA and KERRA among others.

**D: High Linkage and Low Interest:** These includes stakeholders who have a relationship or have supported various WRUA activities but have low interest in water resources issues.

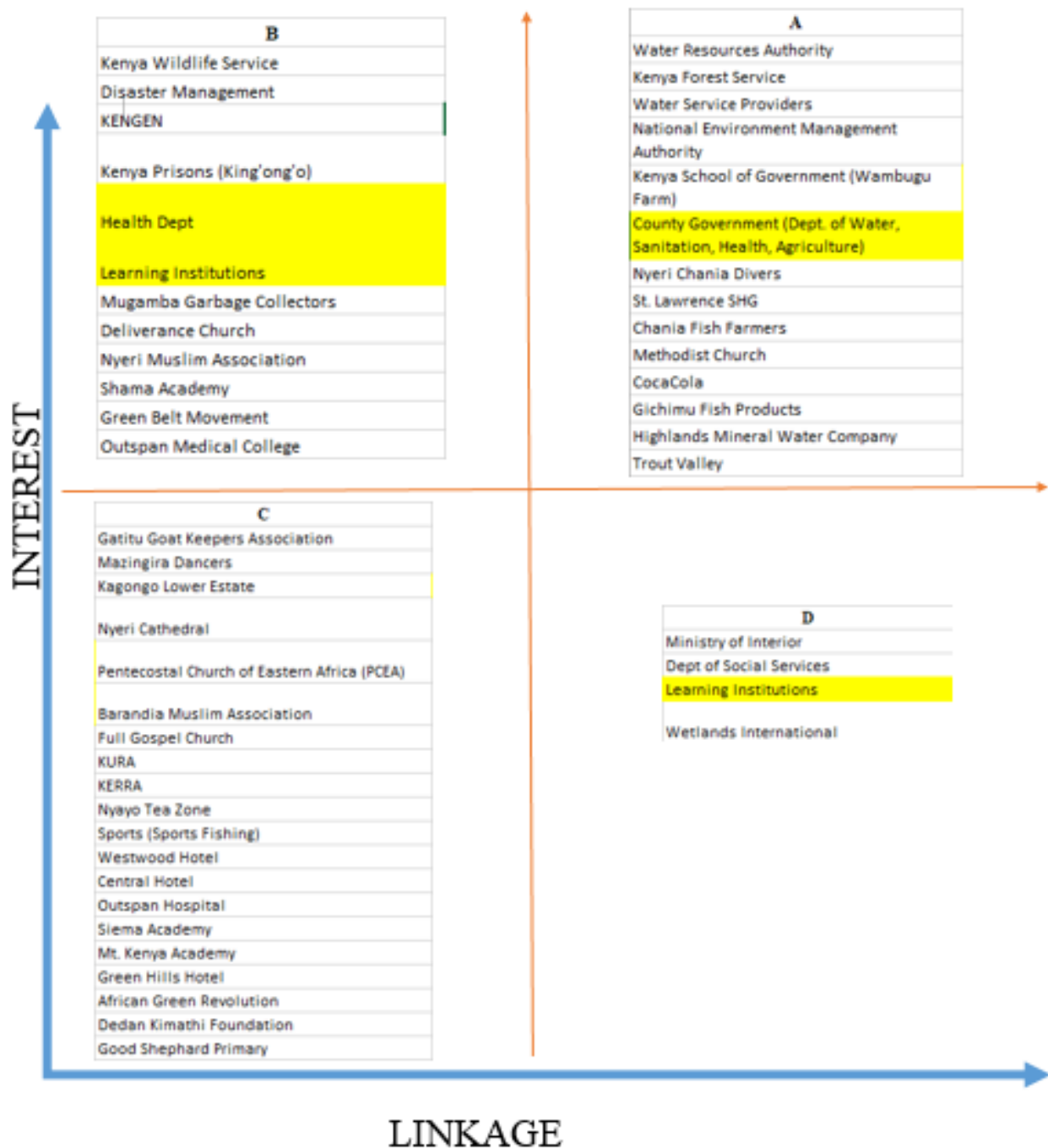


Figure 2 Stakeholder Analysis (Interest & Linkage)

### 3.12 Targets

- To establish baseline information of the sub catchment with regards to the physical and livelihood activities
- To continuously update baseline information in consultation with Water Resources Authority

### 3.13 Proposed outputs

- Baseline survey report
- Established database on existing water resource information

### 3.14 Activities plan and Budget

- Develop the activity plan clear with; major activities, specific activities, stakeholders involved, estimated budgets and implementation periods.

<b>CH: Catchment Characteristics</b>			
<b>Target</b>	<ul style="list-style-type: none"> <li>• To establish baseline information of the sub catchment with regards to the physical and livelihood activities</li> <li>• To continuously update baseline information in consultation with Water Resources Authority</li> </ul>		
<b>Output</b>	<ul style="list-style-type: none"> <li>• Baseline Survey Report</li> <li>• Established database on existing water resource information</li> </ul>		
<b>Activity</b>	<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
Baseline information Update	Notify the general public on the activity through posters and barazas	100	YEAR 2
	Train selected WRUA members on citizen science for continuous update of baseline information as well as for the proposed baseline mapping activity (3 Members per zone, 4 Zones)	250	YEAR 2
	Conduct a baseline survey within the sub catchment	300	YEAR 2
	Reporting and Submission of the baseline survey report to WRA and WRUA (3 Bound Copies)	50	
Continuous Update of baseline information	Establish a database on baseline information	200	YEAR 3
	Periodic updating of baseline information by the trained WRUA members	500	YEAR 4 -10
<b>TOTAL</b>		<b>1400</b>	

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## 4 MANAGEMENT APPROACH

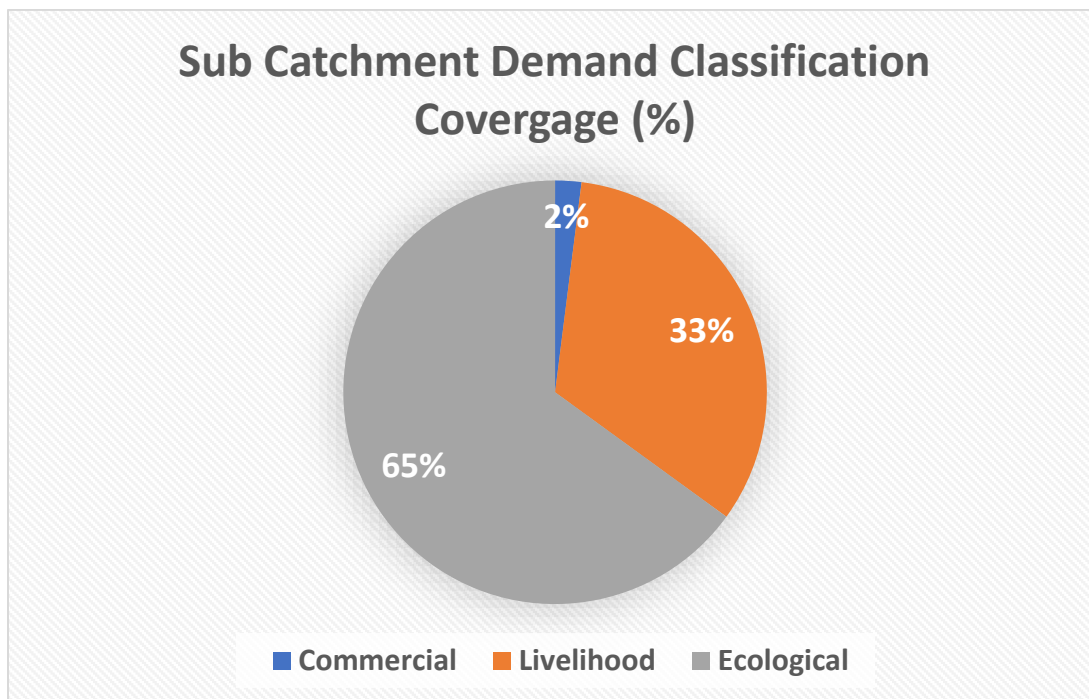
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### 4.1 Introduction

This chapter documents two aspects of the sub catchment; Biophysical with regards to resource and demand classification and management of the sub catchment as an institutional entity.

### 4.2 Sub-Catchment demand Classification

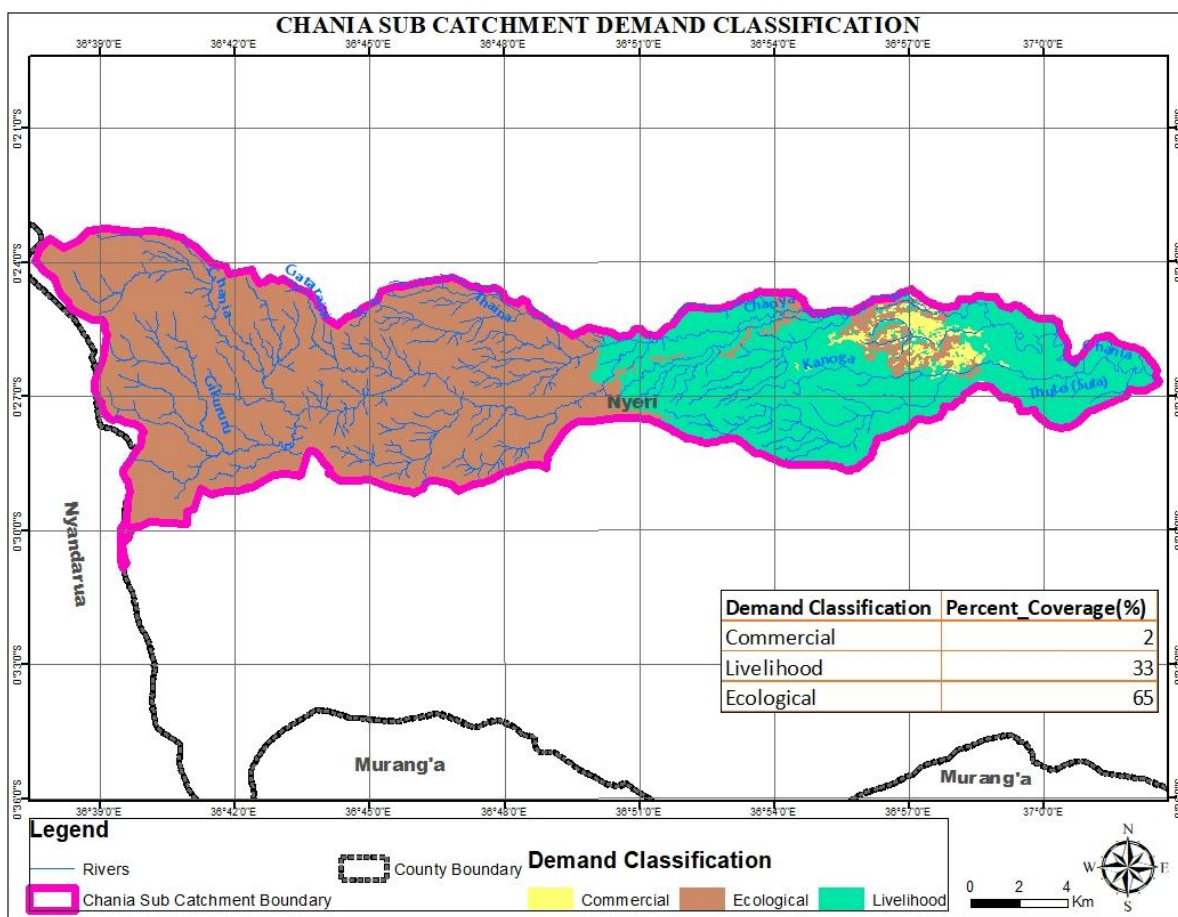
Based on the derived land use and participatory mapping undertaken, Chania sub catchment falls under three (3) resource clusters namely; ecological, livelihood and commercial. The clusters are as illustrated from figure below



By virtue of the sub catchment partly falling within a gazetted area within Aberdare forest, the sub catchment demand classification is largely under ecological cluster with a coverage of 65%, on the other hand livelihood cluster falls under 33% while commercial cluster constitutes 2% of the entire sub catchment area coverage of 277 km<sup>2</sup>.

Commercial classification is concentrated within the middle section of the sub catchment within Nyeri town which also sums up as Nyeri County headquarters. Livelihood classification which constitutes 33% of the sub catchment is located within the middle and lower section of the sub catchment where most of the populace have settled. Most of ecological demand classification is located within the upper most section of the sub catchment where almost all the rivers within the sub catchment originate as illustrated from the figure below.





### 4.3 Sub-Catchment resource Classification

Based on demand classification and water resource analysis not limited to water availability, demand and water quality long term record analysis, the sub catchment is in **ALERT** state.

### 4.4 WRUA institutionalisation

#### 4.4.1 WRUA formation

The WRUA was formed on 8th June 2006 by Chania community as a community based association together with stakeholders and Water Resources Authority (WRA). The main agenda for the formation of the WRUA was to address catchment issues and solve water use conflict. For instance, the community living along Chania River had been faced with water resources problems and conflicts arising from the water use. This necessitated formation of the WRUA to cater and solve water problems.

Chania River WRUA was registered at Attorney General's Office on 14<sup>th</sup> September 2007 and issued with registration certificate **No.28051**. The WRUA has been compliant with the AG requirements such as with submission of annual returns. Chania River WRUA was registered with WRA on 30<sup>th</sup> Sep 2009 and issued with registration certificate No. 007. They signed a memorandum of understanding (MOU) with WRA on 28<sup>th</sup> February 2013.

Following the formalization of their engagement with WRA, Chania River WRUA developed a Sub Catchment Management Plan (SCMP) on 28<sup>th</sup> September 2009 which was to be

implemented for 5 Years. The SCMP has since expired and the review was done 30<sup>th</sup> September to 4<sup>th</sup> October 2019, compilation took place on 8<sup>th</sup> to 10<sup>th</sup> October 2019. Final document was ratified on 25<sup>th</sup> October 2019 by WRUA members and stakeholders.

The WRUA Comprises of 21 management members of which 7 of them are women, 2 youth members and 2 persons living with disability. It has 3 sub committees namely Finance, procurement and monitoring with a 5 member executive committee.

Currently, the already registered WRUA members are approximately 80, however, there is need for recruitment of more members into the WRUA based on the current estimated population of residents within Chania sub catchment which stands at approximately 113,873 from population projection.

#### **4.4.2 Institutional management setup**

The WRUA is comprised of the executive committee with the chairman heading the WRUA. The other members in the executive are Secretary, Treasurer, Vice Chairman and Vice Secretary who are constituted after every 3 years through an election as stated in their constitution and by-laws. In addition to the WRUA having the executive committee, it has three additional subcommittees namely; Finance, Monitoring and procurement. However, a gap was identified during the stakeholder engagement whereby the WRUA management lacks livelihood enhancement and flood and drought subcommittees.

#### **4.5 Targets**

- To Enhance WRUA capacity on Governance and book keeping
- To mobilise and publicise WRUA activities
- To constitute two additional committees and reorganize the constitution of entire sub committees from 5 to 3 per sub committee

#### **4.6 Proposed outputs**

- Capacity building reports on Governance and book keeping
- Additional sub committees constituted and minutes of the Annual General Meeting in place
- Publicised WRUA activities

#### 4.7 Activities plan and Budget

- Develop the activity plan clear with; major activities, specific activities, stakeholders involved, estimated budgets and implementation periods.

<b>CH 4: MANAGEMENT APPROACH</b>			
<b>Target</b>	<ul style="list-style-type: none"> <li>• To Enhance WRUA capacity on Governance and book keeping</li> <li>• To mobilise and publicise WRUA activities</li> <li>• To constitute two additional committees and reorganize the constitution of entire sub committees from 5 to 3 per sub committee</li> </ul>		
<b>Output</b>	<ul style="list-style-type: none"> <li>• Capacity building reports on Governance and book keeping</li> <li>• Additional sub committees constituted and minutes of the Annual General Meeting in place</li> <li>• Publicised WRUA activities</li> </ul>		
<b>Activity</b>	<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
Publicity and awareness creation	Organizing barazas	360	YEAR 1
	Creating publicity materials (Posters, Billboards)	3,000	YEAR 1
	Involvement of learning institutions in conservation and create synergy with the CBC school greening programmes as well as other stakeholders (NGOs)	800	YEAR1 - YEAR 10
Strengthen good Governance	Training on Governance, Conflict Resolution, Financial Management and Book Keeping	1,200	YEAR1 - YEAR 6
	Constitution of additional sub committees and reorganization of the sub committees	80	YEAR1 - YEAR 6
<b>TOTAL</b>		<b>5440</b>	

### 5.1 Introduction

This Chapter looks at; surface water and groundwater resources' availability, apportionment of resource, the water allocation balance.

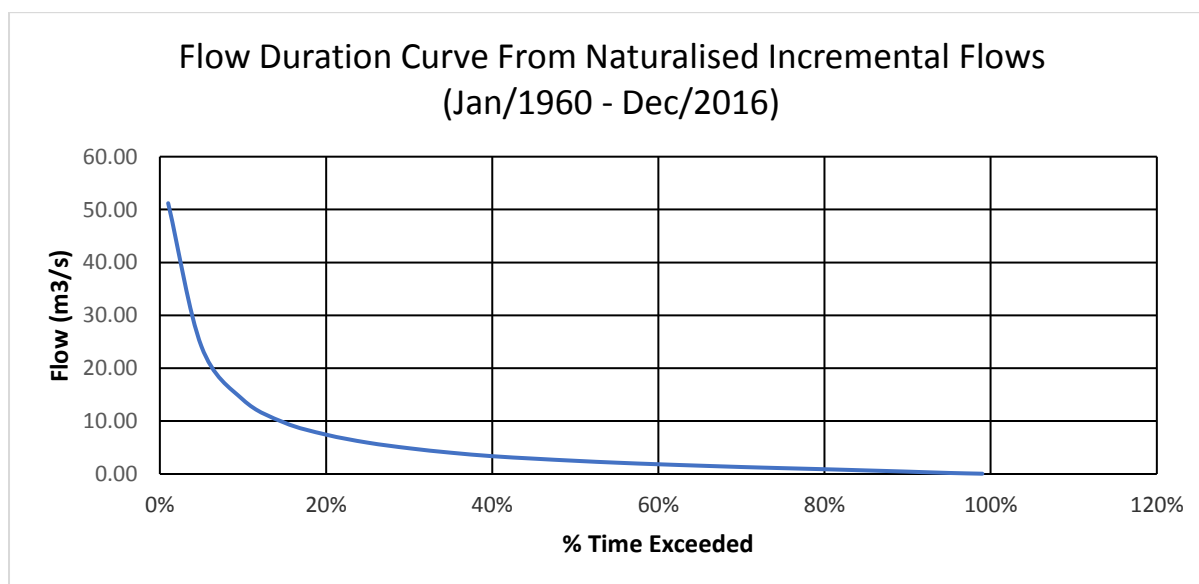
### 5.2 Surface water

The sub catchment has adequate surface water to sustain the available and potential demand, however, there is need to invest in the available storage infrastructure. Table below illustrates the naturalised incremental flows within the sub catchment.

*Table 3: Naturalised incremental flows within the sub catchment*

Item	Criteria	Discharge (m <sup>3</sup> /day)	Volume (MCM/yr)
Reserve	Q95	11,266	4.11
Normal Flow	Q80	51,907	18.95
Normal Flow available for Domestic use allocation	Q80 – Q95	40,641	14.83
Flood Flow	Q50	215,388	52.35
Flood volume available for allocation	Cumulative flood volume		10.98
Flood discharge available for allocation	Flood volume/292 days	37,611	

A detailed quantification of water flow regimes within the sub catchment is as illustrated from the figure below indicating the flow duration curve adopted from the naturalised incremental flow.



### **5.3 Ground water**

Based on the studies undertaken by ISC – KWSCRIP in year 2018, the sub basin 4AC where Chania sub catchment forms one of the two sub catchments within the sub basin has a ground water potential of 4.43 MCM/YR. On the other hand Chania's sub catchment ground water potential was estimated at 3.24MCM/YR.

### **5.4 Water Apportionment**

Water Apportionment is the process of assigning priorities to various water use categories. The existing water regulations give priority to reserve and domestic water demand. Water resources are apportioned to other uses depending on demand and resource availability.

## 5.5 Water Allocated

This section focuses on allocated water within Chania sub catchment, an analysis of allocated water per class and category of abstraction has been undertaken based on the records obtained from WRA's Upper Tana sub region office.

Table 4 Surface water allocation by category and class of abstraction as at September 2019

Category	Public (M3/Day)	Domestic (M3/Day)	Livestock (M3/Day)	Subsistence Irrigation (M3/Day)	Commercial Irrigation (M3/Day)	Industrial/Commercial (M3/Day)	Hydropower (M3/Day)	Others(M3/Day)
A	0	0	0	53.5	0	0	0	0
B	0	115.94	0.48	952.18	1860.64	2109	0	394
C	0	4.9	0	9274.25	7464.85	45.45	958	6220.8
D	53628	0	0	0	0	0	0	0
<b>Total</b>	<b>53628</b>	<b>120.84</b>	<b>0.48</b>	<b>10279.93</b>	<b>9325.49</b>	<b>2154.45</b>	<b>958</b>	<b>6614.8</b>

Table 5 Groundwater allocation by category and class of abstraction September 2019

Category	Public (M3/Day)	Domestic (M3/Day)	Livestock (M3/Day)	Subsistence Irrigation (M3/Day)	Commercial Irrigation (M3/Day)	Industrial/Commercial (M3/Day)	Hydropower (M3/Day)	Others(M3/Day)
B	0	250.5	16.6	75	0	0	0	42

## 5.6 Allocation balance

Table 6 Total Allocation balance as at September 2019

	Surface Water		Groundwater	
	Normal Flow (MCM/YR)	Flood Flow (MCM/YR)	(MCM/YR)	Comment
<b>Total resource available for allocation</b>	14.834	13.728	3.240	
<b>Existing Allocations(Public, Domestic, Livestock, Subsistence Irrigation, Industrial, Others)</b>	22.819	0.000	0.140	
<b>Existing Allocations(Commercial Irrigation)</b>	0.000	7.156	0.000	
Balance	-7.985	6.572	3.100	

### **5.7 Targets**

To develop water allocation plan for equitable water allocation within the sub catchment

### **5.8 Proposed outputs**

Water Allocation Plan to be in place

### **Activities plan and Budget**

<b>CH: 5 WATER BALANCE AND DEMAND MANAGEMENT</b>			
<b>Target</b>	To Develop water allocation plan for equitable water allocation within the sub catchment		
<b>Output</b>	Water Allocation Plan to be place		
<b>Activity</b>	<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
Create awareness on the findings and recommendation of the abstraction survey	Planning meeting on sensitization baraza logistics	31.5	YEAR 1
	Hold 12N0. Public barazas, 3 per zone to sensitize community on abstraction survey recommendations	360	YEAR 1
	Send invitation to all the water resource abstractors calling for a sensitization meeting	10	YEAR 1
	Hold 1 consultative meeting with a key focus on water resource abstractors and the entire community at large.	200	YEAR 1
Implementation of abstraction survey recommendations	Carry out quarterly inspection and patrols to enforce the abstraction survey recommendations in collaboration with WRA and other stakeholders	1,500	YEAR 2 – YEAR 10
Develop the water allocation plan	Hold planning meetings to initiate water allocation development process.	31.5	YEAR 4
	Resources mobilization through proposal writing to financial institutions and development partners to develop a water allocation plan	100	YEAR 4
	Sourcing for technical professional to develop the water allocation plan	50	YEAR 4
	Development of the water allocation plan	6,000	YEAR 5
<b>TOTAL</b>		<b>8,283</b>	



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## 6 WATER ALLOCATION AND USE

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### 6.1 Introduction

This chapter looks at the authorised abstractions and type of use. Water is allocated to different types of uses depending on demand and water resources availability.

### 6.2 Thresholds

Chania River sub Catchment lies in management unit 4AC within Tana Basin. Determination of water allocation thresholds is based on water resource availability within the respective basin. In Chania sub basin, abstraction categories have been clustered based on those abstract water for irrigation, domestic, industrial, public and livestock use. Most of them being in classes A, B, C and D, with category B comprising of 70%, category A 15%, Category C 10% and D 5 %.

#### 6.2.1 Surface water

Surface water forms the main source water for all users within the sub catchment compared to ground water due to its availability. The surface water thresh holds are as tabulated below;

CATEGORY	THRESHHOLDS
A	0 – 19.9 M <sup>3</sup> /Day
B	20 – 4,999.9M <sup>3</sup> /Day
C	5000 – 9,999.9M <sup>3</sup> /Day
D	10,000M <sup>3</sup> /Day

#### 6.2.2 Ground water

Ground water aquifers within the sub Catchment are classified as Mt Kenya and Aberdare Volcanics and partly Ewaso Ng'iro volcanics. However, due to the abundance of surface water, groundwater within the sub catchment has been exploited by very few individuals.

### 6.3 Water Allocation by source

Based on the Permit data base records, an analysis of allocated water resources within the sub catchment have been summarised into category by source as illustrated from table below.

SOURCE	M <sup>3</sup> /DAY	MCM/YR
Groundwater	384.1	140,196.5
Surface Water	83081.99	30324926.35
Total	<b>83466.09</b>	<b>30,465,122.85</b>

#### 6.4 Water Allocation by category

Total water resources allocated within the sub catchment have also been summarised from the table below based on the information obtained from WRA's Upper Tana Sub Region Office.

Category	M <sup>3</sup> /Day	MCM/YR
A	317.5	11,588.7
B	5,735.59	2,093,490.35
C	23,968.25	8,748,411.25
D	53,628	19,574,220
<b>Total</b>	<b>83,649.34</b>	<b>30,427,710.3</b>

#### 6.5 Storage

There are no official storage allocations within the sub catchment, however, during the SCMP workshop and transect walk some naturally occurring Ponds such as Kiunyu and Kanoga dams were identified.

#### 6.6 Status of Authorisations & Permits

The table below shows water permit application status within the sub catchment as at September 2019 both for ground water and surface. There is no application for water storage within the sub catchment, this can be attributed to availability of surface and ground water potential.

Authorization, Applications & Permits	Number		Sub Total
	S/W	G/W	
<b>Authorizations issued</b>	11	10	21
<b>Permit issued</b>	7	4	11
<b>Applications on process</b>	5	1	6
<b>Deferred applications</b>	0	1	1
<b>Pending RO verification</b>	2	1	3
Received inspection report	1	0	1
<b>Total</b>	<b>26</b>	<b>17</b>	<b>43</b>

## 6.7 Water Use per Category

Based on information obtained from WRA's Upper Tana Sub Regional office, water use by category has been summarised within the table below.

Category	Volume Abstracted/ m3/Day	Public (M3/Day)	Domestic (M3/Day)	Livestock (M3/Day)	Subsistence Irrigation (M3/Day)	Commercial Irrigation (M3/Day)	Industrial/ Commercial (M3/Day)	Hydropower (M3/Day)	Others (M3/Day)
A	317.5	0	0	0	15.5	0	0	0	302
B	5735.59	0	343.4	1	986.55	1860.64	2109	0	436
C	23968.25	0	4.9	0	9274.25	7464.85	45.45	958	6220.8
D	53628	53628	0	0	0	0	0	0	0
Total	83649.34	53628	348.3	1	10276.3	9325.49	2154.45	958	6958.8

## 6.8 Targets;

- Enforcement of compliance on WRM rules on abstraction standards
- To update the abstraction survey done in 2017 owing to gaps identified on quantification of water abstraction by volume

## 6.9 Proposed outputs;

An updated abstraction survey report

A detailed enforcement plan

## 6.10 Activities to streamline Water Use & compliance

<b>CH: SIX; WATER ALLOCATION AND USE</b>			
<b>Target</b>	Enforcement of compliance on WRM rules on abstraction standards  To update the abstraction survey done in 2017 owing to gaps identified on quantification of water abstraction by volume		
<b>Output</b>	Updated abstraction survey report A detailed enforcement plan		
<b>Activity</b>	<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
Enforcement on compliance	Planning meeting to develop an enforcement plan	100	YEAR 1 – YEAR 10
	Undertake periodic enforcement	1,000	YEAR 1 – YEAR 10
Update Abstraction survey	Planning meeting	30	YEAR 3
	Hold three public baraza in three zones (1 per zone)	60	YEAR 3
	Resource mobilization to undertake abstraction survey	100	YEAR 3
	Hire Consultant to review and update the Abstraction Survey	1800	YEAR 3
	Presentation of abstraction survey report	50	YEAR 3
<b>TOTAL</b>		<b>3,140</b>	

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## **7 WATER RESOURCE PROTECTION**

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### **7.1 Introduction**

This section of the plan develops strategies to mitigate, prevent and manage pollution from both point and non-point sources. Water pollution refers to a condition where water within a water body is contaminated due to the presence of undesirable materials. Sources of pollution can be broadly categorized into two; point and non-point source pollution. Point source pollutions are those with traceable points of origin into a water body, an example is the effluent from a factory / course while non-point source example result from agricultural activities are diffuse.

### **7.2 Current status**

#### **7.2.1 Protection of the reserve**

Based on the long term time series on discharge obtained from the Water Resources Authority from the monitoring stations, the water quantity has been on an average mean of during the dry season is and during the wet season. On the other hand water quality has been on the decline especially from section commencing at the middle section of the sub catchment where the informal settlements are on the increase. Nyeri town found within the middle section of the sub catchment, has further contributed to pollution especially during the dry season where garbage collection and effluent discharge has had challenges.

Currently, there is only one point source discharge at NYEWASCO treatment plant who have an EDCP in place and have met the standards as stipulated by the Water Rules 2007 and EMCA 1999.



### 7.2.2 Protection of water resources

Generally within the sub catchment, there are three types of pollution; pollution emanating from soil erosion making the water turbid and non-palatable, car wash and laundry from different site of the sub catchment and informal settlements due to poor sanitation. Most of the water points are also not protected, a factor that has contributed to pollution especially on unprotected springs where laundry and livestock are taken with non-structural troughs for watering the livestock.

A general observation made during the transect walk is an aspect of siltation which was documented to reduce the quantities of reservoirs such as in Kiunyu dam as well as reducing the discharge on springs that have not been protected.

### 7.2.3 Pollution and effluent control

One pollution survey has been undertaken within the sub catchment hence the need to act on the recommendations put forward by the pollution survey report. However, owing to the rapid developments taking place within the sub catchment, there is need to update the pollution survey. There is also need to ensure that all the dischargers within the sub catchment are compliant with the standards as stipulated within the Water Rules 2007 and EMCA 1999.



*Figure 3 Stone crashing site adjacent to the river*

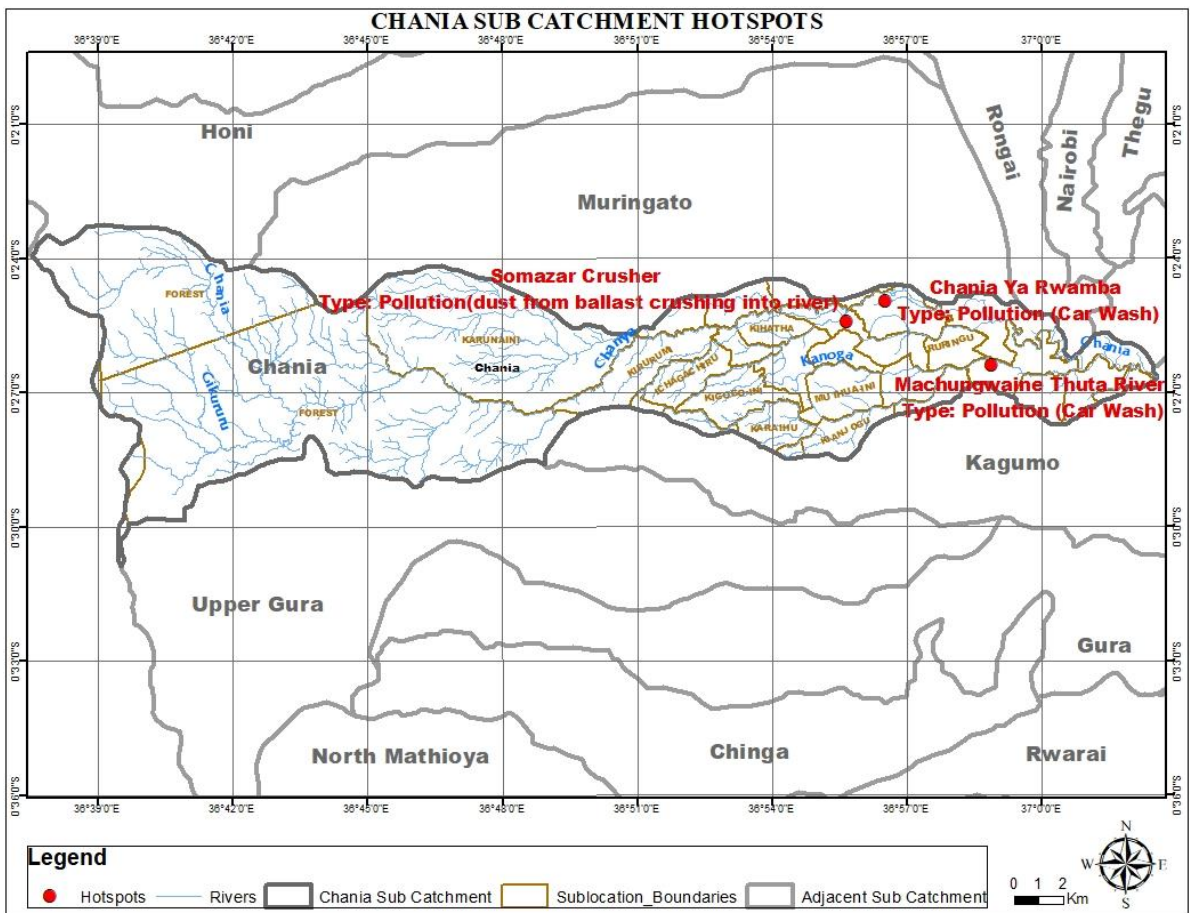


*Figure 4 Oil leakage adjacent to the river an indication of car wash activities*





Figure 5 Dumpsite adjacent to Chania River within the middle section of the Sub Catchment



### **7.3 Targets**

- Update the baseline pollution survey for monitoring and reviewing the implementation of recommendations brought forward by the report.
- Establishing of water quality monitoring stations
- Capacity building WRUA members on simple water quality monitoring as well as the regulatory and policy frameworks on water standards.
- Periodic monitoring of water quality within the sub catchment.

### **7.4 Proposed outputs**

- Updated pollution survey report
- Established water quality monitoring stations
- Report on training of WRUAs on water quality monitoring and regulatory frameworks on water quality monitoring
- Quarterly water quality monitoring reports from the WRUAs



## 7.5 Activity Plan and Budget

<b>CH: 7; Water Resources Protection</b>			
<b>Target</b>	Update the baseline pollution survey for monitoring and reviewing the implementation of recommendations brought forward by the report.		
<b>Output</b>	<ul style="list-style-type: none"> <li>• Updated pollution survey report</li> <li>• Established water quality monitoring stations</li> <li>• Report on training of WRUAs on water quality monitoring and regulatory frameworks on water quality monitoring</li> <li>• Quarterly water quality monitoring reports from the WRUAs</li> </ul>		
<b>Activity</b>	<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
Mitigate Pollution on Water Resources	Creation of Awareness for pollution survey (6 Meetings)	180	YEAR 3
	Conduct a review on pollution Survey	2,500	YEAR 3
	Purchase 3 No. of water quality monitoring equipment and train WRUA on simple Water Quality Testing methods	5,000	YEAR 4
	Monitoring of water quality by WRUA	1,200	YEAR 4 – YEAR 10
Proper solid waste management	Collection and re-using of Non-biodegradables items such as plastics	1,000	YEAR 6
	Establishment of a recycling plant for the WRUA	4,000	YEAR 6
Enforcement of Rules and Regulations	Capacity Building on enforcement rules as stipulated within the regulatory and policy documents	600	YEAR 2 – YEAR 10
	Enforcement of compliance on water quality	1,000	YEAR 2 – YEAR 10
<b>TOTAL</b>		<b>15,480</b>	

### 8.1 Introduction

This chapter focuses on appropriate catchment management strategies for sustainable yield of water quantity and quality. This is because land and water are integrated and needs to be managed effectively for sustainable productivity. A catchment area is that land area from which water is collected by natural landscape (section 22, Water Act, 2016). On the other hand, Riparian habitat is an ecosystem associated with a body of water or that is dependent on the existence of a perennial, intermittent rain water. The Rules (2007) guides a riparian land area of a river to be a maximum of 30 meters and a minimum of 6 meters on both sides of the river, depending on the width of the river or simply taken to be the highest flooding water mark recorded. The Authority is also empowered to define the extent of the riparian as deem fit on the basis of best protecting the resource. On the other hand, the riparian area of a spring eye is defined as a minimum radius of 3 meters and a maximum radius of 15 meters. The water Rules (2007) further prohibits any anthropogenic activities that may interfere with the pristine nature of the any riparian and catchment at large. Among such prohibited activities include but not limited to; the planting of eucalyptus within the riparian area, destructive mining, farming that destroys riparian and development of structures within the riparian areas. The Authority under the Water Act, 2016 is charged to regulate the use and management of the resource as the county governments are mandated to manage the resources.

### 8.2 Catchment conservation

The sub catchment within the uppermost zone is under a gazetted area, however, it is potentially exposed to degradation from human activities e.g. overgrazing, cutting down of tress and Cultivation system by the name Plantation Establishment and Live hood Improvement Scheme (PELIS). An observation made during the SCMP development workshop as well as during the transect walk is that degradation within the sub catchment results from planting of water Eucalyptus trees along the river banks whereby no other vegetation may thrive within such areas, encroachment of riparian areas due to subsistence farming, quarrying, marram mining, poor faming method which results to soil erosion and siltation of water bodies.

#### 8.2.1 Erosion/sediment surveys

Currently, no erosion and sediment survey has been carried out. However, there is need to undertake erosion and sedimentation survey within the sub catchment due to the intense erosion

Soil and Water conservation measures are capital intensive more so where mechanical methods are involved. Within Chania sub catchment, there is need to implement soil and water conservation methods due to the nature of slopes which in many cases are more than 50% steep, a factor that has enhanced soil erosion especially in areas where farming activities are practiced. For instance, during the transect walk gullies and siltation of rivers was observed as illustrated from the figure below. To enhance catchment conservation, Chania WRUAs are planning to have consultative knowledge sharing meeting/forums with all stakeholders within the catchment. Chania WRUA member are also planning to construct gabions, water pan for harvesting surface runoff, terraces and planting of grass strips.



*Figure 6 Siltation along R. Zaina, an aspect of poor farming practices and soil erosion*



*Figure 7 Mining activities adjacent to the river*

### **8.3 Riparian conservation**

The riparian area such as along the rivers and wetlands have been encroached by farmers because of the fertile soil as well as population increase which has prompted land fragmentation leading to riparian encroachment. During implementation of previous SCMP developed in the year 2009, WRUA members together with the landowners planted indigenous trees and Bamboo seedlings along river Chania riparian areas an estimated distance of 10km. Priority areas for conservation are the encroached areas along Gichi stream tributary of Chania river, kwa Rwamba, Witemere ,Kiunyu and Thuta stream. Marking and pegging was also carried out along Chania River, an estimated distance of 10Km. There is need to ensure that the remaining 54Km of Chania River are marked and pegged.







*Figure 8 Encroachment of wetland within the middle section of the sub catchment*



*Figure 9 Encroachment of wetland within the middle section of the sub catchment*





#### **8.4 Targets**

Rehabilitate and conserve catchment and riparian area

#### **8.5 Proposed outputs**

Marking and pegging of the remaining stretch of 54 Km within Chania River



## 8.6 Activity Plan and Budget

CH 8: CATCHMENT CONSERVATION				
		Target	Rehabilitate and conserve catchment and riparian area	
		Output	Marking and pegging of the remaining stretch of 54 Km within Chania River	
Activity		Sub-activity	Budget*1000	Year of Implementation
1.	Rehabilitation of riparian areas through making and pegging and planting of water friendly trees	One day Planning meetings.(30 members)	50	YEAR 3
		Sensitization and barazas (2 per every zone) 6 meetings to involve- 10 stakeholders per meeting.	100	YEAR 3
		Marking and pegging – The remaining 54KM of Chania River on both sides.	1200	YEAR 3
		Removal of unfriendly trees and enforcement.	300	YEAR 3
		Establishment of tree nurseries with a production of 20,000 seedlings (3 No.) one per Zone.	3000	YEAR 3
		Procurement of seedlings and growing  Trees (2000 bamboo seedlings and 45,000 indigenous trees.)	5 000	YEAR 3
		Planting of water friendly vegetation eg Napier grass.		
		Monitoring and tending of planted tree seedlings	300	YEAR 2 – YEAR 10
2	Catchment restoration	3 days Training on good agricultural practices (GAPS)	350	YEAR 2
		One day Planning meetings.(30 members)	50	YEAR 6
		Sensitization and barazas (2 per every zone) 6 meetings to involve- 10 stakeholders per meeting.	100	YEAR 6
		Construction of gabions for controlling surface runoff gulley erosion	3000	YEAR 6
Total			13,450	

### **9.1 Introduction**

The Flooding normally occurs in low lying areas of water bodies such as; rivers, lakes and other reservoirs when the water volumes exceed the waterbody's embankments. The chapter outlines; measures that are key to mitigating the impact of floods and other water related disasters. Primary to the measure is to develop the Integrated Flood Management Plan (IFMP) for affected sub catchments and other plans or strategies that build the community's resilience to other disasters such as; Drought, Landslides, Salinization etc.

### **9.2 Current Status**

#### **9.2.1 Floods**

Flooding only occurs in a few isolated area, where people have encroached into riparian areas. These incidents occur the confluence of Gichi and Chania, Zaina and Chania, confluence, Chania kwa Rwamba, Chania kwa Winne and Witemere. At Gichi and Chania confluence and Chania kwa Winne the river floods into the nearby farms while Chania kwa Rwamba and Witemere flooding occurs into the settlements causing displacement of the people in those areas. One remarkable incident where flooding caused immense loss to the residents of Chania sub catchment was documented within the year 1997/1998.

#### **9.2.2 Landslides**

Rarely do landslide occur in this sub catchment. They are reported to occur during heavy rainy seasons and mostly in the upper zone

#### **9.2.3 Drought**

Rare cases of drought has been reported in Chania sub catchment in middle zone such as Witemere. The only severe drought was reported in the year 1984 which affected the entire nation.

### **9.3 Targets**

Mitigate against potential flood occurrence within the sub catchment

### **9.4 Proposed outputs**

- Early flood warning system in place
- Report on the construction of check dams

## 9.5 Activity Plan and Budget

<b>CH: 9; Flood Management</b>			
	<b>Target</b>	Mitigate against potential flood occurrence within the sub catchment	
	<b>Output</b>	Early flood warning system in place Report on the construction of check dams	
<b>Activity</b>	<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
Flood mitigation measures	Sensitization on flood management and mitigation measures	200	YEAR 2 – YEAR 10
	Construction of two Check dams	3,000	YEAR 8
	Develop early flood warnings system	2,000	YEAR 8
	<b>TOTAL</b>	<b>5,200</b>	

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## 10 CLIMATE CHANGE ADAPTATION

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### 10.1 Introduction

In as much as climate change is an aspect of long-term anthropogenic activities at the global scale, climate change impacts are felt at the smallest scale with unique impacts at the respective scale. Therefore, this chapter presents documented impacts of climate change within Chania sub catchment and the possible mitigation measures that the community members may have at some point used to cope against climate change impacts on livelihood and water resources. The chapter further presents a list of activities that will be carried out as coping mechanisms against the impacts of climate change.

#### 10.1.1 Indicators of Climate Change

While climate change occurs progressively, some impacts that emanate from it are felt with great magnitude. In some cases, scientists have been able to predict the frequency of occurrence of these impacts which are mostly manifested from erratic weather patterns. Globally, some of the indicators of climate change have been manifested through destructive winds, erratic rainfall patterns and enhance temperatures among other global indicators throughout the world.

#### 10.1.2 Global trends in climate change

Trends in climate change have been predicted to worsen in the near future as a result of increased anthropogenic factors some of which have been attributed to the greenhouse gas emission as well as the decrease in vegetation and tree cover that are attributed with carbon sequestration. The effects of climate change will further increase with predicted change in seasonality as well as enhanced change in weather parameters such as rainfall, wind and temperature.

**Table: 10-1 some of the Global trends in rainfall and temperature**

Rainfall		Temperature	
I.	Increased rainfall variability (Duration and intensity) <ul style="list-style-type: none"><li>• Decrease in shoulder season length</li><li>• Prolonged drought seasons</li><li>• Increased impacts on rivers and wetland ecosystems (Pollution, encroachment and reduced water levels)</li></ul>	I.	Higher mean annual temperature <ul style="list-style-type: none"><li>• Increase evaporation and decreased water balance</li><li>• Reduced crop quality and food security.</li><li>• Reduced soil moisture levels</li></ul>
II.	Intensification of rainfall events <ul style="list-style-type: none"><li>• Increased flooding;</li><li>• Increased sedimentation and reduced capacity of water reservoirs</li><li>• Increased challenge to storm water systems in urban settlements;</li><li>• Increased soil erosion;</li><li>• Increased river bank erosion and demands for protection structures</li></ul>	II.	Higher maximum temperatures, more hot days and more heat waves <ul style="list-style-type: none"><li>• Increased in heat stress on humans and livestock</li><li>• Increased incidence of heat-related illnesses;</li><li>• Decreased crop yields and rangeland productivity</li><li>• Increased Extended range and activity of some pests and disease vectors;</li></ul>
		III.	Higher minimum temperatures, fewer cold days and frost days <ul style="list-style-type: none"><li>• Reduced risk of cold-related illnesses.</li><li>• Reduced heating energy demand;</li></ul>

## 10.2 Climatic evaluation findings

ISC under the KWSCR Project analyzed the climate change in Kenya using data from SimCLIM and CORDEX models. SimCLIM data is downscaled to 5km resolution from the IPCC AR5 climate models. It presents the monthly projection from 1996 to 2100 through selected models or a model ensemble, with different environmental sensitivities. CORDEX (A Coordinated Regional Climate Downscaling Experiment) data is downscaled to 45km resolution and has a daily temporal scale to 2100.

In the analysis, the future climates are presented against the representative concentration pathways (RCPs), which are seen as estimations of the potential curtailment of greenhouse gas emissions over the 21<sup>st</sup> century.

**Table: 10-2 Climatic model scenario; Best case (RCP 4.5) and Worst Case (RCP 8.5)**

	CO <sub>2</sub> (ppm)	CH <sub>4</sub> and N <sub>2</sub> O (ppm)	Resulting radiative forcing (W.m <sup>-2</sup> )
<b>RCP 4.5 (Best case - Medium scenario)</b>	538	92	4.5
<b>RCP 8.5 (Worst case)</b>	936	377	8.5

In order to further analyse the baseline and predicted weather parameters, precipitation and temperature analysis has been undertaken at sub basin (4AC) level since invalid observations may be drawn while modelling the same parameters at the sub catchment level.

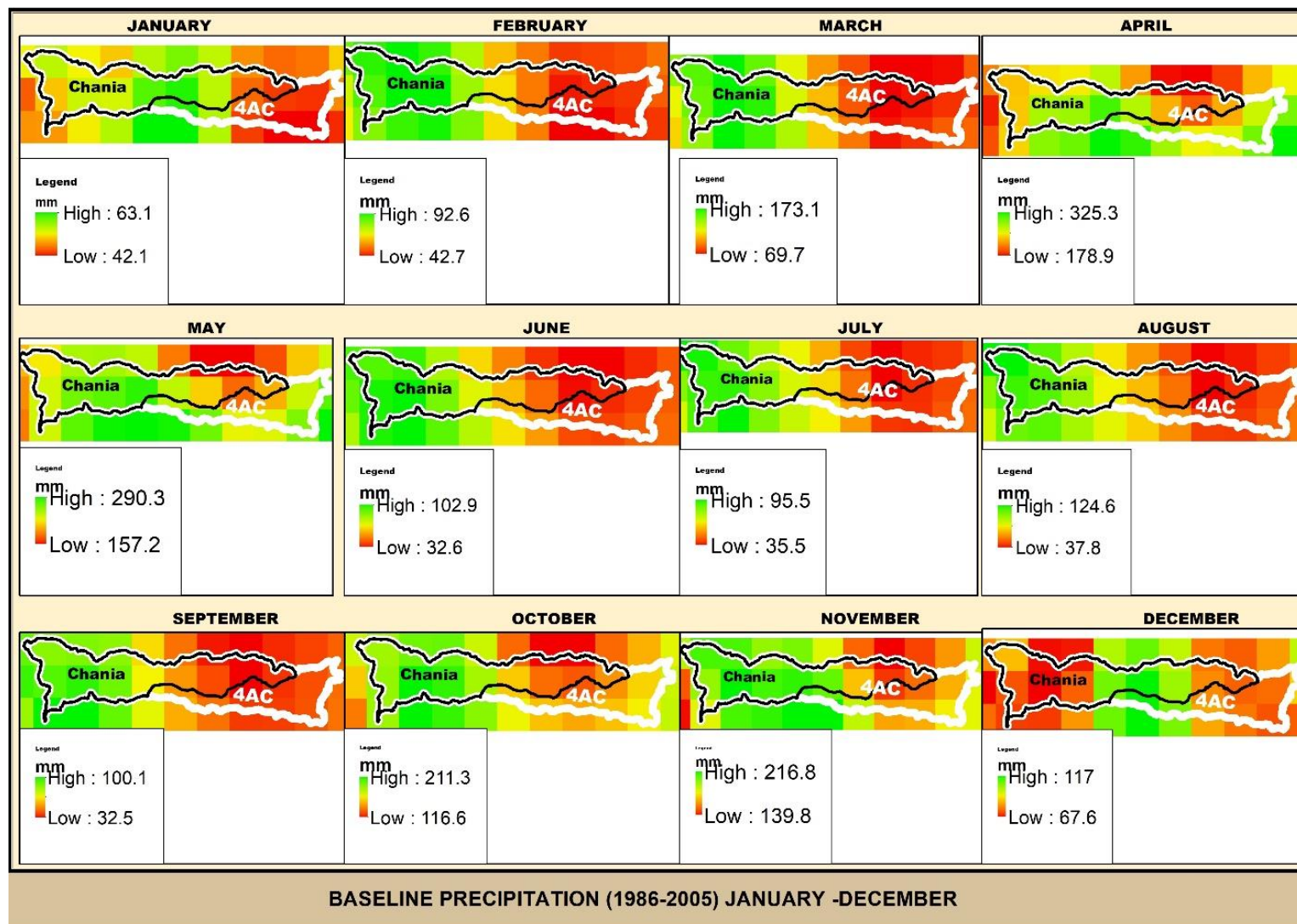


Figure 11 Baseline precipitation for the years (1986 - 2005) January to December

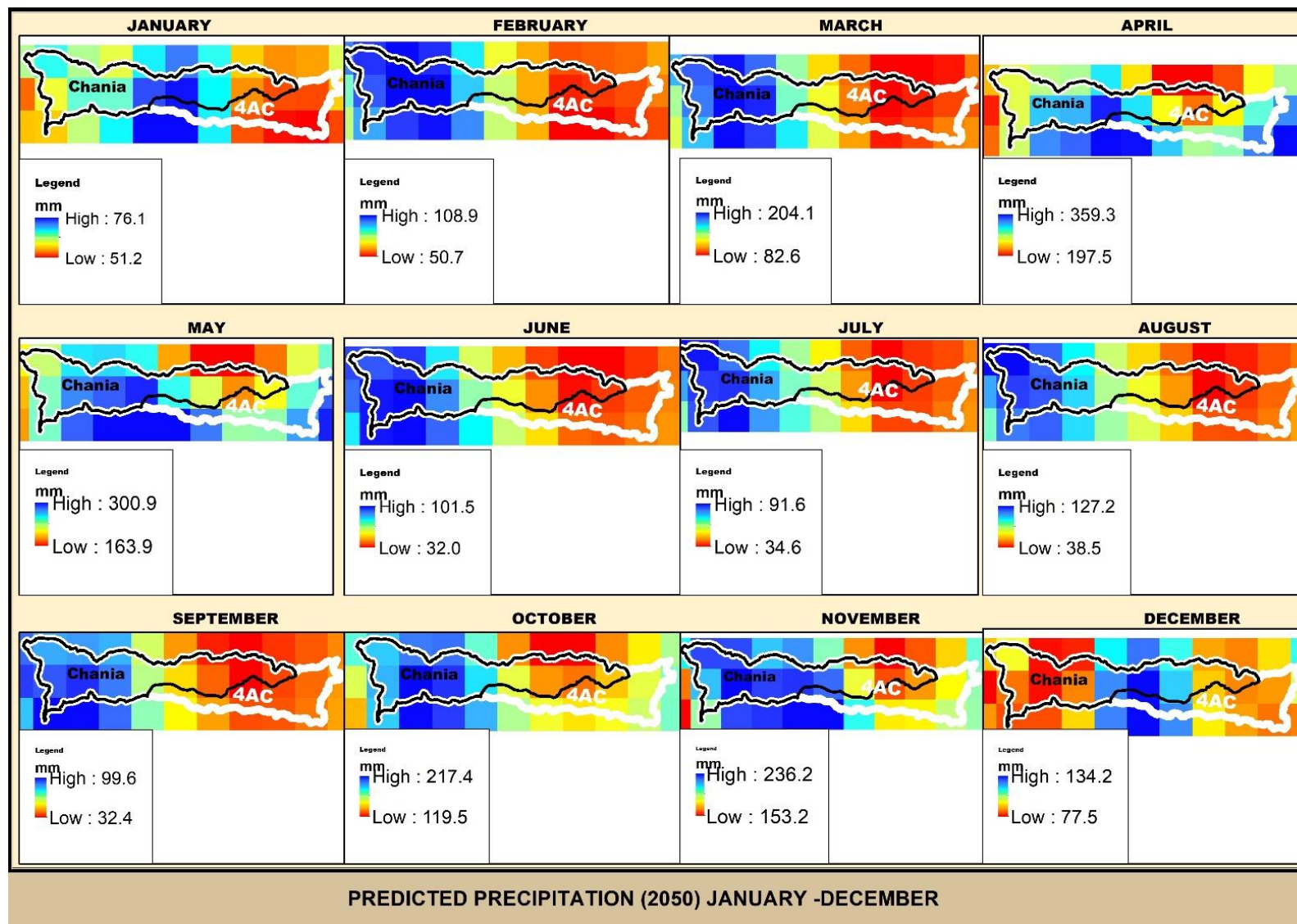


Figure 12 Predicted Spatial Rainfall Monthly Variability 2050 (January - December)



Based on the baseline and predicted precipitation trends, a general increase can be denoted from the visual analysis of the monthly precipitation variability especially from the two rainy seasons experienced in Kenya which are March, April, May (MAM) and October, November, December (OND). On the other hand, the dry seasons are anticipated to receive decreased rainfall amounts.

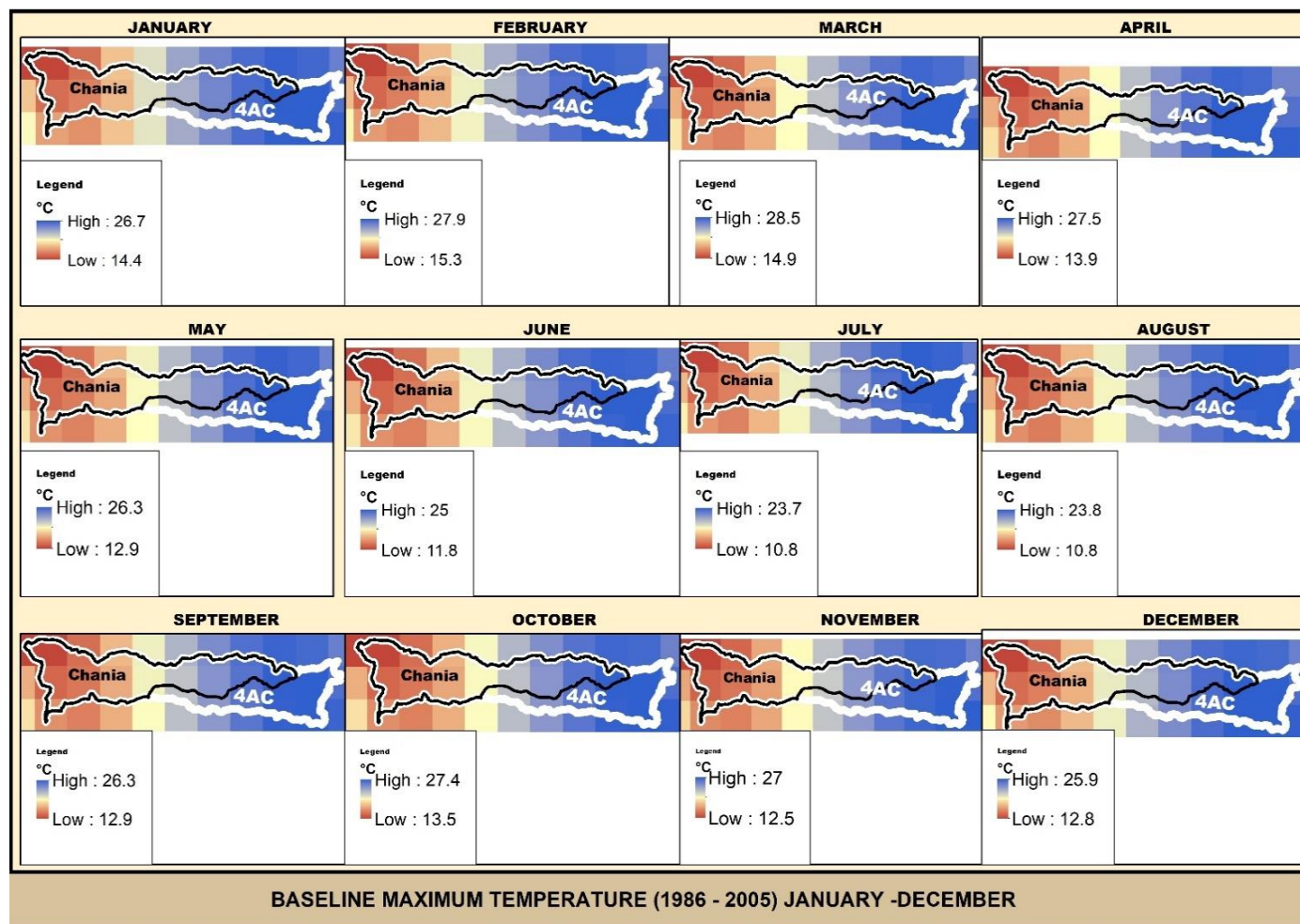


Figure 13 Baseline Monthly Maximum Temperature for the Year (1986 - 2005) January – December



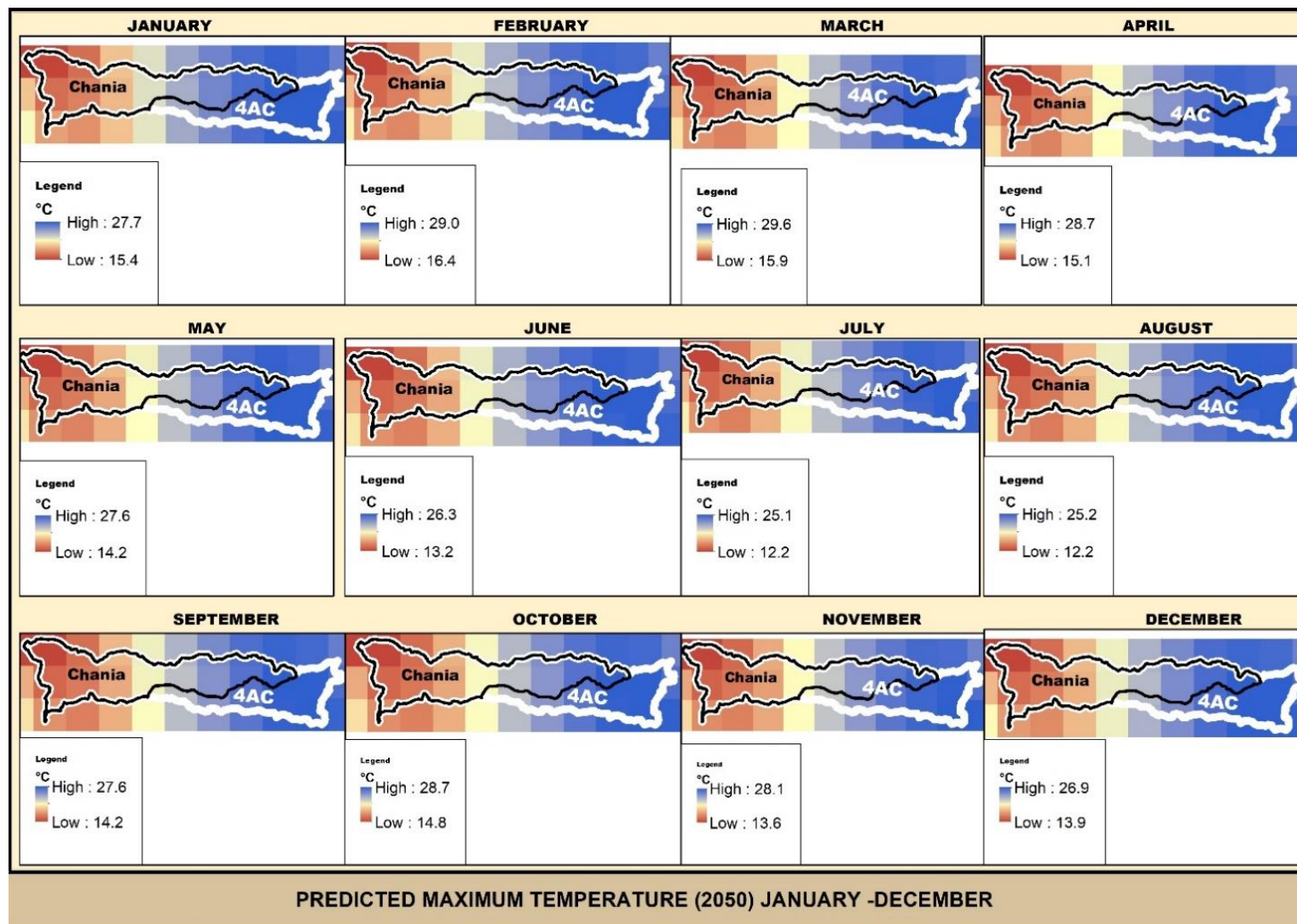


Figure 14 Predicted Monthly Maximum Temperature (2050) January - December

Based on the observed trend from the baseline and predicted maximum temperature, temperature is anticipated to increase over time.

### 10.3 Impacts of climate change

Through a stakeholder engagement while developing the Chania sub catchment management plan, participants identified some of the indicators of climate change within the sub catchment whereby historical knowledge and experience was put to task. Notably, participants indicated changing of seasonality and prolonged seasons of dry spells as some of the indicators within the sub catchment. Table below is a summary of the climate change impacts as experienced by participants from Chania sub catchment.

*Table 7 Local indicators of climate change and their effect within Chania Sub catchment*

Indicators	Effects
Unpredictable weather patterns	Limited decision making on crop cultivation hence poor harvest due to unfavorable crop productivity
Prolonged periods of dry spells	Reduced production on crop products Increased cost of purchasing food products
Erratic rainfall patterns (Intensity)	Increased occurrence Flash floods, soil erosion and sedimentation
Erratic changes in temperature	Increased spread of diseases and vector of same diseases such as malaria
Extinction of some crop species ( Oranges- Reduced productivity)	Loss of livelihood

### 10.4 Targets

To enhance the community's coping strategies against the impacts of climate change.

### 10.5 Proposed outputs

- Progress activity reports on sub activities implemented to enhance the communities resilience on climate change
- Model demonstration farm strategically set up by Chania WRUA to facilitate site visits by the community within the sub catchment

## 10.6 Activity Plan and Budget

<b>CH 10: Climate Change Adoption</b>				
<b>Target</b>		<ul style="list-style-type: none"> <li>To enhance the community's coping strategies against the impacts of climate change.</li> </ul>		
<b>Output</b>		<ul style="list-style-type: none"> <li>Progress activity reports on sub activities implemented to enhance the communities resilience on climate change</li> <li>Model demonstration farm strategically set up by Chania WRUA to facilitate site visits by the community within the sub catchment</li> </ul>		
<b>Activity</b>		<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
	Capacity building and Awareness Creation on coping mechanisms against climate change	Hold barazas with an aim of educating the community on the need planting the right variety of trees	100	YEAR 2
		Organize exchange visits to other WRUAs who have already established demonstration farms to cope with climate change impacts	200	YEAR 2
		Establish a Model Demonstration farm on simple water harvesting to cope with prolonged periods of dry spells	500	YEAR 3
		Capacity building of the community on alternative farming methods other than existing ancestral crop production methods	1,000	YEAR 2& 3
<b>TOTAL</b>			<b>1,800</b>	



### 11.1 Introduction

This chapter focuses on the current and planned water infrastructural facilities within the sub catchment. Water infrastructural facilities by definition includes both at the household level to the national level. At the household level they may include large volume storage facilities as well as boreholes and wells. At the community level some of the water resource infrastructure may include projects supported by the NGOs, NG-CDF or fully funded by the CBOs which may include water intake points, protected springs providing water for households among others. At the National level water infrastructure may entail existing or planned infrastructural development such as dams and water pans. It is important to note that at the state or national level one has to check with the laid plans such as with the National Water Master Plan, CIDP and County Water Master Plan is there is one in place. For the purpose of the Chania SCMP development, water resource infrastructure have been categorized into the following;

- Water Reservoir facilities which partly includes storage tanks, water pans and dams that might have been or are planned to be constructed.
- Water Abstraction facilities which include intakes especially by the Nyeri Water and sanitation company, boreholes, weir, springs and wetlands among other facilities

### 11.2 Current status

#### 11.2.1 Existing water infrastructure

Existing water resources infrastructure are mainly owned by the commercial water abstractors mainly the water service providers. Other water infrastructures such as dams occur naturally due to topography and geological conditions of the areas they occur such as Kiunyu dam. For instance, Nyeri Water and Sanitation Company (NYEWASCO) has an intake at Ihwa while the waste water treatment works is in Kangemi area. NYEWASCO have their storage facilities at Kamakwa which supplies domestic water to Nyeri town and its environs. Tetu Aberdare Water and Sanitation Company (TEAWASCO) also has an intake within the upper zone of the sub catchment at Zaina forest and partly supplies domestic water to this sub catchment. NYEWASCO and TEAWASCO are ran by the County government of Nyeri through the regulation of Water Services Regulatory Board (WASREB) following the enactment of Water Act 2016.

Furthermore, there are about three (3) community water projects, namely; Zaina/Muhoya Association Water Project (ZAMUA), Kimathi/Muhoya and Ihwa which have storage facilities as well. Within the sub catchment there are only about five (5) schools that have water storage

tanks with a storage capacity approximately 10M<sup>3</sup> each. The existing boreholes are privately owned. With regards to compliance on storage facility permitting, only NYEWASCO and TEAWASCO fully comply with WRM rules while the other partially comply.

While Chania sub catchment has numerous springs more so within the upper zone, only four springs have been protected, there is an urgent need to conserve about seven strategic springs which have not been protected. There is also need to ensure the existing and encroached wetlands are also protected as well as ensure restoration of the degraded wetlands within the sub catchment.

### **11.2.2 Planned infrastructure**

- Plans are under way to protect at least seven remaining springs on public land through the implementation of the sub catchment management plan. Some of the identified springs for protection include;
  - Gataro
  - Kirurumi,
  - Witemere
  - Ikeu
  - Nyakahiti,
- There is also need to ensure that there is in place storage facilities that are strategically located within the sub catchment such as in schools, health facilities and Polytechnics in the sub catchment for roof harvesting. Some of the identified strategic locations for erecting storage facilities for the public include:-
  - Kihingo
  - Ihwa
  - Gaithuri
  - Thunguma
  - Githwariga
  - Nyamachaki
  - Githiru
  - Kiamuiru
  - Ndurutu
  - Zaina dispensary
  - Githakwa dispensary
  - Kinunga healthy centre

- There is also an urgent need for protection of wetlands within Chania sub catchment as well as protection and rehabilitation of the naturally occurring dams such as through desilting. Some of the identified strategic dams/naturally occurring ponds include:-
  - Gakanga
  - Machungwa-ini
  - Githwariga
  - Kiunyu dam
  - Kwa Rwamba

### **11.3 Targets**

To increase water quality and quantity

### **11.4 Proposed outputs**

Report from construction of check dams, purchase, distribution of water tanks and spring protection

### 11.5 Activity Plan and Budget

<b>CH: Catchment Characteristics</b>			
<b>Target</b>	To increase water quality and quantity		
<b>Output</b>	Report from construction of check dams, purchase, distribution of water tanks and spring protection		
<b>Activity</b>	<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
Construction of water infrastructure	Planning meetings with stakeholders	33	YEAR 2
	Awareness creation on water infrastructure development and roof water harvesting	66	YEAR 2
	Develop and protection of 5 Springs (Nyakahiti, Ikeu, Githima, Karuru, Kirurumi)	5,000	YEAR 3
	Construction of common intake	4,500	YEAR 7
	Construction of water pans	18,000	YEAR 10
	Purchase of Tanks	2,800	YEAR 4
<b>TOTAL</b>		<b>30,399</b>	



### 12.1 Introduction

This chapter focuses on the right to access clean, safe and adequate water as enshrined within the Kenyan Constitution Article 43(1) (d) as well as in the Water Act 2016 section (63). Special focus is channelled towards the rights of the vulnerable groups such as people living with disability, elderly, women, children, youth, and people living with HIV/AIDS among others. In addition to access to clean, safe and adequate water, this chapter also focusses on the involvement of the vulnerable groups within the management of water resources at the WRUA level as well as the executive committee.

### 12.2 Current Status

Chania sub-catchment has adequate water, however, rivers especially from the middle section of the catchment are continuously polluted an aspect that violates the right of the people downstream within the lower section of the sub catchment as well as the adjacent sub catchment. With regards to management, Chania WRUA management committee is partly constituted by some vulnerable groups as follows, two people living with disability, seven women and two youth.

#### 12.2.1 Rights based Approach

Children, elderly and persons living with disability are vulnerable when denied their rights to access adequate, safe and clean water. In this regard, there lacks appropriate water access points to persons living with disability and elderly. There is therefore need for creation of awareness to the community about the access of clean safe and adequate water as enshrined the Kenya constitution. Women and people living with disability should also be encouraged to take up management positions in the water sector. There is also a need to ensure convenient access points and infrastructure is put in place to enable the people living with disability have access to water.

On the other hand, it is also prudent to understand that instance of violation of water rights was observed during the transect walk as well as through the focussed group discussions. Violation water rights within the sub catchment has a direct effect on aquatic organisms, some of these instances where water right was violated included the following instances;

- Water pollution
- Encroachment on riparian land
- Soil erosion and siltation
- Mining at proximity to rivers and riparian land

### **12.2.2 Cross cutting Issues**

In as much as there is representation of the vulnerable groups within the management committees, there is need to ensure that the representation is balanced. There is also need to ensure that there is adequate sensitization and capacity building on Integrated Water Resources Management for the community to understand the need for involvement of the vulnerable groups in aspects water resources management. An aspect observed during the focussed group discussions is that youths within the sub catchment are unwilling to participate in managerial activities more so within the WRUA management committees.

### **12.3 Targets**

- To Equip the community and the vulnerable groups with knowledge in management of water resources
- To ensure that there is access to safe, clean and adequate water.

### **12.4 Proposed outputs**

- Report on purchase and distribution of tanks for the elderly and less privileged
- Capacity building report on civic education
- Periodic reports on monitoring, evaluation and enforcement

## 12.5 Activity plan and Budget

CH: 12			
<b>Target</b>	<ul style="list-style-type: none"> <li>To Equip the community and the vulnerable groups with knowledge in management of water resources</li> <li>To ensure that there is access to safe, clean and adequate water.</li> </ul>		
<b>Output</b>	<ul style="list-style-type: none"> <li>Report on purchase and distribution of tanks for the elderly and less privileged</li> <li>Capacity building report on civic education</li> <li>Periodic reports on monitoring, evaluation and enforcement</li> </ul>		
Activity	Sub-activity	Budget*1000	Year of Implementation
Civic Education	Sensitization: barazas 6 n.o barazars annually ,meetings	300	YEAR 2
	Monitoring, evaluation and enforcement against the violation of rights	500	YEAR 2 – YEAR 10
	Capacity building the community on the right to water resources for three days after every three years.	1500	YEAR 2
	Dissemination of acquired information.	0	YEAR 2 – YEAR 10
Provision of appropriate water access points	Sensitization and identification of target groups.	250	YEAR 4
	Procure and install water tanks 20 No.5M <sup>3</sup> to elderly and people with disability	1400	YEAR 4
<b>TOTAL</b>		<b>3,950</b>	

### 13.1 Introduction

Livelihood is a means of securing the basic necessities -food, water, shelter and clothing- of life". Livelihood is further defined as a set of activities performed to live for a given life span, involving securing water, food, fodder, medicine, shelter, clothing and the capacity to acquire above necessities working either individually or as a group by using endowments (both human and material) for meeting the requirements of the self and his/her household on a sustainable basis with dignity to the environment. This Chapter seeks to establish the current livelihood activities carried out in the sub-catchment and the impact on water resources and catchment conservation. The objective is to address issues related to livelihood activities for the sake of enhancing livelihood for maximum returns/improved productivity or where the activities are detrimental to catchment and water resources conservation, make recommendation for alternative livelihoods.

### 13.2 Current Status

#### 13.2.1 Existing livelihood framework

Chania sub catchment enjoys diverse and dynamic livelihood activities where residence constitute mixed subsistence farmers, commercial large-scale coffee/ tea farmers, large business enterprises and industries. In the upper zone livestock farmers practice free range livestock keeping where livestock is left to graze in forested area and water freely in rivers. Agro-forestry farming is practice in some parts of upper catchment like Zaina and Kiandongoro forest. This leads to catchment conservation but other areas of the same catchment are degraded due to human settlement and encroachment. High rates of school drop outs, early marriages and high level of illiteracy are the challenges area faces. The living standard are therefore below poverty line. The people in this sub catchment are a bit apprehensive to alternative livelihood methods. Some of the major livelihoods engagements in the sub catchment include;

- **Subsistence farming**

This is practised in almost entire sub catchment, where farming is done on sloppy and riparian areas. Most farmers do not practise good/modern farming methods. This hence brings about erosion of the soil thus degradation of the soil fertility and water pollution due to high sediment load in the river. Subsistence farming include onions, beans, maize, bananas, sweet potatoes, Irish potatoes, etc

- **Business**

Major businesses are located in the middle zone, which host the Nyeri town, the County headquarters. Here industries, big hotels, banks, supermarkets, hospitals and local markets are situated.

- **Quarrying/Mining**

Quarrying is mostly practised in the middle and lower zones. This is only limited to mining of building stones and ballast stone. This mining is done on individual farms, where sanitation is not provided and miners are exposed to high risk of landslide, do not have protective gears. Mining is done in small scale where modern mining technology is not applied.

- **Livestock farming**

Communities in this sub catchment keep about one to two cows per household with only a few commercial farmers. Very few people keep goats and sheep.

- **Commercial farming**

Tea farming is practised in the upper zone while coffee farming is done in the lower zone and partly in the middle zone. One of the notable tea farm is the Nyayo tea zone located within the upper section of the sub catchment. However, the youth are not directly involved in both tea and coffee farming since the elderly own them and are usually unwilling to subdivide the tea and coffee farms. This has led to rural urban migration by the youth. Some coffee and tea plantation employ under aged persons.

Horticulture is also practised in the entire Chania sub catchment but mostly concentrated in the upper zone. This is high done along the riparian hence leading to soil erosion and pollution.

### **13.3 Proposed Alternative Livelihoods**

To enhance productivity of existing activities and substitute resource destructive activities, alternative livelihoods need to be introduced in this sub catchment. These include but not limited to:-

- Bee keeping
- Dairy goats
- Fish farming
- Poultry farming
- Pig farming
- Upland arrowroot farming
- Introduce alternative fuel instead of fire wood eg bio gas

#### **13.4 Targets**

Diversification and enhancement of livelihood projects

#### **13.5 Proposed outputs**

Reports on capacity building and monitoring of livelihood projects

Established livelihood projects and storage facilities

### 13.6 Activity plan and Budget

<b>CH: 13; Livelihood enhancement</b>			
<b>Target</b>	Diversification and enhancement of livelihood projects		
<b>Output</b>	Reports on capacity building and monitoring of livelihood projects Established livelihood projects and storage facilities		
<b>Activity</b>	<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
Provision of alternative livelihoods projects	Capacity building on alternative livelihood projects	1,500	YEAR 1
	Implementing alternative livelihood projects	5,000	YEAR 1 – YEAR 10
	Setting up of proper storage facilities	2,000	YEAR 2
	Value addition to existing livelihood products	5,000	YEAR 5 – YEAR 10
	Monitoring of implemented livelihood projects	200	YEAR 1 – YEAR 10
<b>TOTAL</b>		<b>13,700</b>	

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## **14 INSTITUTIONAL DEVELOPMENT**

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### **14.1 Introduction**

The WRUA's institutional development caters for the human capacity to run and dispense their mandates and also the fixed facilities that enable their operations and functions. This section of the plan examines the capacity of the WRUA in human resource perspective and the physical asset development by the institution. The capacity of the WRUA is discussed in relation to their; their knowledge, skills as well as the facilities that enable them operate effectively to achieve their core mandate. It further addresses the gaps identified in order to strengthen the WRUA capacity to be a self-reliant entity, and to collaborate and network with other stakeholders with mutual interest.

### **14.2 Institutional set-up**

The WRUA organizational structure has a gap in the sense that they have not constituted additional sub-committees as stipulated within the WDC version 2 of 2014. The sub-committees to be constituted includes that of livelihood and the other for floods and drought. A recommendation is, therefore, to have the two subcommittees put in place for the smooth running of the Institution

### **14.3 Institutional capacity**

Chania WRUA had been capacity built on Governance, Integrated Water Resources Management (IWRM), Financial Management and Record Keeping, however, there is need to undertake periodic capacity building especially due to change of management teams. More efforts need to be channelled towards capacity building of the WRUA personnel on aspects water resources management and resource monitoring. However, an in-depth capacity assessment ought to be undertaken in order to understand specific capacity building needs.

### **14.4 Facilities**

Chania WRUA operates from an office based within Tana Water Works and Development offices where they are hosted by TEAWASCO (Tetu Abardares water and Sanitation Company). However, there is no MOU or any guarantee of Tenancy. In addition, the office does not have office equipment e.g Chairs, Tables, cabinets, Desktop, printer, Motorbikes and other necessary equipment for undertaking monitoring within the catchment.

### **14.5 Targets**

To strengthen Chania WRUA institutional capacity and equip the office with working tools

### **14.6 Proposed outputs**

Report on capacity building of WRUA on institutional development

Equipped WRUA office in place



## 14.7 Activity plan and Budget

<b>CH: 14; Institutional Development</b>				
<b>Target</b>		To strengthen Chania WRUA institutional capacity and equip the office with working tools		
<b>Output</b>		Report on capacity building of WRUA on institutional development Equipped WRUA office in place		
<b>Activity</b>		<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
	Capacity building on institutional development	1.Sensitization meeting	720	YEAR 1
		2.No.meetings per zone after every 5 years	600	YEAR 2
		2.training on institutional development (Governance, Resource Mobilization and Project management)	1200	YEAR 1, YEAR 4, YEAR 7
		3. Recruitment of new members.		YEAR 1 – YEAR 7
	Develop the WRUA office	Rehabilitate the WRUA office	100	YEAR 2
		Construction of the WRUA office	1200	YEAR 10
		Equipping the WRUA office with Furniture's, desktop ,motor bike, cabinets, laptop ,Printers	1300	YEAR 2
	<b>Total</b>		<b>5,120</b>	

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## **15 MONITORING AND INFORMATION MANAGEMENT**

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### **15.1 Introduction**

This chapter seeks to establish the existence of a water resource and climatic monitoring network within the sub catchment. Examine their operational status and the existing framework for data collection, analysis and dissemination between the WRUA and other stakeholders. Key focus is tailored on the input the WRUA can give towards supporting the formal monitoring network. Secondly, there's the need to develop frameworks for community-based resource monitoring.

### **15.2 Water resource monitoring status**

Water resource monitoring is important since it helps Water Resources Authority prioritize water resources appropriation and allocation mostly during the dry season at the sub basin level. At the sub catchment level, Water Resources Authority may engage the WRUAs through a MoU established between them to monitors water resources status. However, key focus is dedicated to evaluate the following; water quality, water quantity and catchment status.

Within Chania sub catchment, there are at least two active river gauging stations (4AC04 and 4AC05) with the latter strategically located at the confluence of all the rivers within the sub catchment. River gauging station 4AC04 is located along Chanya River at proximity to Nyeri town. The river gauging stations are used by the authority to monitor both discharge and water quality with water level being done on daily bases as at 0900hrs and 1600hrs in the evening and discharge being monitored on monthly bases. However, owing to the nature of costs associated with water quality monitoring, water quality monitoring is undertaken periodically. Worth noting is that extra river monitoring networks (4AC06 and 4AC05) had been established, however, they are not operational.

A recommendation would be to rehabilitate the stations or establish strategic monitoring stations based on the current water demands both from domestic water use and land use. With regards to ground water monitoring the sub catchment does not have a station to monitor ground water resources status, however, the authority has so far relied on the information derived from the drilling of boreholes within the sub catchment as contained within the Borehole Completion Record (BCR). Pertinent information contained within the BCR include ground water yield as well as the ground water quality.

In as much as the monitoring is done by the authority, there is need to capacity build the community on simple but reliable means of water resources monitoring that may be used to by the community such as in establishing water resource alert status within the sub catchment. This information may also be used by the community to make decisions such as during the wet

season in early warning of imminent floods especially at the lower sections of the sub catchment.

### **15.3 Water use monitoring**

Water Resources Authority (WRA) is the only institution mandated in regulation and management of water resources in Kenya as enshrined within the Water Act 2016. With regards to this, WRA provides permits for water resource utilization/abstraction while ensuring that abstractors comply with permit conditions. Domestic water abstraction is given priority while ensuring that the environmental flows are met. On the other hand irrigation water demand is given based on the flood flow, key to note is that one condition when issuing irrigation permit is that the abstractor should ensure that they have a storage in place.

Surface water abstractions are mainly along Chania River and River Zaina, notable abstractors along these river channels include Nyeri Water and Sanitation Company Limited (NYEWASCO), KEREMARA limited, Trout Garden conservancy limited, CocaCola, Muhoya Kimathi Irrigation water project and Huhoini Mukaro Irrigation water project among others. Some of the abstractors such as NYEWASCO and CocaCola have measuring devices installed while others do not have measuring devices installed, however, plans are underway to ensure that the abstractors have installed measuring devices.

### **15.4 Data and Information management**

Water level monitoring is done by a trained community personnel who submit the daily readings to Upper Tana Sub Region Office through ODK/Manual notes. At the SRO, the information is evaluated for quality checks and fed into a database system. Based on WRAs data and information architectural flow, the data originating from the sub region is forwarded to the respective regional offices, in this regard, Tana Regional office. The Regional offices later forward the data and information to the headquarters. However, decision making regarding water allocation and apportionment based on the information collected or resource available is done at the sub regional together the basin water resource committee.

There is only two operational manual river gauging station (4AA05) within the sub catchment which is located at the confluence of all the rivers within the lower section of Chania sub catchment.



Figure 15 River Gauging Station encountered during the transect walk

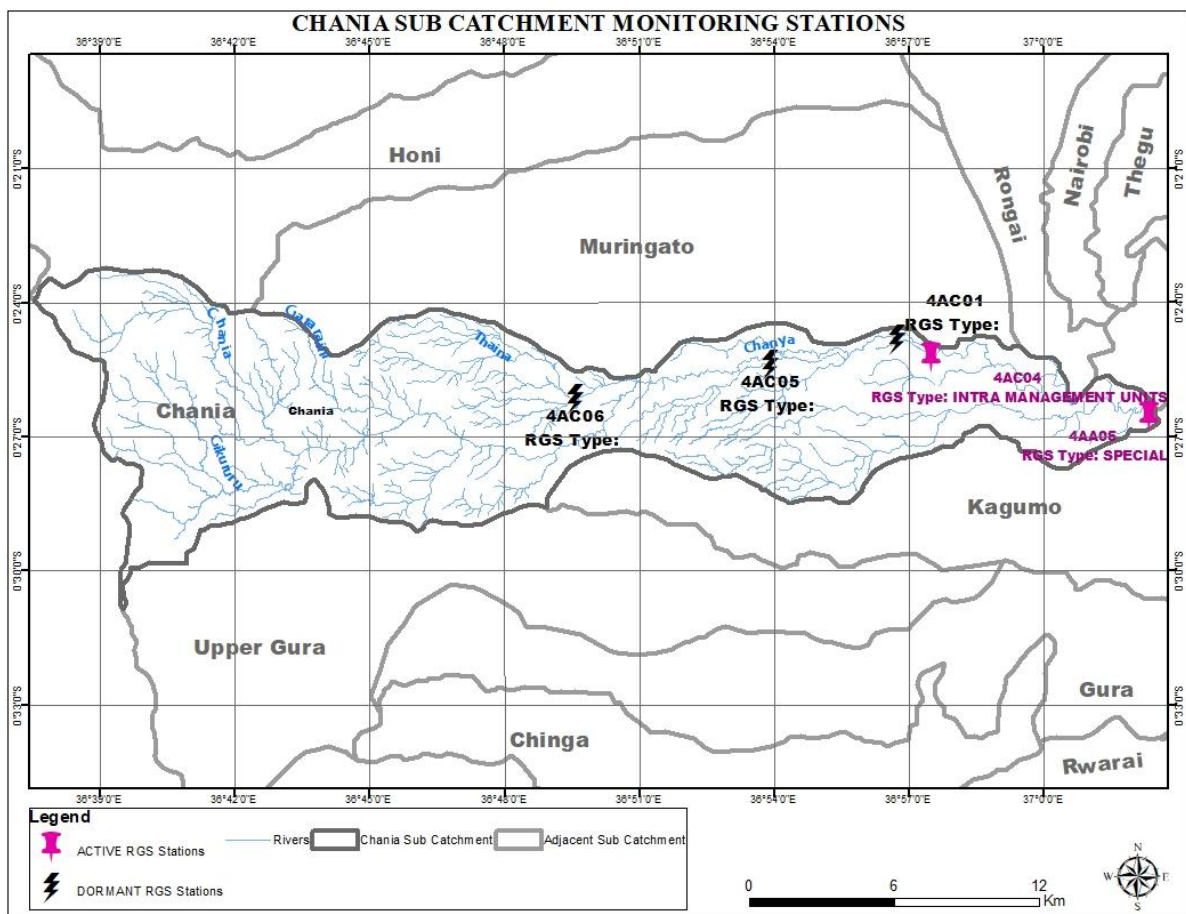


Figure 16 Monitoring Station and their operational status

### **15.5 Reporting and dissemination**

While the data collected is used for decision making for purposes of allocation and apportionment, the data is also generally analysed and up scaled to sub basin as well as the basin level for the development of monthly and quarterly reports which are published in WRAs Year books. Water resources availability may also be available from WRA's website in summary form, however, a stakeholder may also be provided with data on request from WRA.

### **15.6 Targets**

To improve water resource information

### **15.7 Proposed outputs**

- Establishment and rehabilitation of monitoring stations
- Established database and a software in place in place
- Reports on capacity building WRUAs on data collection, establishment and rehabilitation of monitoring stations

## 15.8 Activity Plan and Budget

<b>CH:</b>			
	<b>Target</b>	To improve water resource information	
	<b>Output</b>	Establishment and rehabilitation of monitoring stations Established database and a software in place in place Reports on capacity building WRUAs on data collection, establishment and rehabilitation of monitoring stations	
<b>Activity</b>	<b>Sub-activity</b>	<b>Budget*1000</b>	<b>Year of Implementation</b>
Capacity development of selected WRUA members and stakeholders on catchment data collection	Training the WRUA members for 5days (30 members)	400	YEAR 2
Sensitize community on importance of hydrological equipment	Awareness creation 4 baraza (after every 3 years)	300	YEAR 1, YEAR 4, YEAR 7
Rehabilitation of existing monitoring stations	3 Sub met stations (Kiandongoro, Zaina & Ministry Of Works)	600	YEAR 2
	RGSs 3 in no.( NYEWASCO, Kingongo & Zaina)	1,000	YEAR 2
Establishment of monitoring facilities and equipment	Establishment of ;	2,000	YEAR 6
	2 Automated RGS Stations		
	Siting of 1 dedicated Borehole for monitoring groundwater	70	YEAR 7
	Drilling & equipping of monitoring borehole	2,000	YEAR 7
Establishment mechanism of information sharing	Establish a data base	100	YEAR 2
	Procurement of 1 computer	70	YEAR 2
	Procurement of compatible data software	2,000	YEAR 2
	Establishment of a MoU with all relevant data custodian e.g. WRA, KFS,KMD, KWS etc.	100	YEAR 2
<b>TOTAL</b>		<b>8,640</b>	

## **16.1 Introduction**

The understanding of the state of the WRUA's operational budget, ways to meet WRUA's Operational budget and SCMP investment budget is key for the success of the plan. This section details the mechanisms to raise SCMP investment and operational budget. The challenges facing the financing of the institution and SCMP implementation are discussed and solutions sought for the sake of enabling proper facilitation of the SCMP implementation as well as the institution.

## **16.2 WRUA financing**

### **16.2.1 WRUA operational budget**

- What is the operational cost of the WRUA in monetary terms?

ITEM	Approximated Annual budget
Communications	6,000
Transport	70,000
Stationary	40,000
Audit expenses	20,000
Salaries	120,000
Miscellaneous	30,000
<b>Total</b>	<b>286,000</b>

### 16.3 Mechanisms to meet WRUA's Operational Budget

WRUA finances consists of operational budget raised by members through subscription and IGAS for the day to day activities namely transport, communication, stationary, audit, salaries and miscellaneous expenses,

Item	Annual revenue projection
Members Subscription	51,000
Income Generation Activities	500,000

In an effort to raise adequate WRUA operational/recurrent budget, the WRUA will employ the following strategies;-

- Ensure all members pay annual subscription on time
- Advocate for New members recruitment
- Initiate Income Generating Activities e.g Selling of tree seedlings, Fish farming, recreational facilities (Zaina falls)

#### 16.3.1 SCMP investment budget

Chania WRUA SCMP implementation budget of Ksh 117,292,000 is intended to be raised through proposal development to financial institutions, well-wishers and other development partners.

#### 16.3.2 Summary Investment Budget tabulation

chapter	Title	Budget estimate *1000
1	Introduction	-
2	Overview of the Sub Catchment	-
3	Catchment characteristics	1,400
4	Management approach	5,440
5	Water balance and water demand management	8,283
6	Water Allocation and use	3,140
7	Water Resource protection	15,480
8	Catchment and riparian conservation	13,450



9	Flood Management	5,200
10	Climate change adaptation	1,800
11	Water Resources infrastructure development	30,399
12	Right based Approach /poverty reduction	3,950
13	Livelihood enhancement	13,700
14	Institutional development	5,120
15	Monitoring and information management	8,640
16	Financing and implementation	1,290
<b>TOTAL</b>		117,292

#### **16.4 Targets**

To strengthen the WRUA financial base for operation and SCMP implementation

#### **16.5 Proposed outputs**

Audit reports

## 16.6

## Activity Plan and Budget

CH: 16 FINANCE AND IMPLEMENTATION				
Target		To strengthen the WRUA financial base for operation and SCMP implementation		
Output		Audit Reports		
Activity		Sub-activity	Budget*1000	Year of Implementation
	Capacities build WRUA management on financial management and procurement processes.	Planning meeting	30	YEAR 2
		Hold 3, five days’ workshop of 21 members to train WRUA leaders on financial management (every 3 years).	1,200	YEAR 2, YEAR 5, YEAR 8
	Sensitization and mobilization of WRUA members.	Planning meeting on how to execute public sensitization.	10	YEAR 1
		Hold 12 public barazas within the three zones of the catchment	50	YEAR 1
TOTAL			1,290	

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## **APPENDICES**

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### **1. LIST OF PARTICIPANTS**

## **2. WORKPLAN AND BUDGET**

