

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT**  
**FOR**  
**THE PROPOSED LORIEN INTERGRATED**  
**AGROFORESTRY FARMING IN LORIEN ZONE, RUMURUTI**  
**WARD, LAIKIPIA WEST SUB-COUNTY, LAIKIPIA**  
**COUNTY.**



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**January 2020**

# Certification

This EIA Project Report was prepared in accordance with the Environmental Management and Coordination Act (EMCA), 1999; the Environmental (Impact Assessment and Audit) regulations, 2003 and their subsequent amendments for submission to the National Environment Management Authority (NEMA). We hereby certify that to the best of our knowledge, all information contained in this report is an accurate and truthful representation of all findings as relating to the proposed project as per project information provided by proponent.

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Joel Sing'oei Murei  
Chairman- Project Management Committee  
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**Disclaimer:**

*This EIA Project Report is strictly confidential to the Proponent and any use of the materials thereof should be strictly in accordance with agreement between the proponent and the Consultant. It is, however, subject to conditions in the Environmental (Impact Assessment and Audit) Regulations, 2003 under the Kenya Gazette Supplement No. 56 of 13<sup>th</sup> June 2003.*

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PROJECT REPORT FOR THE  
PROPOSED LORIEN INTEGRATED AGROFORESTRY FARMING IN LORIEN ZONE,  
RUMURUTI WARD, LAIKIPIAWEST SUB-COUNTY, LAIKIPIA COUNTY**

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## Acronyms

CIDP	County Integrated Development Plan
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMMP	Environmental Mitigation and Monitoring Plan
KCSAP	Kenya Climate Smart Agriculture Project
NEAP	National Environment Action Plan
NEMA	National Environment Management Authority
NGO	Non-Governmental Organization
OSHA	Occupational Safety and Health Act
PMC	Project Management Committee
PPE	Personal Protective Equipment
WRMA	Water Resources Management Authority

# Executive Summary



## Introduction

Contributing 34.5% of Gross Domestic Product directly, Agriculture is the backbone of Kenya's economy. However, the sector is extremely vulnerable to erratic weather. 98% of Kenya's agriculture is rainfed. With climate change, the sector is under threat from prolonged drought, floods, pest and disease etc. The government of the Republic of Kenya, has made commitment to enhance agricultural productivity. As Part of the big four agenda, the president has vowed to enhance food security and nutrition. Through World Bank support, the Kenya Climate Smart Agriculture Project (KCSAP) is being implemented in 24 Counties to boost the sector to enhance agricultural productivity.

Lorienn Integrated Agroforestry is a registered Community Based Organization (CBO). Over the years, Lorien community has continued to experience low household income, food insecurity, and high rates of unemployment among youths leading to low standards of living. Additionally, the small produce damaged by wild animals from the neighbouring Rumuruti forest. The Lorien Agroforestry farming was necessitated by unutilized farming potential in the area. Due to this, members from four villages in Lorien came together with the aim of practicing sustainable agriculture. KCSAP awarded investment grant for implementation of their Agroforestry Farming project activities for sustainable land management.

The total project cost is estimated at Ksh 21,994,150 (Twenty-One Million Nine hundred and ninety four thousand and one hundred and fifty shillings); with a community contribution of Ksh 3,579,000 (three million five hundred seventy-nine thousand shillings) and the KCSAP requested support of Ksh 18,415,150 (Eighteen million four hundred and fifteen thousand and one hundred and fifty shillings). The fund will be used for establishment of the proposed project. The activities of the project are; establishment of 300 acres of mango fruits intercropped with beans and sorghum as soil cover and setting up of solar electric fence.

Pursuant to the Environmental Management and Coordination Act (EMCA) 1999; and its subsequent amendment EMCA (Amendment) 2015, the proposed project must be subjected to environmental impact assessment prior to the commencement of activities. In an effort to comply with the legal requirement of the Government of Kenya on the fulfilment of the Environmental (Impact Assessment and Audit) regulations 2003, KCSAP commissioned a National Environmental Management Authority (NEMA) registered experts, to carry out an Environmental Impact Assessment for the proposed Lorien Agroforestry Project for sustainable land management. This project report was conducted in accordance to the requirements as stipulated in the EMCA, 1999 and EIA/EA Regulations 2003.

This Environmental and Social Impact Assessment (ESIA) project report outlines various activities that will be undertaken during all the phases of the proposed project: Planning and design, construction, operation and decommissioning phases. The EIA report links the operations of the proposed project with the likely adverse environmental and social impacts that may result from the proposed development. Mitigation measures for the potential negative impacts are highlighted while enhancing positive impacts, in order to achieve the project objectives and environmental sustainability. The proponent is advised to adhere to EMCA, (1999), and OSH, (2007) Act. Further, there should be adherence to the Disability Act 2005 to ensure that the facility is friendly to those with disabilities.

The project has received prerequisite approvals from relevant authorities. This EIA report seeks an approval from the National Environmental Management Authority (NEMA) in accordance with the EMCA, 1999 and subsequent amendments EMCA, (amendment) 2015. Preliminary designs and site plans for the proposed project have been completed and approved. The project components will be done professionally with due regard to approved and established procedures. Upon completion, the project will lead to food security and improved livelihood of the locals. The purpose of the study is to identify the negative and positive impacts that would be generated by the proposed project. Means to mitigate the identified negative impacts and enhance the positive ones are dwelt with as appropriately as possible.

#### **Scope and Objectives of the ESIA**

The EIA covers, activities that will take place in the proposed farm. The enterprise that will be established at the farm area: bush clearing and land preparation, use of herbicides, electric fence installation, construction of power house and office. The purpose of this study was to assess the impacts that may result during the construction, operational and decommissioning phase of the proposed Lorien Agroforestry farming.

#### **The Study Methodology**

The study was guided by the EMCA, 1999 and its subsequent amendments. Methodology used in this study included: mobilization and planning; desktop review of documents; field data collection; project data synthesis; public consultations and consultancy debriefing session. The general steps followed in environmental and social impact assessment were as follows:

- Environmental screening, in which the project was identified as among those requiring Environmental Impact Assessment under schedule 2 of EMCA, 1999.
- Environmental scoping that identified the key issues to be addressed in the ESIA study.
- Desktop studies to gather any relevant secondary data and information on the impacts of the proposed project on the environment and possible mitigation measures by making use of similar reports for other projects that have been undertaken along the proposed project corridor.
- Public participation by conducting interviews, discussions and public meetings with key stakeholders including members of the community affected by the project to obtain their views on the impacts of the project and possible mitigation measures. This is as per the Kenyan Constitution, EMCA, 1999.

A number of stakeholders from both the government agencies and the local community were consulted for their input to the study through conducting public meetings and KII, administration of questionnaires and on-site field visits. Through this, stakeholders showed overwhelming support for the proposed project. Most stakeholders agreed that the proposed development will generate positive environmental and social impacts in the project area after completion and commissioning.

### **Project Description/Activities**

Lorien Agroforestry CBO intends to develop member farms into a commercial farm to grow mango trees, intercropped with beans and sorghum on 300 acres of land which will be fenced with solar electric fence. The farm will mostly utilise rain fed except for a few farms with piped practicing irrigated farming. At full production capacity the farm estimates to harvest 4 tone of mangoes per acre ater five years in production; 162 tonnes of beans and 135 tonnes of sorghum. 110 top bar hives placed along the solar powered electric fence tto protect the crops from elephants' damage.

### **Project location and cost**

The proposed project is located in Lorien zone, Rumuruti ward, Laikipia West Sub-County, Laikipia County. The coordinates of the proposed project area; Latitude 0°13'40.99"N and Longitude 36°30'3.68"E. The total project investment budgeted for is **Ksh 21,994,150** (Twenty-One Million Nine hundred and ninty four thousand and one hundred and fifty shillings). (*Appended as annex 2*)

### **Project Alternatives**

Lorien Agroforestry has considered alternative methods and options for the implementation of the project. These relate to site, processing methods, waste management options and farming method alternatives. The best options likely to prevent environmental impacts have been chosen for the implementation of the project.

### **Environmental and social impacts**

The project is likely to have both positive and negative environmental and social impacts during the construction, operational and decommissioning phases.

#### **The anticipated positive impacts:**

- Improved livelihood through creation of employment
- Injection of money into the local economy
- Creation of market for construction materials
- Improved well-being of women and children (in terms of nutritional value)
- Generation of revenue for the government; both county and national through payment of tax.
- Increased food production improving food security
- Utilization of the idling land and increasing the value in the area
- Passing of skills to the locals
- Proper land and water resources mamagement

### The anticipated negative impacts

The project impacts identifications were restricted to environmental, socio-economic and cultural impacts. Potential anticipated negative impacts and mitigation measures are as summarized in table 1 below.

**Table 1: Summary of Negative Environmental Impacts and the proposed Mitigation Measures**

Environmental & Social impacts/aspects	Mitigation measure (s)
<b>PLANNING AND DESIGN PHASE</b>	
<b>Drawings/plans approval</b>	<ul style="list-style-type: none"> <li>• Ensure that the design/drawings of the electric fence is approved by the relevant Government department</li> <li>• Results from screening and hydro-meteorological and geological survey data should be taken into consideration at detailed design stage</li> <li>• screening through the site with participation of professional experts (e.g. geologist, biologist, archaeologist, hydrologist, environmentalist).</li> </ul>
<b>Site organization</b>	<ul style="list-style-type: none"> <li>• Deliver and store materials at appropriate location</li> <li>• Hire the right number of workers with clear work schedule/roles and appropriate dress gear</li> </ul>
<b>CONSTRUCTION PHASE</b>	
<b>Loss of biodiversity</b>	<ul style="list-style-type: none"> <li>• Strictly confine the excavations of the site only within the sections upon which the construction works will take place</li> <li>• Re-vegetate exposed areas on the site so as to mitigate further erosion of soil</li> </ul>
<b>Soil erosion</b>	<ul style="list-style-type: none"> <li>• Implement soil conservation measures e.g. terraces to prevent erosion</li> <li>• Stabilize all cut slopes with variety of suitable grasses</li> <li>• Set up proper gabions and drains along erosion prone section</li> <li>• Use heavy machineries/vehicles only where necessary</li> <li>• Excavation should be done under controlled conditions; minimizing vegetation removal, avoiding creating large open expanses of bare soil, creating wind breaks</li> </ul>
<b>water quality: (Surface/ground water)</b>	<ul style="list-style-type: none"> <li>• Sedimentation of the Ewaso_Narok River should be avoided</li> <li>• Prevent chemical run off during rains/irrigation</li> <li>• Drip trays will be used when removing used oil from construction equipment's/vehicles</li> <li>• Used oil storage facility should be kept under lock and key, concreted and banded placed in banded wall</li> <li>• Fuel storage tank should be placed on concrete floor &amp; banded</li> <li>• Safe disposal of wastes (liquid/solid)</li> </ul>
<b>Ambient air quality (dust &amp; fumes)</b>	<ul style="list-style-type: none"> <li>• Diesel equipment to be equipped with gas absorbers</li> <li>• The proponent will ensure that equipment which will be acquired for on site preparation of pre-cast materials and concrete mixing will utilize the latest technology to have minimum emission.</li> <li>• Watering access roads and the site to suppress dust</li> <li>• Covering truck loads using tarpaulins</li> <li>• Personnel will be provided with dust masks to avoid inhalation of the same.</li> <li>• Prioritize use of low sulphur content fuel.</li> <li>• Stock piles to be covered with tarpaulins</li> </ul>

<b>Environmental &amp; Social impacts/aspects</b>	<b>Mitigation measure (s)</b>
<b>Increased water demand</b>	<ul style="list-style-type: none"> <li>• Excavation of storage dams</li> <li>• Waste water recycling and rain water harvesting should be practiced</li> <li>• Installation of flush toilets with low volume cisterns and high pressure</li> </ul>
<b>Soil contamination</b>	<ul style="list-style-type: none"> <li>• Drip trays will be used in maintenance areas</li> <li>• Refuelling &amp; repair of construction equipment will be done in designated areas</li> <li>• Periodic maintenance will be done on all equipment to avoid oil leaks getting into the soil</li> <li>• A bioremediation plan shall be established for the purpose bioremediation of oil contaminated soils</li> <li>• All machinery must be keenly observed not to leak oils on the ground, this can be done through regular maintenance of the machinery</li> </ul>
<b>Excess noise &amp; vibrations</b>	<ul style="list-style-type: none"> <li>• Equipment to be used should be selected on the basis of the noise minimization during acquisition and properly maintained while in use.</li> <li>• The construction equipment will strictly conform to set noise standards.</li> <li>• The proponent should also monitor noise levels and install appropriate noise barriers and acoustic screens.</li> <li>• All farm equipment will be subject to a routine maintenance to ensure they are in good working order.</li> <li>• The equipment to be used should be located far away from the receivers so as to prevent interference.</li> </ul>
<b>Archeology and cultural sites</b>	<ul style="list-style-type: none"> <li>• Any cultural heritage site discovered during construction will be preserved and the cultural heritage commission informed accordingly.</li> </ul>
<b>Increase in Solid wastes</b>	<ul style="list-style-type: none"> <li>• Metallic and timber off cuts will be stored in designated areas and sold or given to authorised scrap metal dealers or given to the locals for domestic use.</li> <li>• Cement empty bags and containers will be re-used or returned to supplier for re-use</li> <li>• Express condition shall be put in the contract that before the contractor is issued with a completion certificate; he will clear the site of all debris and restore it to a state acceptable to the supervising architect and environmental consultant.</li> <li>• Materials from excavation of the ground and foundation works shall be reused for earthworks and landscaping.</li> <li>• Bins/ receptacles shall be placed at strategic locations within the site as collection centres to facilitate sorting of the various types of wastes.</li> <li>• The contractor and proponent shall work hand in hand to facilitate sound waste management.</li> <li>• Use of an integrated solid waste management system through a hierarchy options i.e. source reduction, recycling, composting and reuse shall be encouraged. This will facilitate proper handling of solid waste during operation stage.</li> </ul>
<b>Landscape and visual characteristics</b>	<ul style="list-style-type: none"> <li>• Where there shall be no roads and buildings, the visual characteristics of the landscape shall not be altered</li> <li>• Excavated area/borrow pits should be properly rehabilitated- proper reclamation to restore the landscape</li> </ul>

<b>Environmental &amp; Social impacts/aspects</b>	<b>Mitigation measure (s)</b>
<b>Occupational Health and Safety/public safety</b>	<ul style="list-style-type: none"> <li>• Personnel at construction site to wear complete PPE always</li> <li>• Workers/employees to go through safety and health inductions</li> <li>• Only qualified personnel to operate farm/construction machinery</li> <li>• Designate a Health &amp; Safety officer to be in-charge of enforcing site compliance with OSH rules &amp; regulations</li> <li>• Provision of adequately stocked first aid kit and at least one trained first aider on site</li> <li>• Safety warning signs displayed in different points and the contact numbers of the persons responsible for handling emergencies on the site</li> <li>• All plant equipment will be subject to a routine maintenance programme to ensure they are in good working order, hence minimising health and safety risks</li> </ul>
<b>Surface drainage</b>	<ul style="list-style-type: none"> <li>• Terracing and levelling the project site to reduce run-off velocity and increase infiltration of rainwater into the soil.</li> <li>• Drainage channels shall be installed in all areas that generate or receive surface water. The channels will be covered with gratings or other suitably approved materials to prevent occurrence of accidents and dirt entry that may compromise flow of run-off causing flood.</li> <li>• The channels shall be designed with regard to peak volumes</li> </ul>
<b>Loss of grazing land</b>	<ul style="list-style-type: none"> <li>• Train farmers on how to make animals feeds</li> <li>• Use of crops remains as fodder</li> </ul>
<b>Water points access corridor blockage</b>	<ul style="list-style-type: none"> <li>• Provide gates/access routes to the Ewaso_Narok River for the locals</li> </ul>
<b>Obstruction of migration corridor</b>	<ul style="list-style-type: none"> <li>• Provision of wildlife migration corridor and ecological sites, translocation</li> <li>• Undertake due diligence to ensure animals are not locked out</li> </ul>
<b>OPERATION PHASE</b>	
<b>Soil contamination</b>	<ul style="list-style-type: none"> <li>• Pesticides, Herbicides, fertiliser and fungicides shall be kept in a properly constructed area with proper ventilation, concreted floor, bunded and lockable shed</li> <li>• Application of these chemicals shall follow the right procedures</li> <li>• Hazardous waste shall be kept in a lockable, concreted and bunded storage facility.</li> </ul>
<b>Soil erosion</b>	<ul style="list-style-type: none"> <li>• Ensure good soil conservation measures e.g. use of gabions</li> <li>• Backfilling of excavated areas/cuttings</li> <li>• Access roads and the plant periphery will be left with trees and this will protect soil erosion.</li> </ul>
<b>Water quality (surface and ground)</b>	<ul style="list-style-type: none"> <li>• Construction of proper drains around the infrastructure</li> <li>• Ensure waste water drain channeled into soak pits/ septic</li> <li>• Waste water quality will be tested to ensure that the quality meets specific purposes and is in accordance with national regulation</li> <li>• The transport of hazardous materials to and from farm will be done in accordance with laid down procedures</li> <li>• Application of herbicides, fungicides and pesticides will be in accordance with the law and guidelines- e.g. PERSUAP REGAL AG 2013 regulations</li> <li>• Use non-organic fertilizer</li> </ul>

<b>Environmental &amp; Social impacts/aspects</b>	<b>Mitigation measure (s)</b>
	<ul style="list-style-type: none"> <li>• Under continuous monitoring of irrigation water quality</li> <li>• Ensure good soil conservation measures to avoid sedimentation of water</li> </ul>
<b>Air quality</b>	<ul style="list-style-type: none"> <li>• Emphasize on switching off of farm produce transport vehicle engine when not in use</li> <li>• Ensure scouting, spot spraying and integrated pest management</li> </ul>
<b>Solid wastes</b>	<ul style="list-style-type: none"> <li>• Domestic solid waste will be disposed of at a strategic point in accordance with the waste management regulations</li> <li>• farm waste channeled for generation of energy/ use as manure</li> <li>• Train farmers on wastes segregation and encourage recycling of waste materials</li> </ul>
<b>Public safety</b>	<ul style="list-style-type: none"> <li>• All plant equipment will be subject to a routine maintenance programme to ensure they are in good working order</li> <li>• All workers/employees at the farm to wear PPE at all times depending on the work type and place</li> <li>• Install warning signs on the live wire</li> <li>• allow for migration corridors and safe gates in designated areas</li> <li>• Monitoring of voltages</li> </ul>
<b>Noise and vibrations</b>	<ul style="list-style-type: none"> <li>• All farm equipment will be subject to a routine maintenance programme to ensure they are in good working order, hence minimising noise levels.</li> <li>• Employees to wear appropriate ear protection in workplaces where noise levels exceed set limits</li> </ul>
<b>Spill over of human-wildlife conflict</b>	<ul style="list-style-type: none"> <li>• KWS to allow for migration corridors</li> <li>• KWS to provide access route/corridor or safety gates in designated areas to the forest</li> <li>• Allow utilization of forest products controllably</li> </ul>
<b>Occupational health and safety/public safety</b>	<ul style="list-style-type: none"> <li>• Have a safety and health work plan in place</li> <li>• All farm equipment will be subject to a routine maintenance programme to ensure they are in good working order, hence minimizing health and safety risks</li> <li>• All workers be subject to wearing appropriate personal protective equipment (PPE) depending on the work type and place</li> <li>• All workers to go through safety and health inductions when just employed</li> <li>• Safety warning signs clearly displayed at the work station</li> </ul>
<b>DECOMMISSIONING PHASE</b>	
<b>Demolition wastes</b>	<ul style="list-style-type: none"> <li>• Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3. Composting and reuse 4. Combustion 5. Sanitary land filling.</li> <li>• Donate reusable demolition waste to charitable organizations, individuals and institutions</li> <li>• Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site</li> <li>• All debris should be removed and recycled, reused or disposed of at a licensed disposal site</li> </ul>
<b>Site degradation</b>	<ul style="list-style-type: none"> <li>• Backfill all the excavated areas</li> <li>• Implement an appropriate re-vegetation programme to restore the site to its original status</li> <li>• Consider use of indigenous plant species in re-vegetation of the sites</li> <li>• Level the site to match the original state</li> </ul>



<b>Environmental &amp; Social impacts/aspects</b>	<b>Mitigation measure (s)</b>
<b>Landscape and Visual characteristics</b>	<ul style="list-style-type: none"> <li>• Grading and re-profiling of the surface and re-vegetation will change the landscape and visual characteristics</li> <li>• Rehabilitate the borrow pits/excavated areas</li> </ul>
<b>Soil erosion</b>	<ul style="list-style-type: none"> <li>• Establish plant cover/re-vegetate the open space to reduce soil erosion</li> </ul>
<b>Public safety</b>	<ul style="list-style-type: none"> <li>• Disconnect all active of electricity connection at the farm</li> <li>• Properly store sharp objects from demolition of the farm structures</li> </ul>
<b>Renewed human-wildlife conflicts</b>	<ul style="list-style-type: none"> <li>• Use of community based natural resource management schemes and incentive</li> <li>• Maintanaining of the electric fence</li> </ul>

### **Conclusions and recommendations**

The studies conducted on the proposed Lorien Agroforestry Farming shows that the project will pioneer development in the area, sustainably improve food security in Laikipia and Kenya at large through increased food production; create rural employment opportunities for vulnerable groups; and champion Laikipia County in becoming a leading producer of food crops. Additionally, the project will stimulate economic development in the marginalized region of Lorien, Laikipia and contribute to regional balanced development.

Considering the positive socio-economic and environmental benefits which will accrue as a result of the proposed development and the ESIA having found no major impacts to arise from the development, it is our recommendation that the project be allowed to proceed on the understanding that the proponent will adhere to the mitigation measures recommended herein and will further still implement the proposed Environmental and Social Management Plan (ESMP) together with the Environmental Monitoring Plan (EMP) to the later. Kenya as a country has a big shortage of such Agroforestry project developments; hence the construction of the proposed project goes a long way in solving food insecurity challenges.

# 1. Introduction



## 1.0 Introduction

Economic benefits from the proposed project would aid in the realization of the national development goals, hence alleviate poverty in the long run. The project area has high potential for agricultural production which can play pivotal role in improving the levels of food insecurity, livelihood of a large cross-section of the rural poor and marginalized communities. This can only be realized through efforts to have a developed sustainable farming practices in the counties.

The Environmental and Social Impact Assessment (ESIA) was carried out with the aim of identifying both the negative and positive impacts of the proposed project and formulate a sustainable Environmental and Social Management Plan (ESMP). This would guide the decision and policy makers on appropriate ways to handle the pertinent environmental issues that may arise during the project life and afterwards. Myriad adverse impacts, ranging from vegetation/biodiversity loss, changes in ecological setup, and environmental pollution to cultural disorientation need keen appraisal so as to achieve fairly less retrogressive impacts from such development.

## 1.1 Project Background

Lorien Integrated Agroforestry CBO is dully registrred CBO with two hundred and fifty registered members drawn from Tuigoin, Kapkures, Narok and Ol Arinyiro villages. The main livelihood strategies in the area includes; maize farming, bean farming and livestock keeping. Over the years, food insecurity has been a challenge to community; dwindling agricultural production due to erratic rainfall, drought and human-wildlife conflict, this has contributed to low household income. Despite the challenges, land in Lorien zone is fertile and with good climate.

Traditionally the Government has funded its projects through annual budgetary allocations derived from tax and duty collections, this has not been enough to meet the funding requirements. Project specific donor support supplemnts the governments support. KCSAP i s a Government of Kenya (GoK) project, supported by the World Bank, under the State Department for Crops Development in the Ministry of Agriculture, Livestock, Fisheries & Irrigation (MoALF&I), with the target of increasing agricultural productivity and building resilience to climate change risks in targeted small holder farming. The proposed project by KCSAP is part of World Bank in building climate smart agriculture, which entails establishment of 300acres of mangoe trees intercropped with beans and sorghum and crop cover as one of KCSAP-supported Value chain crops for Laikipia and establishment of 11km long solar powered community electric fence around the farm to keep off wildlife.

Human-wildlife conflicts present one of the greatest challenges to wildlife management in Kenya today. Conflict arises due to the close proximity between people and wildlife, and more pronounced in highland areas where agricultural activities and high human populations invariably lead people to encroachment in wildlife territory. Human-wildlife conflict is also a land-use problem, and occurs because of incompatibility land use types and interests sharing a common boundary e.g. state owned national reserve neighboring a crop producing private lands – all of them legitimate undertakings. Additionally, Human wildlife conflict in Mt. Kenya Ecosystem is also as a result of encroachment of communities on former wildlife areas, blocking of wildlife corridors, and increase in animal population. Conflicts are both direct and indirect.

## **1.2 Environmental and Social Impact Assessment**

Environmental and Social Impact Assessment (ESIA) is a systematic analysis of projects to determine their potential environmental impacts, the significance of such impacts and to propose mitigation measures to the negative impacts. ESIA is both a planning and a decision-making tool. According to the provisions in the EMCA, 1999, all new projects listed under schedule II must undergo an environmental impact assessment (EIA) and a report filed with NEMA for review and action before commencement. In an attempt to comply with national and international legislations and protocols, KCSAP as the funds provider have contacted the services of EIA/EA Experts to carry out an Environmental Impact Assessment for the proposed Integrated Agroforestry Farming in Lorien Zone, Rumuruti Ward in Laikipia County

The need to conduct this ESIA for the proposed project was aimed at complying with the requirements by the National Environment Management Authority (NEMA), subjecting all projects of this nature to ESIA. This ESIA study was carried out in accordance with the EMCA, 1999, Environmental Impact/Audit Regulations of 2003 and in consonance with Environmental Assessment Guidelines of the World Bank.

## **1.3 ESIA Objectives**

The main objective of the ESIA study is to predict, assess, and analyse the possible positive and negative environmental and social impacts that are expected during the construction, operation and decommissioning phases of the project. This was done with the aim of proposing the possible mitigation measures for the highlighted negative impacts.

The specific objectives of the ESIA study were to:

- Prediction and evaluation of potential environmental impacts of the project, and propose workable mitigation measures for the significant negative impacts of the project on the environment.
- Facilitation of consultative public participation and incorporate expressed views into the study report.
- Preparation of a detailed Environmental Monitoring Plan for the proposed project.
- Preparation of a detailed Environmental and Social Management Plan (ESMP) for the proposed project.

#### **1.4 Scope of the ESIA Study**

In order to identify the potential environmental and social impacts, and to come up with the proper mitigation measures for the proposed project, the consultant used both conventional and participatory approaches.

In conducting this exercise, the consultant undertook:

- The reviewing of preliminary designs for the proposed project to get acquainted with environmental issues in the project site vicinity.
- The planning and preparing of a time schedule for the activities to be undertaken for the ESIA. Social and cultural environment: Population, land use, planned development activities, community structure, employment and labour market, sources and distribution of income, cultural properties.
- Visiting the project site, and widely consulting with the local communities, local leaders and other relevant key stakeholders.
- Carrying out a comprehensive assessment ensuring all environmental concerns and views of all parties/persons likely to be affected by the project are taken into consideration.
- Developing an environmental management plan with mechanisms for monitoring and evaluating the compliance and environmental performance, which include the cost of mitigation measures and the timeframe of implementing the measures.
- Publicizing the project and its anticipated effects by posters in strategic places, publishing a notice in both official and local languages in the Kenyan Gazette and one of the local dailies.
- Liaising with NEMA for compliance with all mandatory and regulatory requirements relating to the ESIA.

## 2. ESIA Methodology and Reporting

### 2.0 The Approach of ESIA Study

As stated earlier, the ESIA Study was carried out in compliance with the government of Kenya's Environment Management and Coordination Act of 1999 and the Environmental (Impact Assessment and Audit) Regulations 2003 among other relevant laws, regulations and guidelines standards.

### 2.1 The Term of Reference

This report is to assist NEMA, the government and public in understanding the potential environmental consequences of the proposed project. Further, the terms of reference developed for this study covered the following;

- To ascertain regulatory compliance;
- To describe the potential impacts that may occur both during construction phase and operational phase
- To identify the impact imposed on existing infrastructure; the demand put on natural resources;
- To describe the potential effects of the development on both the natural and human environment taking into account health and safety matters;
- To propose suitable mitigation measures for identified negative impacts;
- To develop a comprehensive Environmental Mitigation and Monitoring Plan and
- To provide a decommissioning plan, and offer conclusion and recommendation.

### 2.2 Steps and Methodology of the ESIA Study

#### 2.2.1 Environmental Screening

This step was conducted through legal review and desktop studies to assess whether there will be a need for an environmental and social impact assessment, and what level of assessment is necessary. This was done using a screening checklist in reference to requirements of the EMCA, 1999, and specifically the second schedule. Given the scale and the impact level of the proposed project, Environmental and Social Impact Assessment summary report was opted for. Issues considered included the physical location, sensitive issues and nature of anticipated impacts.

#### 2.2.2 Mobilization and ESIA Planning

The consultancy team was mobilized upon receiving instructions from KCSAP. At the commencement of the study, the consultants met with the Project coordinator to discuss and agree on the scope of work, understand the ToR and agree on the proposed methodology.

During this meeting, the consultancy team presented their detailed work plan in order to agree on specific timing for various inputs, progress meetings and reporting dates. The consultancy team also discussed and finalized the logistical modalities and staff who the client provided to the team during the assignment period.

### **2.2.3 Environmental Scoping**

Scoping, a result of preliminary physical assessment of the site and its surroundings, helped narrow down to the most critical environmental and social issues requiring attention for detailed evaluation, among the significant issues identified included:

- The physical environmental aspect in the area.
- Waste generation
- General water use trends in the area.
- Potential risks in terms of accidents
- Animal attack, cattle rustling, and vandalism by the community members
- Social issues especially concerning the immediate neighbourhood, amenities and safety

It also included discussions with key stakeholders, managers and design engineers as well as interviews with local communities.

### **2.2.4 Desk Review of Documents**

The consultancy team reviewed all the relevant available documents on project activities and components from the client e.g. project designs documents. In addition, Kenya's environmental legislation and regulations and all the recognized guidelines and standards on ESIA.

### **2.2.5 Site Assessment and Data Collection**

Field visits were made for physical inspections of the areas around the project site and the environmental status of the surrounding areas to determine the anticipated impacts. The team established the nature of the surroundings including: existing infrastructure, economic and social set up of the local communities whose normal daily activities will be and/or likely to be affected by the implementation of the proposed project. During the field study, the consultancy team collected existing information through interviews with community members and key informants from lead agencies on the likely adverse impacts of the proposed project.

- Site assessment: - the immediate neighbourhood was interviewed while the environmental and social settings of the area were undertaken (Biophysical assessment). The assessment team visited the proposed site during the assessment period in January 22<sup>nd</sup>, 2020.
- Geographical Positioning System (GPS) used to capture the proposed site coordinates
- Socio-economic factors and amenities around the project area assessed

## **2.3 Stakeholders Consultation Meeting**

Public participation meetings were conducted at Lorien Integrated Agroforestry CBO premise. Public baraza and Focused Group Discussions (FGDs) were conducted with locals sampled from across the Lorien Zone villages located around the project corridor. To ensure adequate public participation in the ESIA process, questionnaires were administered to the local communities, leaders, and the information gathered was subsequently synthesized and incorporated into the ESIA Study Report. The consultant incorporated the concerns and

views of all stakeholders and the affected people. KII was conducted with government officials present at the meeting.

#### **2.4 Project Data Synthesis**

Both primary and secondary data collected were analysed and used in the preparation of the Environmental Management and Mitigation Plan (EMMP) encompassing the potential negative environmental impacts, mitigation measures and monitoring indicators. The EMMP is incorporated in the ESIA project report.

#### **2.5 Reporting**

The Environmental Social Impact Assessment summary project report was compiled from the findings in accordance with the guidelines issued by NEMA for such works and prepared and submitted by the proponent for consideration and approval. The Consultant ensured constant briefing of the client during the exercise. Description plans and sketches showing various activities are part of the Appendices. Compilation of this report was undertaken by the EIA/EA Experts as stipulated under EMCA, 1999 for submission to the NEMA.

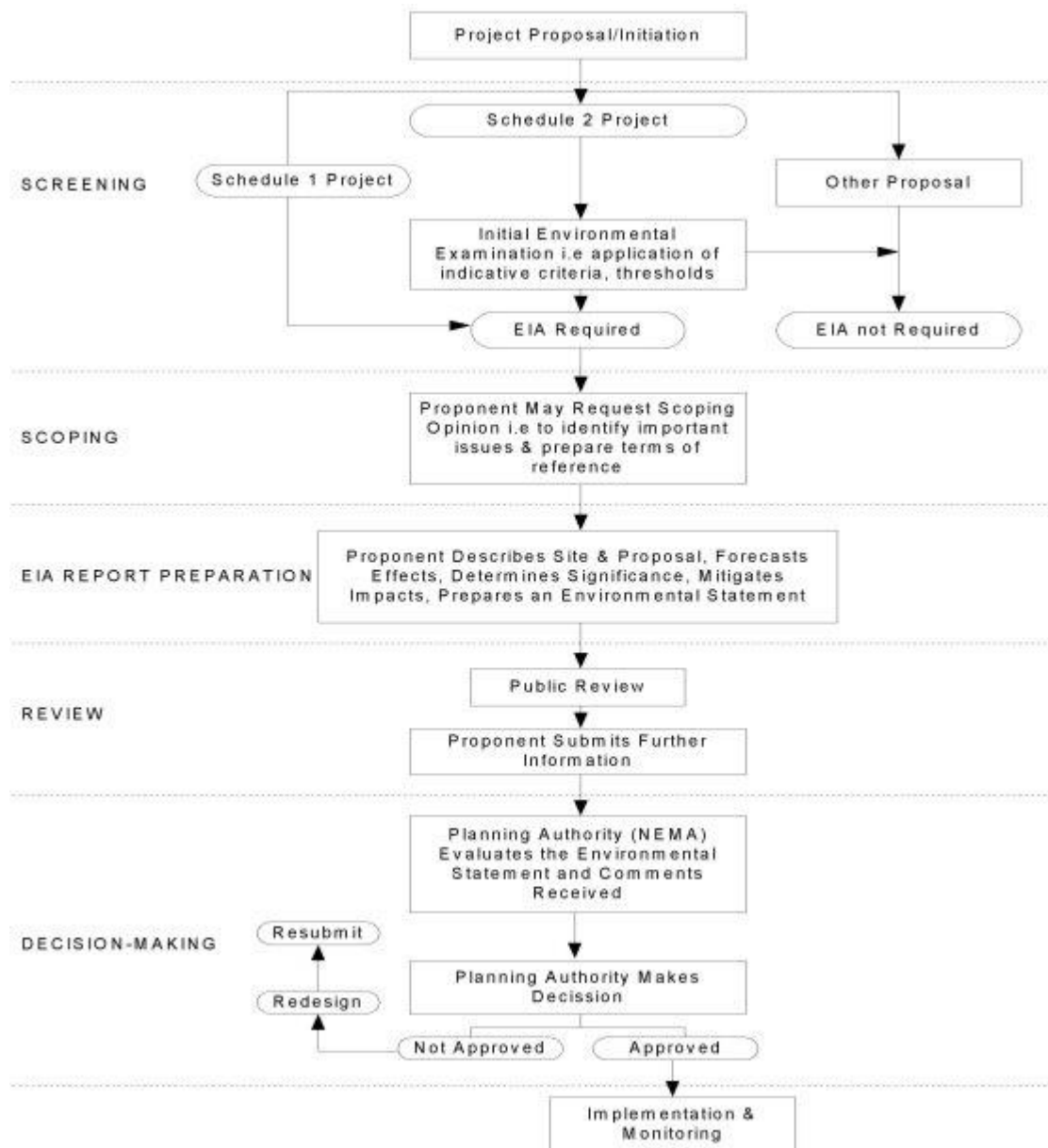
#### **2.6 Reporting Structure of ESIA Study**

Based on the existing information, the ESIA summary project report was carried out to full completion and processing. The Consultant (Lead Expert) coordinated the day-to-day functions and any related institutional support matters. Otherwise, all formal communications are to be directed to NEMA through the proponent.

As per the Environmental Impact Assessment (EIA/EA) Regulations of 2003, the project report is expected to include the following:

- The nature of the project and the budget;
- The location of the project including information on: vegetation, climate, settlement and infrastructure;
- Environmentally sensitive area to be affected
- Review of policy, legislative and institution framework environment, water resources exploitation and development;
- The activities that shall be undertaken during the project construction, operation and decommissioning phases;
- The materials to be used, products and by-products, including waste to be generated by the project and the methods of their disposal;
- The potential environmental impacts of the project and the mitigation measures to be taken during and after implementation of the project;
- Any other information that the Authority may require.

A Summary of steps in an ESIA are as shown in Figure below:



**Figure 1: General ESIA process steps in assessing projects**



## 3. Project Description



### 3.0 Introduction

The Government of Kenya, through KCSAP supported by the World Bank has identified the need to increase agricultural productivity and build resilience to climate change risks in targeted smallholder farming and pastoral communities in Kenya. Lorien Integrated Agroforestry CBO, forseeing to implement agroforestry project in their farms to enhance food security and iproved locals livelihood through project support by KCSAP. These project is intended to support the agricultural sectors. The project intends to establish 300acres of mangoe trees, intercropped with beans and sorghum as cover crops, the area will be fenced off with solar powered community electric fence to protect the crops from wildlife destruction.

Agroforestry was identified as the most effective method of farming that ensures utilization oif the land, soil and water and conservation and enough food production. Solar powered community electric fencing is required to minimize human-wildlife conflict. Fencing will start from already existing community electric fence connecting to Rumuruti Forest electric fence. There are approximately four identified hot spots serving as elephants'/wildlife routes into the farms and hence deserves priority consideration for fencing.

### 3.1 Project objectives

Thee project aims to establish integrated agroforestry farming for sustainable land management in Lorien. The projects overall objective is to improve the standard of living of the CBO members and enhance their resilience to the unexpected recurrent droughts which result in total crop failures and massive loss of livestock.

#### 3.1.1 Specific Project Objectives

The specific project objectives include the following:

- To improve food security and increase sustainable household incomes.
- To create employment through engagement. of youth men and women in full-time farming.
- To improve on nutritional status of members and indirect beneficiaries through availability of diversified farm produce.
- To improve on environment through increased vegetative cover and reduction of carbon dioxide from the atmosphere to a certain level (Carbon sequestration).
- To reduce/control human-wildlife conflict in the area.

### 3.2 Project Area Location

Lorien Agroforestry farm is located in Lorien Zone, Rumuruti Ward, Laikipia West Sub-County, Laikipia County, approximately 30km from Nyahururu town; 8km off Nyahururu-Rumuruti Road. The proposed site is on coordinates Latitude 0°13'40.83"N and Longitude 36°30'3.68"E with elevation of 1889 above sea level. The proposed site seats 1.5km away from Rumuruti forest and 1km from Ewaso\_Narok River. The road to the site is murrum road; the area is supplied with piped water. The project area is predominantly plain with no hills and mountains, the area is drained by Ewaso\_Narok River, with tributaries at the edge of Aberdatres. The farm encompasses; Tuigoin, Kapkures, Narok and Ol Arinyiro Villages. The member farmers will be allowed upto 1 acres per member of mangoes intercropped with beans; ½ acre per member for sorghum.

The project site neighbours Kariuli farm and Mahiga Chinga farm from West; Salama farms from North; Gatunda farm from South and Thuita Farm from East. A few farms in Tuigoin Narok and Ol Arinyiro villages borders the Ewaso\_Narok River.

### 3.3 Nature of the Project

The proposed development of Lorien Integrated Agroforestry will incorporate several activities.

- Arable agricultural operations; establishment of 300acres of mango fruit trees intercropped with beans and sorghum on the same area as cover crop
- Installation of 110 Kenya Top Bar Hives
- Establishment of 11km long solar powered electric fence

#### 3.3.1 Arable agriculture Operations

The proposed Lorien Integrated Agroforestry farm will involve, the growing of mango trees, intercropped with beans and sorghum. The crops will be grown both through rain fed agriculture and irrigation in a few farm spaces with piped water. The harvested crop will be for commercial use and provision of household food. A total of 300 acres will be utilized for this purpose. The cropping operation will also employ sustainable agricultural practices through effective pest and weed control management systems.

The farm will utilise open field cultivation, this involves taking care of the soil, seed sowing/transplant by oneself (farmer) and crop protection from hazards until harvest. The following raw materials will be required for the cropping operation to be conducted at the CBO farms;

**Table 2: Raw Material Requirement for Farming**

Raw Materials	Application	Responsibility
Mango	For transplanting	PMC
Beans and sorghum seeds	Crop seeds for planting	PMC
Pesticides, herbicides	Crop protection, pest control	PMC
Fertilizer	Soil nutrition	PMC
Agricultural lime	Soil PH stabilization	PMC
Disel fuel, oil, lubricants	Farm machinery energy source	-
Tractors	Ploughing	-
Knapsack sprayer	Pest, weed control	PMC

Cropping will be through rain fed, water from the River will be used on the transplanted mangoes to its maturity. Farm members with piped water will irrigate their farms. The key activities at the farms will be to establish mango tree orchard intercropped with beans and sorghum as cover crop, this will conserve water and soil in the farm. The cropping operation will employ sustainable agricultural practices through effective pest and weed control management systems.

### **Activities**

#### **a) Mango Tree Orchard Establishment: -**

The process of establishing mango tree involves land preparation; digging of holes for transplanting of the seedlings. Ewaso\_Narok River water and piped water within the farm premises will be used to the maturity of the seedlings. Afterwards the growth will be through rain fed system. Soil sampling will be done across the farm from approximately 125 points to check the suitability of the soil. Planting will be composed of approximately 15,000 high quality seedlings procured. Most of the weeds will be destroyed through ploughing and application of pre-emergence herbicides. Preplanting application of basal fertilizer will be undertaken. Additionally, manure obtained from cattle paddocks will be utilized as part of the composting plan on the farm.

Mango will be susceptible to fruit fly, mango weevil etc. during the flowering period, these pests may lead to foliage loss. This will be controlled using recommended pesticides at optimum application rates. The mango will be grown on a commercial scale purpose. After the crop maturity, the estimated yield is 4000kg per acre.

#### **b) Beans and sorghum Establishment: -**

Beans and sorghum will be grown using rain fed operations. The crops will be intercropped with mango fruit trees as crop cover. Fertilizer, pesticides and herbicides will be used to enhance good produce.

#### **c) Lagstroth Establishment: -**

110 beehives will be sourced for installation along the 11km solar powered electric fence, this will help keep elephants away.

### **Products and By-products**

The main products from the farm will be mango fruits, beans, sorghum and honey. The harvested crops will be mainly for commercial purpose and a few for household consumption. Mango and sorghum crops grown are one of the value chain crops in Laikipia. Beans are soil cover crops enhancing soil and water management. A total of 300 acres of land is available for implementation of the activities. Water from Ewaso\_Narok River is also available, the proponent can also carry out rain water harvesting. Majorly rain fed agriculture will be practiced by the proponent.

#### **3.3.1.1 Materials**

Farm machineries such as tractors shall be used during construction phase. Hand tools will additionally be used by the farmers in digging of holes, weeding and setting up of the crops. Seeds will be used for the beans and sorghum crops and quality seedlings will be sourced for mango fruit trees. Agrochemicals to be used include fertilizers, pesticides, lime, fumigants and compost.

A store will be in place for storage of fertilizers and agricultural tools and inputs.

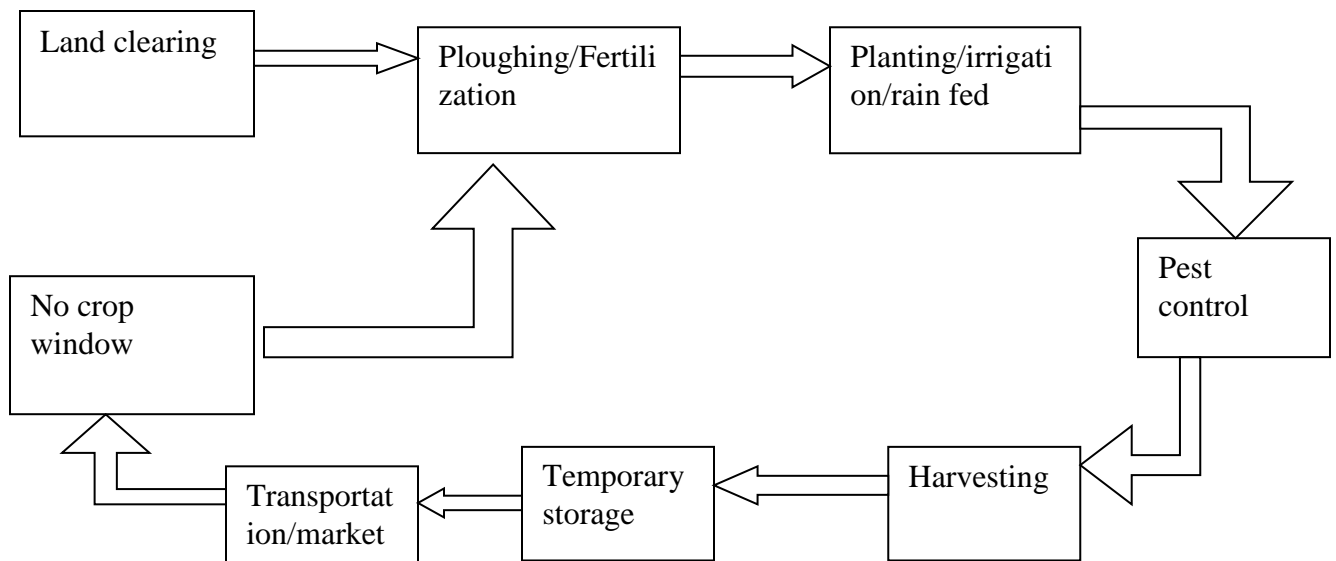
### 3.3.1.2 Solid waste generated

Categories of waste generated

The proposed project will generate waste in these categories

1. Green matter waste from the crops being grown and trimmings
2. Containers of agrochemicals e.g. fertilizer bags, chemical containers. These will be disposed off appropriately through burning or recycling.
3. Farm machinery oil and fuel containers- will be recycled.
4. Plastic linings
5. Human waste and sanitation

The typical farming methodology to be employed is as given in the diagram below.



**Figure 2: Farming process flow diagram**

### 3.3.2 Kenya Top Bar Hives

110 Kenya Top Bar Hives will be installed along the electric fence perimeter to prevent elephants destroying the fence. Ideal location will be identified to hoist the beehives. The honey produced will be harvested using electric centrifuges, packed, labelled and sold. Members will be trained on the best honest harvesting techniques. Safety will be adhered to during the harvesting period. Bee keeping is one form of environmental conservation, instead of charcoal burning/illegal logging, the locals can earn a living from bee keeping. The apiary is estimated to produce over 2200kg

### 3.3.3 Electric Fencing

The fence will be established as the most effective barrier to manage human-wildlife conflict in the area. The fence will start from already existing community fence around Kifuko farm the Rumururi Forest KWS fence. The electric fence to be erected will comprise of four strand running through W insulators. The fence will be to control large animals from the farms and also limit human access in and out of the farm. Conflict areas were identified as hot spot from the community meeting. The fence to be erected will be aligned along the border of the Rmuruti Forest and the community boundary

### **3.4 Integrated Agroforestry Farming**

Lorien Integrated Agroforestry CBO farm will implement the project through four (4) different project phases; site preparation (Planning), construction, operation, decommissioning & closure phases. This sections illustrates on mango fruit trees, crop farming and beekeeping (Kenya top bar hives).

#### **3.4.1 Site Preparation Phase**

The preparation phase prior to the commencement of this project will include but not limited to the following activities:

- Estimation of the Bill of Quantities for the new construction works to be conducted on site.
- Obtaining relevant authorization and documentation from regulatory bodies including NEMA and Laikipia County and other relevant stakeholders that will be affected by the project implementation.
- Acquisition and delivery of construction material and farm machinery to site.
- Hiring of onsite local labour for the construction phase.
- Acquisition and delivery of construction raw materials to site.
- Communication with relevant stakeholders on project commencement.

#### **3.4.2 Construction Phase**

The following activities will be undertaken during the construction phase of the project:

- Clearing of vegetation on the previously used arable land.
- Clearing of vegetation and stamping to prepare the land for farming.
- Plantation of the identified crops (Mango fruit trees, beans and sorghum)
- Commissioning of the beehives
- Solid waste management facility

#### **Project Construction Inputs**

The development of the farm will utilize, but not be limited to the following inputs:

- **Land:** The land for the proposed project is owned by the members Lorien Integrated Agroforestry CBO. A copy of the land title/allotment is appended to this report as annex. A total of 300 acres of land will be available for implementation of the project
- **Water:** The possible water source in the project vicinity is the Ewaso\_Narok River and piped water in some member farms. However, the farm will majorly be rain fed.
- **Labor:** There is readily available labor in the project area. CBO members will add input in farming practice. Workers will also be hired based on their experience and the ability to perform the various tasks.
- **Construction materials:** Farm machinery such as tractors shall be used during the construction phase. Other materials that shall be used include natural stones, sand, aggregates, timber for making structural formwork, steel bars, reinforced concrete block, pre-cast units, among other necessary building/construction materials for the construction of office/store.

- **Technology:** Agroforestry technologies will be practiced where mango fruit trees will be intercropped with beans and sorghum. This is a way of conserving soil and water. Additionally, the practice will fully utilise the land space and with more produce.
- **Agrochemicals:** The Chemicals to be used include fertilizers, pesticides, lime, fumigants and compost. The total range of pesticides fertilizers to be used will be as per the agronomists recommendations.
- **Planting materials:** The planting of mango fruits, beans and sorghum will be done from seedlings sourced from reliable vendors and in the cases of sorghum and beans seeds will be used.

#### **3.4.3 Operation Phase**

During the operation phase, three main activities will be undertaken by Lorien Integrated Agroforestry CBO farm. Land allocation will be done in accordance with the requirements of each activity for an effective farming operation. General operations of the farm will involve:

- Obtaining of all relevant licenses for the operation of the farm
- Disease control and surveillance
- Proper management of wastes generated

#### **Project Output**

##### ***Pests and Disease Management***

Recommended pesticides will be used as per the specifications. Farmers will be trained on surveillance of pests and disease. Herbicides will be used to manage weeds, alongside manual removal of weeds.

##### ***Waste Generation***

During the operational phases of the project, various types and classes of waste will be generated by the farm. This will include as detailed below:

- Solid waste (empty containers & chemical packaging)
- Green matter waste from the vegetables being grown and trimmings
- Human waste and sanitation

The generated wastes shall be managed as follows:

- ➡ Chemical packaging will be disposed off appropriately through burning or recycling.
- ➡ Green matter waste can be used as manure in the farm.

#### **3.4.4 Project Monitoring and Review**

This stage involves a continuous process of employing monitoring and improvement activities. Some of the areas of concern include;

- Solid waste handling, temporarily storage, transportation and disposal.
- Liquid waste disposal problems e.g. guarding against culvert blockage.
- Pollution; air, noise, water.
- Occupational safety and health issues.

It is recommended that the area of influence is monitored for ammonia, hydrogen sulfide and mercaptans using passive diffusion tubes. Odour surveys can also be performed but possibly only if complaints are registered from the immediate neighbours.

### **3.4.5 Decommissioning Phase**

Upon shutting down/removing the infrastructure from operation/use, the contractor will ensure that unnecessary material and structures will not be left on the project site. This will involve demolition of the office/store, removal of site residential camps, signage, pegs and any other temporary structures that were erected to facilitate the construction.

All wastes in form of metals, stones, wires, plastics and iron sheets that will have accumulated during the period will also be properly disposed of in accordance with the waste disposal By-laws. The same will apply to the tools and machines. Wastes generated as part of camp decommissioning activities will be managed so as to comply with standard waste management procedures. Disposal locations will be selected by the contractor and the local council based on the properties of the particular waste generated.

In general, the following shall be done:

- Organic wastes will be composted and sold to other farmers as manure
- Hazardous wastes (chemical containers e.t.c) to be incinerated
- Re-usable wastes e.g drip lines, polythene sheets will be sold to other farmers,

Farm inspection will be done to provide valuable information for deciding on alternative for future use. The immediate environmental concerns will be remedied and the rest of the crops farm area left as they are, for a future buyer or occupier.

Equipment that cannot be used at the farm will be cleaned and taken to another facility of the same nature of business or sold. This will include components to water systems, process piping and other reusable specialized equipment. Additionally, equipments that may be contaminated and require decontamination will be identified. Decontamination will involve removal, purging and proper disposal of liquids and solids contained in equipment, and rinsing or high pressure washing with water and detergent. Chemical analysis of wipe samples taken from washed equipment surfaces will be performed to document that residual hazardous substances have been removed.

### **3.5 Electric Fence**

The proposed project would wish to install 11 kilometres of solar powered community electric fence. The fence will stretch from already existing solar powered electric fence connecting to Rmuruti Forest KWS electric fence. The KWS has no objection to the fence helping the community protect their crops from wildlife destruction. The project is a four strand fence.

**Design:** The proposed electric fence will have the design of a simple electric fence and will comprise of four strands running through W insulators on line posts and strain on strain end insulators at every 200 metres and line posts spaces at 10 metres. Additionally, the fence will have spikes at the top. The fence will be able keep off both small and large animals from the community areas. The fence will also control human access in and out of the farm and thus curb illegal activities like food produce stealing. Detailed sketch design details attached as appendix.

**Alignment:** The fences erected will be aligned along the border of the Rumuruti Forest and the farm boundary on the lower side, the fenced will be several metres away from Ewaso\_Narok River. The fence alignment was agreed upon by the community and stakeholder submissions and during the meetings/ workshops held.

The main reason for choosing the alignment was to assist in fence monitoring and maintenance by the community. Stakeholders generally agreed that the main reason for putting up the fence was to mitigate human-wildlife conflicts. The proposed project will have four major components, namely: -

1. Planning
2. Construction
3. Operations
4. Decommissioning

### **3.5.1 Planning**

This has already started and has included the undertaking of this Environmental Impact Assessment. Already, a scoping exercise has been undertaken and it involved extensive consultations with the forest adjacent communities and key stakeholders. Various meetings and discussions held helped in identification of the community solar powered electric fence as the best wildlife barriers to mitigate human-wildlife conflict. In choosing the design of the electric fence, the key problem animals were considered with respect to their sizes, intelligence. The geographical factors and location of site to be fenced were also considered.

Project sustainability was one of the critical issues considered in the planning phase. In this regard, the planning stage has ensured that project sustainability is guaranteed through community participation from the very beginning. The scoping exercise and other initial meeting held between communities and KWS determined that the wildlife barriers were actually required as the best way to mitigate human wildlife conflicts. The scoping exercise determined that the electric fence was indeed the preferred barrier. The project sustainability is also guaranteed due to the high socio-economic benefits that will accrue to the communities.

The erection of the fence will lead to; poverty alleviation through minimization of crops and infrastructure destruction by animals. The fences will also restore social order and improve agricultural production, food security, general security and improved incomes and livelihoods. The farmers/community adjacent will maintain the fence

### **3.5.2 Construction**

This will be the main phase of the project and will include the actual erection of the fence. The fence will be erected on the periphery of the member farms. The design of this fence is that it will comprise of four strands of wire, of which three will be live and one an earth (the lower one). All the live wires will pass through the insulators on the rangeland side of the wooden posts. Key activities to be undertaken include: -

#### **3.5.2.1 Clearing of the Fence Alignment**

This will start with the surveying of the alignment by a surveyor. The fence alignment will be on the boundary between the forest and the CBO farms. The clearing will thus be on the farm side. The electric fence route has thickets and shrubs that will be cleared to pave way for the construction activities. The proponent will determine how the cleared vegetation will be disposed.

The ground within the corridor will be leveled with a grader or dozer and fence set so as to leave a 4 metres width of corridor outside to serve as a firebreak. The other 6 metres will be



graded to form an access tract parallel to the fence line and shall be sloped according to terrain so as to allow for surface drainage. Human labour will be highly utilized to clear the fence line so as to minimize potential impacts associated with use of heavy machinery such as soil erosion.

#### **3.5.2.2 Drainage**

Where necessary, catch-water, cutoff and side/mitre drains shall be cut with an earth moving equipment (or human labour where such equipment cannot be used) during alignment clearing to deviate runoff from the access road. Simple drainage structures (e.g. culverts and drifts) shall be constructed along the fence alignment as identified by a supervisor. Also, where necessary, forming the appropriate cross-section shall involve cutting and pushing earth lengthwise or crosswise in fill. The fill shall be compacted in 200 mm layers in accordance with the standard specifications for construction of such structures.

#### **3.5.2.3 Pitting and Erecting Fence Post**

Holes for the posts will be dug using human labour and simple hand tools. Holes will be dug to a depth of 600 mm depth and a width of about 300 mm wide. The holes will be spaced at intervals of 10 metres. Fence posts will be treated wooden posts 1676mm long, 125-150mm diameter. The line posts will be stalled in holes dug; In rocky or loose soils, the posts will be supported by concrete of a ration of 1:3:6 and must allow for outflow of rainwater off the posts. All posts will be well tamped prior to the attachment of insulators and wires.

#### **3.5.2.4 Strainer Assemblies**

Strainer assemblies will be installed at any point where there is a rise and fall in the fence line and at every point where the fence alignment changes.

#### **3.5.2.5 Electricis**

**Energizers: B1600 (power plus)** These will be solar powered units, which have proved capable of powering a fence of this design over a distance of 10 km with 5 KV potential difference (Odhiambo, G.W, 2006).

**Shock stops:** These will be coupled to the energizer to enable maintenance staff to switch the fence off and on during maintenance. They will be mounted on a panel located in an energizer house.

**Lightening Diverters Kit:** These will be built in spiral chokes manufactured using thick wall PVC pipes class B and galvanized wires and connected between the fence and the earth.

**Earthing:** The earthing system for both the energizer and the lightening diverter will be installed. Three earth pegs interconnected by an under gate cable tied by a joint clamp will be driven deep into the ground and space at two metres. This will be at least 10m from any water supply, earth peg, underground telephone or power cable.

**Wiring:** The high tensile plain wires will be highly galvanized with a tensile strength. The wires will be passed in line W-insulators on wooden posts and through porcelain reel insulators on the steel posts and directly nailed to the posts. The earth wires will be stapled directly to the posts interlinked by wire links from the top strand to the lowest. The two crosswires, consisting of four strands of wire each will be tensioned in unison to ensure that

both wires have equal tension. To these two cross-wires will be attached 4 X 150 mm lengths of thick wall PVC pipe (or porcelain reel insulators) to accommodate the live wires.

**Staples:** On treated timber posts used in the fence framework, the wires will be secured with shanks, hot dipped, galvanized fencing staples. The staples will be hammered into the post pointing slightly downwards, and to avoid the danger of splitting, the timber will be set in a staggered pattern down the post.

**Line Clamps:** All connections to the live wires will be made with line clamps, which will be well tightened and covered with a film of grease.

**Warning:** “HATARI” warning signs will be attached to the 2nd live wire at a spacing of approximately 40 metres.

### **3.5.2.6 Gates and Access Roads**

These will be constructed at any point where access to the farm is required. This will generally vary with different areas to allow human access for the River for water, firewood and other products. The actual gate locations and distances between them will be discussed with the members and committee and each gate will need to be justified as they should be as few as possible. The fence will have a service or access road which will be a fairly motorable road, and which will be well maintained for proper monitoring of the fence.

### **3.5.2.7 Energizer house**

The energizer houses will be built to accommodate the maintenance staff or the security officers at the fence. The houses will be located at convenient points at intervals.

### **3.5.2.8 Materials and Equipment**

The materials and equipments to be used in the fencing project will include the following as indicated in table below

**Table 3: Materials and equipments to be used in the fencing project.**

<b>ITEM DESCRIPTION/ SPECIFICATION</b>	<b>QUANTITY (PCs/No)</b>
Poles -6"x5 " 5 ½ ft	1350
Poles -6"x7" 18 ft	64
w-insulators	2600
Fence staples	55
Force line (end stain insulator ceramic	4802
Underground cable	8
Ordinary nails -5	30
Solar battery 200amp dry cell	4
Solar panel-200w	4
Energizer-b1600(power plus)	4
Solar controlled (poster 300)	4
Lightening arrestor	4
Wire (high tensile wires-nice coated 350gm size)	75
Earth peg metal pipes	50
Joint clamps	450

PVC Pipes Class-B	65
Twin wire cable 6.0mm	175
Solar stand /frame	2
Hatari, Stima” signs	65
Ballast	20
Cement	40
Sand	30

### **3.5.3 Operation Phase**

Once erected, the fence’s operational phase will mainly involve maintenance work and monitoring to ensure that the fence is live and serving as a barrier to mitigate human-wildlife conflicts. Maintenance work will mainly involve clearing of vegetation, the corridor established for the fence’s alignment. This is because the fence should be free of all vegetation as these serve to drain voltage from the fence making reducing its efficiency. Other maintenance work will involve regular servicing of equipment.

The fence will also require close monitoring especially with regard to vandalism, loss of voltage, and wire breakages. Vandalism of batteries and wires is common and this should be monitored. The fence should also be monitored to ensure that there are: -

- “ No broken wires
- “ No broken posts
- “ No broken insulators
- “ No disconnected or intertwined live wires or earthings
- “ No disconnected lead-out wires
- “ No wires are in contact with vegetation or other objects

To ensure proper monitoring and maintenance, the community members will be trained by KWS especially with regard to how the fence works, taking voltage measurements, and how to undertake simple repairs. They will also be given any tools and equipment required to undertake this work.

### **3.5.4 Decomissioning**

The main reason for the erection of barriers is to mitigate human wildlife conflicts. As such, the fence may be regarded as ‘permanent’ in the sense that, without it, the conflict will persist, and in so long as the wildlife and human beings continue to be in close proximity, there is bound to be conflict. With time however, and considering that research is always ongoing, there might come a time when other management tools may be discovered to adequately address the issue of human-wildlife conflicts without needing the fence. In this case, the poles and fence may be left to serve as boundary, and the electrics removed and used elsewhere for provision of solar energy.

## 4. Baseline Information of the Study Area



### 4.0 Introduction

This chapter examines the baseline environmental, socio-economic and cultural characteristics of the proposed project area. The chapter provides information on the existing environmental conditions including sensitive areas that will be potentially impacted by the project. The objective is to document the status quo for the purpose of establishing and assessing the impacts of the project in future.

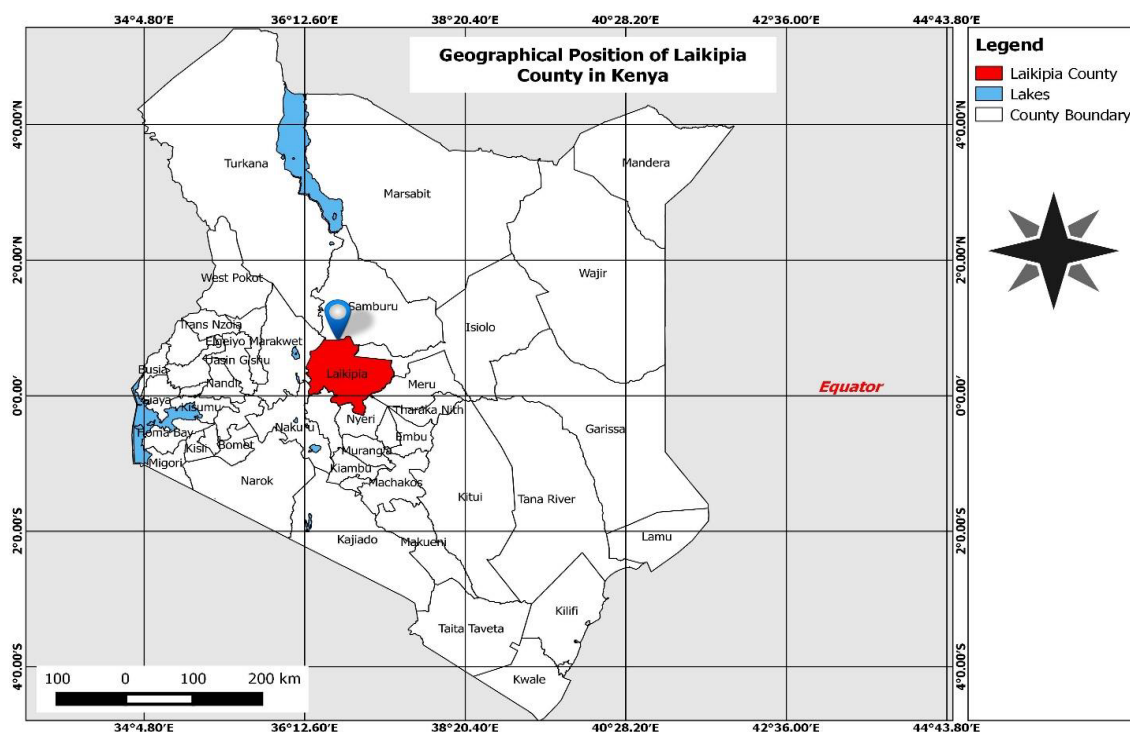
### 4.1 Background

Located on the equator, Laikipia County is found in the Great Rift Valley and is among the smallest Counties in Kenya with 9,462 square kilometers. Laikipia is a vast plain bordering six counties: Meru and Nyeri to the south, Nyandarua to the southwest, Samburu to the north and Baringo to the west. Laikipia lies on the leeward side of Mount Kenya receiving little rainfall. Land in the area is mostly plain land overlooking Mount Kenya. Rumuruti town is the gazetted county headquarter but has been hosted in Nanyuki Town since inception of devolution in 2013. The proposed project is located in Lorian zone in Rumuruti ward. Laikipia is a cosmopolitan with about 23 communities comprising of Maasai, Samburu, Rendile, Somali, Pokots, Kalenjins, Meru, Kikuyu and Turkana among others. “Laikipia” is a Maasai word for trees plain reflecting the large highland plateau.

### 4.2 Administrative Units

Laikipia County comprises of five administrative sub counties (formerly districts) namely Laikipia East, Laikipia North, Laikipia West, Laikipia Central and Nyahururu. The sub county headquarters are at Nanyuki, Doldol, Rumuruti, Lamuria and Nyahururu respectively. The county is further subdivided into 16 divisions, 55 locations and 110 sub-locations.

There are four major urban centres in the county namely: Nanyuki, Nyahururu, Rumuruti and Kinamba. The growth and expansion of Nyahururu and Nanyuki towns is attributed to their long time role as the administrative headquarters. They are also major transport hubs for main routes namely: Nairobi-Isiolo-Marsabit, Nairobi-Meru, Nairobi-Mararal and Nakuru-Nyeri. They have the most vibrant commercial activities and formal employment opportunities hence high population density. According to the population and housing census, 2019, Laikipia County has a population of 518,560 consisting 259,440 males and 259,102 females.



**Figure 3: Geographical Position of Laikipia County in Kenya**

The altitude of Laikipia County varies between 1600 to 2300 meters above sea level with the project area at a mean altitude of 1900. The topography is dominated by gently undulating plateau buildup of extensive lava flow at an elevation of 1600-1800 m. Administratively, the project area is located in Lorien Location and Rumuruti Ward within Laikipia West Sub-county and Laikipia West constituency respectively.

### **4.3 Climatic Condition**

Laikipia County is sandwiched between Mt. Kenya and Aberdare Ranges, which influence the spatial distribution and temporal variability of rainfall.

#### **4.3.1 Rainfall**

The county experiences a relief type of rainfall due to its altitude and location. The annual average rainfall varies between 400mm and 750mm. The main rainy seasons in the project area correspond to the influence of the Inter Tropical Convergence Zone (ITCZ) which comes twice a year, that is, March-May for the long rains and October-November for the short rains. In August continental rains are received in the area, they seem to be an extension of long rains. The amount of mean annual rainfall drops along a steep gradient, from 800-900 mm at the foot of both massifs, where the project site is located, to less than 500 mm in the northern part of the County.

#### **4.3.2 Temperature**

The annual mean temperature of the county ranges between 16° C and 26° C. This is as a result of relief and trade winds resulting to cooler conditions in eastern side which is near Mt. Kenya and hotter in the low-lying areas in the North. Temperatures are highest in the months of January to mid-March before the rainy season and lowest in the months of July to August. The project area falls within Rumuruti weather stations. With a mean temperature of 18°C.

#### 4.4 Topography

The altitude of Laikipia County varies between 1600 to 2300 meters above sea level with the project area at a mean altitude of 1900. The topography is dominated by gently undulating plateau buildup of extensive lava flow at an elevation of 1600-1800 m. Lolldaiga hills are located northwest of Mt. Kenya lying between 1,700 and 2,300 meters above sea level. The project site surrounding is an ancient landform comprising of a series of magnificent high rolling hills.

#### 4.5 Geology and soils

The County consists mainly of a plateau bordered by the Great Rift Valley to the West, the Aberdares mountain ridge to the South and Mt. Kenya to the South East. The larger Laikipia is underlain by metamorphic rocks of Pre-Cambrian age which form part of the extensive African Basement Complex. These rocks are exposed in some parts of the county. Volcanic sediments in the project area were washed down from Mt Kenya. Most of the soils formed from these rocks are cracking clays but in some places silty loams are found. They generally cover the central parts around Mutara, Segera and Lolldaiga-Ole Naishu(the project area).

#### 4.6 Hydrology and Water Provision

The level plateau and Laikipia County's drainage in general is dominated by the Ewaso Nyiro North. Together with the flanks of Mt. Kenya and the Nyandarua Range, Laikipia forms the upper catchment area of the Ewaso N'giro River which is of crucial importance to the semi-arid and arid lowlands to the north-east. The tributaries of the Ewaso N'giro that flow through Laikipia County are perennial streams fed exclusively from Mt. Kenya and the Nyandarua Range during the dry seasons. The forest belts of both mountain systems are of crucial importance in this process. Surface waters that form on the high plateau conduct water only seasonally or episodically. The volcanic portion of the Laikipia Plateau also has a large aquifer, but its rate of renewal appears to be rather low, based on evidence from ground water data.

#### 4.7 Flora and Fauna

Vegetation distribution in Laikipia in general is strongly influenced by altitudinal diversity, with dry forest occurring on the highest elevation and a gradient of *Acacia-Themeda* bush on the plains. Exceptions to the overall regional ecological gradient are edaphic communities of *Acacia drepanolobium* in the central plains, escarpment vegetation and secondary communities induced by historical management factors. Some of the dominant species include *Juniperus procera*, *Olea africana*, *Acacia drepanolobium* and *Acacia nilotica* bushland. The dominant grass types are Triandra communities including *Themeda triandra*, *Pennisetum mezianum*, *Pennisetum schimperi* and *Setaria sphacelata*. The project area is dominated by cedar forests and acacia savannah, open grassland and wooded valleys.

The history of wildlife in Laikipia dates to the pre-colonial period. The pastoralist Laikipia Maasai communities were then few in number, sparse in settlement and nonsedentary. These dynamics meant that there was insignificant competition for resources between wildlife and the community as opposed to the current situation. Laikipia has some of Kenya's richest ecosystems in terms of number of endangered wildlife species and supports high densities of large mammals. However, the area contains no formally protected wildlife areas

but still has the second highest concentration of wildlife in the country (second only to the Masai Mara), and more endangered wildlife species than anywhere else in Kenya.

Most of the wildlife population is concentrated in the private ranches because of better pasture and forage resources within these ranches. Wildlife dispersal from the private ranches into community ranches is more common in the wet season when grazing and foraging is not a constraint. The common wildlife species in Laikipia include plain and grevy zebra, elephants, jerenuk, warthogs, dik-diks, impalas, gazelles, hippos, buffaloes, hyenas and lions.

#### **4.8 Water Resources**

The distribution of water sources is uneven across the county with the northern parts experiencing serious water shortages. 14 per cent of households' access water from within their dwellings while 10 per cent of the households take an average of 1-4 minutes to reach the nearest water point

##### **4.8.1 Surface Water**

Laikipia is drained by the Ewaso Ng'iro River and its tributaries, which originate from Mt. Kenya and the Aberdares. The main tributaries are Ewaso Narok (Ngare Naro), Narumoru, Likii, Sirimon, Ontulili, Ngare ndare, Melwa, Ngare Naro, Ngobit, Rongai, Timau, Moyak, Pesi, Suguroi, Mutara, Nanyuki, and Burguret rivers. Ewaso Narok River is adjacent to the project site; some farm borders the River. In addition, there are two major swamps in the county namely; Marura Swamp which runs along the Moyot valley in Ol-Pajeta Ranch and the Ewaso Narok Swamp around Rumuruti town.

##### **4.8.2 Ground Water Resources**

Boreholes, pans, dams, shallow wells, springs and sub surface dams are also a common feature in the county for domestic and irrigation purposes. Rock catchments in the northern parts of Laikipia are increasingly being exploited. Hydro-geological studies conducted in Laikipia County indicate that the County has high groundwater potential. Chances of striking ground water in boreholes are high but the anticipated yields vary widely. Average boreholes yields in Laikipia County are low at 3.89m<sup>3</sup> /hr with lows of 0.2m<sup>3</sup> /hr to highs of over 30m<sup>3</sup> /hr. This depends on aquifer type, penetration through the aquifers, depth, and drilling and construction precision

#### **4.9 Land Use**

Land use in Laikipia County can broadly be divided into large-scale ranches and conservancies, commercial horticultural farms, pastoralist, small-scale farms, unsettled land, forest reserves and urban centers. Land use at the project site falls within horticultural farms and forests reserve category. A substantial amount of the formerly large scale farms have been sub-divided triggering a massive influx of people mainly from the neighbouring counties of Nyeri Isiolo and Meru. The ranch now borders community settlements/lands in the eastern and northern parts which have in the recent years experienced.

The communities to the West and South eastern boundaries practice mixed farming principally involving crops and livestock production. The main crops grown include potatoes, wheat, maize and beans primarily for subsistence while the surplus is sold to cater for non-farm household needs. The proposed site looks forward to establish integrated agroforestry farm.

#### **4.10 Threats to Natural Resources**

The main natural resources in the area are forests, water bodies (rivers and swamps) and conservancies. Fuelwood collection is the main contributor to natural resource degradation in the area. Human encroachment to the forest ecosystem has led to expansion of agricultural land. This has led to human-wildlife conflict.

#### **4.11 Human-Wildlife Situations**

As pointed out during the Laikipia County Human- Wildlife Conflict Stakeholders Forum (2013), the County population has been growing steadily through natural factors such as immigration of human population moving from the high agricultural potential areas into ASAL. The ecological pressure has in turn resulted into the collapse of some ecologically balanced traditional production systems as population load overstretches the ecological capacities threatening the sustainability of the resources. The changes have resulted in a number of challenges being experienced in the natural resource development in the county. Some notable ones including, severe human-wildlife conflict: wildlife causing loss of human life, injuries and property destruction; encroachment of wildlife corridors; Wildlife poaching (especially of rhinos and elephants) inside and outside protected areas

#### **4.12 Socio-Economic Factors**

The attributes of socio-economic environment include; population and housing; economic activity (including employment and income), community; transportation and health and safety.

##### **4.12.1 Land Ownership**

Land ownership is key, in Laikipia, there exists three main types of land categories; private, community and public. As depicted in the project area, the land is privately owned, title deed has been issued for the farms.

##### **4.12.2 Transportation**

The project area is accessed through Nyahururu-Rumuruti road from Nyahururu/Rumuruti town. The selected site is strategically placed, accessible from different routes. The roads are tarmac road well maintained from time to time. There are also major transport hubs for main routes namely: Nairobi-Isiolo-Marsabit, Nairobi-Meru, Nairobi-Mararal and Nakuru-Nyeri. They have the most vibrant commercial activities and formal employment opportunities hence high population density. This will immensely boost the agricultural activities in the area.

##### **4.12.3 Economic Activities**

**Agriculture** is the dominant economic activity. Majority of residents keep livestock and grow different food crops such as maize, carrots, peas, potatoes, wheat and cash crops as well as horticultural crops. Additionally, Laikipia County is known for its big open ranches like Solio, Borana and Oljogi which provide a significant source of beef for local consumption and export. The county also benefits from **tourism** due to the many wildlife conservancies and ranches. Some of the tourist attraction sites include; Ole Pejeta conservancy, Thomson falls, Laikipia Plateau reserve among others. Agriculture sector employs over 60% of the total labour force in the county. The county is heavily dependent on rain fed agriculture. There is potential of 203,965 hectares for irrigation in the medium potential areas.



#### **4.12.4 Energy Access**

The national power grid serves 156 trading centres and is yet to reach the other 24 centres. The households using electricity for lighting constitute 17.7 per cent of the total households. The Last Mile Connectivity Programme has helped to upscale access for the rural households. The county has several learning institutions, health facilities and boreholes supported by solar energy. Being a semi-arid county, reliable sunshine throughout the year provides high potential for harnessing of solar energy. There are also opportunities of upscaling biogas and wind energy. The electric fence to be set up at the farm will be solar powered.

#### **4.12.5 Population**

The county's population according to the 2009 National Census was 399,227 with males forming 49.8% while female form 50.2% of the population. According to 2019 population and housing census, Laikipia County has a total population 518,560 consisting 259,440 males and 259,102 females. The County has multiple ethnic communities, the Kikuyus and Maasai communities form the largest portion of its residents. Other tribes mainly Borana, Samburu, Kalenjin, Meru, Somali, Turkana, European and Asian settlers are the resident minorities.

### **4.13 Environmental Issues**

#### **4.13.1 Environmental Degradation**

Ewaso Narok swamp is a riparian area under intense threat following encroachment by farmers over the last three decades. Rumuruti, Lariak and Marmanet forests have also faced pressure on extraction of forestry products from nearby communities leading to loss of biodiversity and wildlife habitats. Droughts, floods and invasive species are also threats associated with degradation of environment and climate change effects. In addition, farming in water catchment areas, sand harvesting and other quarrying activities have exacerbated the process of land degradation.

## 5. Policy and Institutional Framework



### 5.0 Introduction

The Republic of Kenya has a policy, legal and administrative framework for environmental management. The Government's policy on proposed project is to provide sustainable, efficient and reliable agricultural productivity to enhance food security and spur socio-economic development. Under the administrative framework, the National Environment Management Authority (NEMA) is responsible for ensuring that environmental impact assessments (EIAs) are carried out for new projects and environmental audits on existing facilities as per the requirements of the Environmental Management and Coordination Act (EMCA) 1999. Projects subject to this requirement are specified in the Second Schedule (amended) of the EMCA, 1999.

There are a number of National policy and legal provisions and International EIA provisions that have a direct bearing on the optimum operation of the proposed project. The sole purpose of this section is to provide the proponent with quick reference to the critical legal and policy provisions to enable proper planning and impact assessment during project planning and implementation. Environmental Management and Coordination Act (EMCA, 1999) is the principle law of environmental management. This framework law guarantees every Kenyan the right to a clean and healthy environment. There are a number of policy, legal and institutional provisions that have direct bearing on the optimum operation of the proposed development. This section outlines the Policy, Legal and Institutional framework pertaining to the proposed project.

### 5.1 National Policy Framework

The Republic of Kenya has a national policy for environmental management. The broad objectives of the national environmental policy in Kenya is to ensure use of natural resources while improving environmental quality and to integrate environmental conservation and socio-economic aspects in the development process. To achieve the above policy objectives, it is a policy directive that appropriate reviews and evaluations of all forms of developmental project plans and operations are carried out to ensure compliance with the environmental policy and legal frameworks. The following section provides details on the relevant policies in the country.

#### **5.1.1 Environment and Development Policy (Sessional Paper No. 6 of 1999)**

The Kenya's policy paper on the Environment and Development was formulated in 1999. The policy defined approaches that will be pursued by the Government in mainstreaming environment into development. The policy harmonized environmental and developmental objectives with the broad goal of achieving sustainable development. The policy paper also provided guidelines and strategies for government action regarding environment and development. With regard to wildlife, the policy reemphasized government's commitment towards involving local communities and other stakeholders in wildlife conservation and management, as well as developing mechanisms that allow them to benefit from the natural resources occurring in their areas. The policy also advocated for the establishment of zones that allow for the multiple use and management of wildlife. This policy is relevant to the proposed development project in view of the potential impacts on the environment and involvement of the public in project planning.

Sessional Paper No 6 of 1999 on Environment and Development presents broad categories of development issues that require sustainable approach. The overall goal is to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development. Among the specific goals of the policy are to:

- Incorporate environmental management and economic development as integral aspects of the process of sustainable development; and
- Encourage sustainable utilization of resources and ecosystems for the benefit of the present generations, while ensuring their potential to meet the needs of the biosphere and future dependants.
- Following on this, the policy outlines the following objectives among others:
- Conservation and management of the natural resources of Kenya including air, water, land, flora and fauna,
- Promotion of environmental conservation through the sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations,
- Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth

#### **5.1.2 National Policy on Water Resources Management and Development**

The National Water Policy is outlined in the Sessional Paper No.1 of 1999. It tackles issues pertaining to water supply and sanitation facilities development, institutional framework and financing of the sector. According to the policy, in order to enable sustainable water supply and sanitation services, there is need to apply alternative management options that are participatory through enhanced involvement of others in the provision of these services but particularly the private sector.

The overall objective of the National Water Policy is to lay the foundation for the rational and efficient framework for meeting the water needs for national economic development, poverty alleviation, environmental protection and social well-being of the people through sustainable water resource development and management. Among the specific goals of the policy are to:

- Preserve, conserve and protect available water resources and allocate it in a sustainable, rational and economic way.
- Supply water of good quality in sufficient quantities to meet the various water needs, including poverty alleviation, while ensuring the safe disposal of wastewater and environmental protection.
- Establish an efficient and effective institutional framework to achieve a systematic development and management of the water sector.
- Develop a sound and sustainable financing system for effective water resources management, water supply and sanitation development.
- It is important for the proposed project management to factor in sanitation facilities in the proposed project to avoid contamination of water resources.

### **5.1.3 Land Policy of 2009**

The Sessional Paper No. 3 of 2009 on National Land Policy was formulated to address the critical issues of land administration, access to land, land use planning and environmental degradation. It also addresses restitution of historical injustices, conflicts, unplanned proliferation of informal urban settlements and information management. It recognizes the need for security of tenure for all Kenyans. The overall objective of the National Land Policy is to secure rights over land and provide for sustainable growth, investment and the reduction of poverty in line with the Government's overall development objectives. Among others, the Policy provides the framework for the maintenance of a system of land administration and management that will provide efficient and effective utilization of land and land based resources.

The Policy designates all land in Kenya as public, community and private land. Most significantly, the Policy establishes a mechanism for securing the tenure of public land by placing all public land under the National Land Commission to hold and manage the land in trust for the people of Kenya. The Policy has provisions aimed at protecting forest reserves and water catchment areas through establishment of mechanisms for repossession of any public land acquired illegally or irregularly and establishment of an appropriate system for registering public institutional land. Through the Policy, the Government will ensure that all land is put into productive use on a sustainable basis by facilitating the implementation of key principles on land use, productivity targets and guidelines as well as conservation.

### **5.1.4 National Environment Action Plan (NEAP), 1994**

The National Environment Action Plan (NEAP) for Kenya was formulated in 1994 through a consultative process involving various stakeholders. The action plan was aimed at integrating environmental considerations into the country's socio-economic development. The integration process was to be realised through development of a comprehensive framework that ensures linkage of environmental management of natural resources to decision-making processes. The NEAP also established the process of identifying environmental problems and issues, awareness raising, building national consensus, defining policies, legislation and institutional needs, and planning environmental projects. An Environmental Action Plan for Arid and Semi-arid Lands (ASAL) and County-specific Environmental Action Plans for 24 ASAL counties were also formulated thus forming part of the building block to the NEAP.

#### **5.1.5 National Poverty Eradication Plan, 1999**

National Poverty Eradication Plan (NPEP 1999) have spelt out the strategies to fight poverty. The vision is to halt the current increase in the incidence of poverty through implementation of well-planned poverty alleviation programmes. The NPEP has the objective of reducing incidences of poverty as well as strengthening the capabilities of the poor and vulnerable groups to earn income. The proposed project will provide employment opportunities during implementation to casual workers and thereafter will offer employment to various service providers like farm attendants; during operation the agricultural produce from the farms can be used for household consumption or sold in the markets to help alleviate poverty and enhance food security in the area. This will go a long way in poverty alleviation through provision of household incomes by employment at farm.

#### **5.1.6 Agricultural Sector Transformation and Growth Strategy 2019-2029**

This document focuses on agriculture as a key sector for growth and employment. It discusses in detail the agricultural sector policy framework and the need for increased support to agro-processing industries in the rural areas and trade. The strategy will enhance sustainable irrigation and water basin management whereby the Government will ensure that efficient technologies are available and affordable and that water is accessible. Water resource authorities will have to monitor and regulate water abstraction to maintain a defined minimum water level. With respect to this legal direction, the proposed development will immensely contribute towards sustainable agricultural development through the creation of income opportunities, wealth generation and empowerment of the youth in economic development through agriculture. This is also in line with the Economic Recovery Strategy for Wealth and Employment Creation which addresses issues of promoting sustainable livelihoods.

#### **5.1.7 Wildlife Policy**

The wildlife policy is aimed at promoting protection and conservation of wildlife in Kenya, both in protected and non-protected areas. The policy is implemented by the Kenya Wildlife Service (KWS). The proposed project borders Rumuruti Forest on one side hence will need to be consistent with this policy. Where wild animals will be disturbed during the construction and operation phase of the project, appropriate mitigation measures must be implemented to minimize disturbance to wildlife.

#### **5.1.8 Wetlands Policy, 2013**

The wetlands policy is intended to promote protection of wetlands in Kenya. The policy sets out strategic measures for the protection of existing wetlands in Kenya. The proposed project has Ewaso-Narok River in its vicinity and has potential of impacting the Ewaso Narokriverine wetland. It would be important to undertake appropriate mitigation measures in order to minimize or avoid degradation of wetlands.

#### **5.1.9 The Kenya National Climate Change Response Strategy of 2010**

This strategy provides measures that the Government of Kenya is taking to address issues related to the impact of climate change on various sectors of the economy. The proposed project will need to take onboard the effects of changing climate in the country, and apply applied climate change mitigation measures. This is important because climate change will in future affect the operation of the project.

#### **5.1.10 The Constitution of Kenya**

Article 42 of the Bill of Rights of the Kenyan Constitution provides that 'every Kenyan has the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures'. Under Chapter 5 (Land and Environment), Part 1 is devoted to land. It requires that land be used and managed in 'a manner that is equitable, efficient, productive and sustainable, and in accordance with the following principles:

- Equitable access to land;
- Security of land rights;
- Sustainable and productive management of land resources;
- Transparent and cost effective administration of land; and
- Sound conservation and protection of ecologically sensitive areas.

Part 2 of Chapter 5 of the Constitution is dedicated to Environment and Natural Resources. Article 69 in Part 2 provides that the state shall;

- Ensure sustainable exploitation, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Work to achieve and maintain tree cover of at least ten per cent of the land area of Kenya;
- Encourage public participation in the management of, protection and conservation of the environment and protect genetic resources and biological diversity;
- Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- Eliminate processes and activities that are likely to endanger the environment; and
- Utilize the environment and natural resources for the benefit of the people of Kenya.

Further, Article 70 states that if a person alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed or threatened, the person may apply to a court for redress. The sub-project should ensure compliance with the constitution in so far as equitable sharing of the resources, between the stakeholders. Further, the project should ensure the sustainability of livelihoods and biological resources within the project areas are protected. Any development proposals should also be cognizant of the increased powers under the Constitution given to communities and individuals to enforce their rights through legal redress.

#### **5.1.11 Kenya Vision 2030**

Kenya Vision 2030 is the current national development blueprint for period 2008 to 2030. One of the aims of the vision is to make Kenya to be a nation that has a clean, secure and sustainable environment by 2030. This will be achieved through promoting environmental conservation to better support the economic pillar. Improving pollution and waste management through the application of the right economic incentives in development initiatives is critical.

#### **5.1.12 Big Four Agenda**

Through deliberation of the big four agenda, Kenya have made an expedient decision to steer itself back on the fast track towards realizing Vision 2030. Food Security is at the heart of Kenyan government policy because higher agricultural output means higher incomes for farmers, food resilience within their households and, that their farms are as productive as possible. The proposed integrated agroforestry farming is in line with the president's big four agenda of enhancing food security and nutrition.

### **5.2 National Environmental Legal Framework**

The Republic of Kenya has numerous statutes that guides environmental management and conservation in the country. Most of these statutes are sector specific and cover a wide range of issues including public health, soil conservation, protected areas conservation, endangered species, public participation, water rights, water quality, air quality, excessive noise control, vibration control, land use, among others. The relevant legislations are described in the following sections.

#### **5.2.1 Environment Management and Coordination Act, 1999 (Amended, 2015)**

The Section Part VI of EMCA 1999 Part II states that every person is entitled to a clean and healthy environment and has the duty to safeguard the same. In order to achieve this goal, the projects listed under the Schedule No. 2 of EMCA must be subjected to Environmental Impact Assessment (EIA). The aim of EIA is to reduce negative environmental outcomes of the listed projects by implementing mitigation measures. The proposed project falls within the Second schedule and must therefore comply with EMCA requirements in as far as EIA is required.

The Project Proponent has commissioned the environmental impact assessment study in compliance with the Act. The environmental management and monitoring plan laid out in this report shall be adhered to by the Proponent.

**Relevance:** *Environmental Management and Coordination Act, 1999 provides a legal and institutional framework for the management of the environmental related matters. This report has been written pursuant to section 58 (1) of this Act.*

There are also several regulations that have been formulated within the framework of EMCA 1999 that are applicable to the proposed project. These are listed in the following sections.

#### **5.2.1.1 Environmental Management and Co-ordination (Environmental Impact Assessment and Audit) Regulations, 2003**

The Environmental (Impact Assessment and Audit) Regulations provides guidelines for conducting EIA studies. The regulations provide details on the parameters to be evaluated when undertaking an EIA study. It also provides guidelines on the conduct of environmental audits and development of project monitoring plans. The proposed project must comply with the requirements of the regulations that also include conducting continuous monitoring and annual audits on the proposed project.

**Relevance:** *The proponent and consultants shall seek the views of the project neighbours through public meetings so as to ensure that their concerns are addressed in this report.*

### **5.2.1.2 Environmental Management and Co-ordination (Water Quality) Regulations, 2006**

The EMCA (Water Quality) Regulations, 2006 provide guidelines on the use and management of water sources in order to safeguard quality of water for domestic use and irrigation, among others. Water Quality Regulations apply to water used for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for any other purposes. Different standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells and other water sources. It is an offence to contravene the provisions of these regulations with a fine not exceeding five hundred thousand shillings. In addition, of immediate relevance to the proposed project for the purpose of this Project Report is Part II Sections 4-5 as well as Part V Section 24.

Part II Section IV states that —Every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution. Part IV Section 24 states that —No person shall discharge or apply any poison, toxic, noxious or obstructing matter, radioactive wastes, or other pollutants or permit any person to dump any such matter into water meant for fisheries, wildlife, recreational purposes or any other uses. According to these regulations, —Every person shall refrain from any action which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of the Act.

**Relevance:** *The project design team should be advised on the requirements of this regulation and appropriately incorporate the regulations in the project design document.*

### **5.2.1.3 Environmental Management and Co-ordination (Waste Management Regulations, 2006)**

The Waste Management Regulations (2006) are contained in the Kenya Gazette No. 69, Legal Notice No. 121. The Waste Management Regulations are meant to streamline the handling, transportation and disposal of various types of waste. The aim of the Waste Management Regulations is to protect human health and the environment. The regulations place emphasis on waste minimization, cleaner production and segregation of waste at source.

The regulation requires licensing of transporters of wastes and operators of disposal site (sections 7 and 10 respectively). Of immediate relevance to proposed development for the purposes of this project report is Part II Sections 4(1-2), 5 and 6. Section 4 (1) states that —No person shall dispose of any waste on a public highway, street, road, recreational area or any other public place except in a designated waste receptacle. Section 4(2) and 6 explain that the waste generator must collect, segregate (hazardous waste from non-hazardous) and dispose waste in such a facility that shall be provided by the relevant local authority.

Section 5 provides method of cleaner production (so as to minimise waste generation) which includes the improvement of production processes through conserving raw materials and energy. Section 11 provides that any operator of a disposal site or plant shall apply the relevant provisions on waste treatment under the local government act and regulations to



ensure that such waste does not present any imminent and substantial danger to the public health, the environment and natural resources.

Section 12 provides that every licensed owner or operator shall carry out an annual environmental audit pursuant to the provision of the act. In section 14 (1) every trade or industrial undertaking is obliged to install anti- pollution equipment for the treatment of waste emanating from such trade or industrial undertaking.

**Relevance:** *The Developer is expected to take all responsibility to ensure that solid waste is properly disposed by a solid waste collection company that has a valid license from the National Environment Management Authority (NEMA).*

#### **5.2.1.4 Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009**

The Noise and Excessive Vibration Pollution Control Regulations, 2009 prohibits excessive noise and vibration. It states that no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. The proponent will have to ensure that no excessive noise and vibrations are made during farming and the construction of the fence. This is important since the use of farm machineries, heavy earthmoving equipment and trucks which can generate excessive noise and vibrations. Motor vehicles used during the construction of the proposed fence should also adhere to the regulations which prohibit excessive noise. The provision of the act on motor vehicle states that no person shall operate a motor vehicle which produces any loud and unusual sound exceeding 84 dB(A) when accelerating. The Act also states that no person shall at any time sound the horn or other warning device of a vehicle except when necessary to prevent an accident or an incident. Any person carrying out construction, demolition, mining or quarrying work should ensure that the vibration levels do not exceed 0.5 centimeters per second beyond any source property boundary or 30metres from any moving source.

**Relevance:** *The contractor shall be required to implement these measures, ensure that all machineries are in good working condition to reduce noise. Also construction activities shall be restricted between 0800Hrs-1700Hrs to ensure that the neighbours are not disturbed.*

#### **5.2.1.5 Environmental Management and Coordination (Air Quality) Regulations, 2014**

The objective of these Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The general prohibitions state that no person shall cause the emission of air pollutants listed under First Schedule (Priority air pollutants) to exceed the ambient air quality levels as required stipulated under the provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient air quality tolerance limits).

**Relevance:** *The contractor shall implement the mitigation measures provided in the EMMP to prevent air pollution especially during construction phase.*

#### **5.2.1.6 Environmental Management and Co-ordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009**

The Environmental Management and Co-ordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009 applies to all wetlands in Kenya whether occurring in private or public land. The objectives of the regulations is to provide for the conservation and sustainable use of wetlands and their resources in Kenya and promote the integration of sustainable use of resources in wetlands into the local and national management of natural resources for socio-economic development. The act also aims at ensuring the conservation of water catchments and the control of floods and the sustainable use of wetlands for ecological and aesthetic purposes for the common good of all citizens. The act also makes provision for the protection of wetlands as habitats for species of fauna and flora. It also provides a framework for public participation in the management of wetlands.

#### **5.2.1.7 Environmental Management and Co-ordination (Fossil Fuel Emission Control) Regulations, 2006**

The EMCA (Fossil Fuel Emission Control) Regulations, 2006 aims at eliminating or reducing emissions emitted from internal combustion engines to acceptable levels. The regulation provides guidelines on use of clean fuels, use of catalysts and inspection procedures for engines and generators. This regulation is applicable to the proposed project since there would be use of vehicles, machineries and equipment that depend on fossil fuel as their source of energy. The requirements of the regulation must be implemented in order to eliminate or reduce air quality degradation. Sections of the regulation citing the standards of recommended emission levels will be given to the contractor and or pinned at strategic points in the contractor's field offices.

#### **5.2.2 Water Act, 2016**

The Water Act aims to “make better provision for the conservation, apportionment and use of water resources of Kenya.” It prohibits persons from diverting, abstracting, obstructing or using water from a body of water except as provided for in the Act (Section.5).

The Act stipulates that a permit is required in all cases of proposed diversion, abstraction, obstruction, storage or use of water, with minor exceptions relating to use for domestic purposes (Section.36). Under the Water Act (General) Rules, it is stated that any rights acquired under the permit are subject to the Public Health Act and the Malaria Prevention Act, in addition to the Water Act itself. Part II Section 5 states that Every water resource is vested in and held by the national government in trust for the people of Kenya. The Water Act clearly defines a reserve and it states that a reserve refers to “quantity and quality of water in relation to a water resource required to satisfy basic human needs for all people who are or may be supplied from the water resource; and to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the water resource.

In utilizing water resources, a national public water works for domestic use shall, subject to the acquisition of a permit from the Authority in case of inter basin water transfer, take precedence over all other water works for the use of water or the drainage of land. Additionally, Subject to the Land Act, 2012, land required for national public water works may be acquired in any manner provided by law for the acquisition of land for public purposes. The Cabinet Secretary may, after reasonable notice to any landholder concerned, cause to be constructed and maintained upon any land such works as the Cabinet Secretary may

consider necessary for the purposes of any national public water works. The Cabinet Secretary shall, within one year of the commencement of this Act and every five years thereafter, following public participation, formulate a National Water Resource Strategy. The object of the National Water Resource Strategy shall be to provide the Government's plans and programs for the protection, conservation, control and management of water resources.

**Relevance** *The proponent shall apply for a permit to abstract water from the river or borehole if need be.*

#### **5.2.3 Occupational Health and Safety Act 2007 CAP 514**

The Occupational Safety and Health Act 2007 applies to all workplaces where any person is at work, whether temporarily or permanently. The purpose of the act is to secure the safety, health and welfare of persons at work and protect persons other than persons at work against risks to safety and health arising out of, or in connection with, the activities of persons at work. Section 19 of the Act provides that an occupier of any premises likely to emit poisonous, harmful, injurious or offensive substances, into the atmosphere shall use the best practicable means to prevent such emissions into the atmosphere and render harmless and inoffensive the substances which may be emitted.

Section 16 provides that no person shall engage in any improper activity or behaviour at the workplace, which might create or constitute a hazard to that person or any other person. The proponent/contractors of the proposed project will need to fully comply with the requirements of the Occupational Safety and Health Act 2007.

**Relevance:** *Workers and occupants safety will be given priority during both construction and operation phases of the project.*

#### **5.2.4 Physical and Land Use Planning Act, 2019**

This is an Act of Parliament to make provision for the planning, use, regulation and development of land and for connected purposes. It establishes the principles, procedures and standards for the preparation and implementation of physical and land use development plans at the national, county, urban, rural and cities level. It provides for a hierarchy of plans in which guidelines are laid down for the future physical development of areas referred to in a specific plan. The ostensible intention is that the three -tier order plans, the national development plan, regional development plan, and the local physical development plan should concentrate on broad policy issues.

The Act also promotes public participation in the preparation of plans and requires that in preparation of plans, proper consideration be given to the potential for economic development, socio-economic development needs of the population, the existing planning and future transport needs, the physical factors which may influence orderly development in general and urbanization in particular, and the possible influence of future development upon natural environment. In the Act, planning authorities require applications for major developments to be subjected to environmental and social impact assessment. Any change of use of the actual development without authority constitutes an offence.

45 (1)9 A county government shall prepare a local physical and land use development plan in respect of a city, municipality, town or unclassified urban area as the case may be. 46 A county government shall prepare a local physical and land use development plan for — (a) zoning, urban renewal, or redevelopment (b) guiding and coordinating the development of infrastructure; (c) regulating the land use and land development.

**Relevance:** *This Act provides for order in terms of development execution. The proponent shall submit the project designs to the local authority for approval. This development shall also comply with all the provisions of this law including vertical zoning requirements.*

#### **5.2.5 The Penal Code CAP 63**

Chapter XVII on —Nuisances and offences against health and convenience contained in the penal code strictly prohibits the release of foul air into the environment which affects the health of the persons. It states —Any person who voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighbourhood or passing along a public way is guilty of a misdemeanour.

#### **5.2.6 The Agriculture, Fisheries and Food Authority Act of 2013**

Agriculture, Fisheries and Food Authority Act, 2013 (No. 13 of 2013) provides for the establishment of the Agriculture, Fisheries and Food Authority, the administration of matters of agriculture and the preservation, utilization and development of agricultural land and related matters. "Agriculture" in this Act means cultivation of land and the use of land and water for any purpose of husbandry, aquaculture and food production and includes cultivation of crops and horticultural practice, breeding of aquatic animals and plants, the use of land, fish harvesting and (e) the use of land for agroforestry.

The Act requires the Authority in consultation with the county governments to among others promote best practices. The Cabinet Secretary is required under the Act with the advice of the Authority, and in consultation with the National Land Commission, to provide general guidelines applicable in respect of any category of agricultural land. These land development guidelines are to be implemented by the county governments. In a like manner, the Cabinet Secretary is given powers to make general rules for the preservation, utilization and development of agricultural land and aquatic resources and prescribe national guidelines for soil conservation. Each county government is required to keep a register of land development orders and land preservation orders, which they may issue under this Act. The Act also provides for participation by farmers Natural Resource (Benefit sharing Bill), 2014

#### **5.2.7 Irrigation Act 2019**

An act of parliament to provide for matters relating to disease of animals. The Act provides for the According to the Act, irrigation any process, other than by natural precipitation, which supplies water to crops or any other cultivated plants, livestock, aquaculture and desired forest trees. Section 16 (6) states that the Cabinet Secretary shall, in consultation with county governments, ensure that the design of national or public irrigation schemes and others, takes into account the needs of various irrigation water users, including livestock and fish producers and the impact the irrigation scheme is likely to have on the environment. Section 20 (1)- a resident of a catchment area who is a crop farmer, livestock producer, fish pond user, or small rural industry entrepreneur or otherwise uses water for irrigation

purposes from a common water source may, together with other members or persons' resident in the same area, form or join an irrigation water users' association.

#### **5.2.8 Public Health Act (Cap. 252; Revised 1986)**

This act provides for proper sanitary conditions and clean environment. The act provides for proper health requirements on all levels of human and environment. Subsidiary legislation section 62(b) defines the distance from building and plot boundaries for sewage disposal specifications such shall include storage tanks, septic tanks sewage filters installation or sewage reception sites. Provision of this act requires accessibility to said sites for the purpose of cleansing or removing the contents there of. The proposed project is not expected to have much of sewage waste other than from the toilets used by the farm employees which will be connected to a septic tank on site. Further, the proponent will comply with the public health act in as far as handling milk as food is concerned.

#### **5.2.9 The County Government Act**

This is an Act of parliament to give effect to Chapter Eleven of the Kenyan Constitution; to provide for County government's powers, functions and responsibilities to deliver services and for connected purposes. Section 113 of the Act makes public participation in County planning processes compulsory).

#### **5.2.10 Forest Act 2005**

This is law was enacted by Parliament in 2005 to provide for the establishment, development and sustainable management including conservation and rational utilization of forest resources for the socio-economic development of the country. Parts of the project area neighbours Rumuruti Forest, indigenous forests. Section 8 of the Act requires all indigenous forests and woodlands to be managed on a sustainable basis for the purposes inter alia of conservation of water, soil and biodiversity, riparian and shoreline protection, sustainable production of wood and non-wood products. Community participation as provided for under Section 46 of the Act should be encouraged. The most appropriate would be initiation of participatory forest management in these forest reserves so that the local community and organization can have a significant input with Kenya Forest Service (KFS) office playing a coordination role.

#### **5.2.11 Agriculture Act (Cap 318)**

This Act of Parliament promotes agriculture, provides for the conservation of soil and its fertility and to stimulate agricultural development in accordance with accepted practices of good land management and good husbandry. Under Section 184 of the Act the Minister may make general rules for the preservation utilization and development of agricultural land. Section 48 part 1 the Minister may make rules considered necessary or expedient so to do for the purposes of the conservation of the soil of, or the prevention of the adverse effects of soil erosion on, any land, prohibiting grazing or watering of livestock and or the firing, clearing or destruction of vegetation including stubble. (3) Any person who cultivates, cuts down or destroys any vegetation, or depastures any livestock on any land of which the slope exceeds 35 per cent shall be guilty of an offence: (6) Any person who, except with the written permission of an authorized officer, cultivates or destroys the soil, or cuts down any vegetation or depastures any livestock, on any land lying within 2 metres of a watercourse, or, in the case of a watercourse more than 2 metres wide, within a distance equal to the width of that watercourse to a maximum of 30 metres, shall be guilty of an offence.

### 5.3 National Administrative/Institutional Framework

There are various national institutions that are important in matters related to environmental management in Kenya. These are described in the following sections.

#### 5.3.1 National Environmental Management Authority

The National Environmental Management Authority is the supreme regulatory and advisory body on environmental management in Kenya. NEMA is required to coordinate and supervise the various environmental management activities being undertaken by statutory organs with a view to promoting their integration into development policies, programmes, plans and projects that provide sustainable development and a safe and healthy environment to all Kenyans. The key functions of NEMA through the National Environment Council include:

- Responsibility for policy formulation and direction for the purposes of the Act;
- Setting national goals and objectives and determining policies and priorities for the protection of the environment;
- Promotion of cooperation among public departments, local authorities, private sector, non-governmental organizations and such other organizations engaged in environmental protection programmes; and perform such other functions as are assigned by the Act.

NEMA's mandate is designated to the following committees:

(i) County Environment Committees

According to EMCA, CAP 387 No. 8, the Cabinet Secretary by notice in the gazette appoints County Environment Committees of the Authority in respect of every county respectively. The County Environment Committees are responsible for the proper management of the environment within the counties in respect of which they are appointed. They are also to perform such additional functions as are prescribed by the Act or as may, from time to time be assigned by the CS by notice in the gazette. The decisions of these committees are legal and it is an offence not to implement them.

(ii) Public Complaints Committee PCC

The Public Complaints Committee is established under Section 31 of EMCA. The PCC is concerned with the investigation of complaints relating to environmental degradation. The PCC has powers to investigate complaints against any person or even against NEMA or on its own motion investigate any suspected case of environmental degradation. PCC is required by law to submit reports of its findings and recommendations to NEC. The law however is weak in that it does not provide PCC with the mandate to see its recommendations enforced.

(iii) Standards and Enforcement Review Committee

The Standards and Enforcement Review Committee (SERC) is a technical committee established under Section 70 of EMCA. The Committee is responsible for formulating environmental standards, methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures. The Permanent Secretary in the Minister of environment chairs SERC. They consist of representatives of various relevant government ministries and parastatals that are Lead Agencies as well as those responsible for matters such as economic planning and national development, finance, labour, public works, law and law

enforcement. Other members are drawn from public universities, and other government institutions.

To operationalize the Act, NEMA through this committee has issued Regulations which have a bearing on the proposed project in regard to compliance with national requirement:

- Environmental Impact Assessment/Audit Regulations, 2003. Legal Notice No. 1
- Environmental Management and Coordination (Water Quality) Regulations, 2006, Legal Notice No. 120.

(iv) National Environmental Tribunal (NET)

The NET is established under Section 125 of EMCA for the purpose of hearing appeals from administrative decisions by organs responsible for enforcement of environmental standards. An appeal may be lodged by a project proponent upon denial of an EIA licence or by a local community upon the grant of an EIA licence to a project proponent. NEMA may also refer any matter that involves a point of law or is of unusual importance or complexity to NET for direction. The proceedings of NET are not as stringent as those in a court of law and NET is not bound by the rules of evidence as set out in the Evidence Act. EMCA provides that any person aggrieved by a decision or award of NET may within 30 days' appeal to the High Court.

(v) National Environmental Council (NEC)

The National Environment Council (NEC) is established under Section 4 (1) of EMCA no 8 Of 1999. NEC is chaired by the Minister in charge of the environment, and is responsible for policy formulation and direction as stipulated under EMCA. NEC sets national goals and objectives and promotes public-private partnerships in environmental protection.

## **5.4 International Conventions and Treaties**

A treaty is a binding agreement under International Law concluded by subjects of International Law, namely states and international organizations. Treaties can be called by many names including; International Agreements, Protocols, Covenants, Conventions, Exchanges of Letters, Exchanges of Notes, etc. However, all of these are equally treaties and the governing rules are the same regardless

### **5.4.1 United Nations Framework Convention on Climate Change**

The primary purpose of the convention is to establish methods to minimize global warming and in particular the emission of the greenhouse gases. The UNFCCC was adopted on 9th May 1992 and came into force on 21st March 1994. The Convention has been ratified by 189 states. Kenya ratified the Convention on 30th August 1994. NEMA is the focal point for the Convention.

### **5.4.2 United Nations Convention to Combat Desertification (UNCCD)**

The above Convention was adopted on 17th June 1994 in Paris and came into force on 26th December 1996. Kenya ratified the Convention in 24th June 1997. The purpose of the UNCCD is to address the problem of the degradation of land by desertification and the impact of drought particularly in arid and dry semi-humid areas. NEMA is the focal point for the Convention.

## 6. Stakeholder Engagement and Public Participation

### 6.0 Introduction

Stakeholder Engagement and Public Participation Process particularly with local citizens affected by development proposals, is frequently construed as an integral aspect of successful decision making in the ESIA processes for major developments. As such, Public Participation is a policy requirement by the Government of Kenya and a mandatory procedure as stipulated by EMCA 1999 section 58, on ESIA. It is an important process through which stakeholders including beneficiaries and members of public living in project areas (both public and private), are given an opportunity to contribute to the overall project design by making recommendations and raising concerns projects before they are implemented. In addition, the process creates a sense of responsibility, commitment and local ownership for smooth implementation. The Stakeholder Engagements were done in order to foster better mutual understanding, address concerns and incorporate opinions to this report

This chapter describes the process of public consultation and participation that was followed in order to identify the key issues and impacts of the proposed project. Views from the local residents, local leaders, surrounding institutions and development partners for the proposed project, who in one way or another would be affected or have interest in the proposed project were sought through interviews and public meetings as stipulated in the Environment Management and Coordination Act, 1999 and its amendment Act 2015.

### 6.1 Consultation and Public Consultation

The purpose of the public consultation was to identify the positive and negative impacts and subsequently propose the mitigation measures for the identified impacts. It also helped in identifying other issues which may be the source of conflict during project implementation. The specific objective of the public participation as required in EMCA, (1999) was to:

- Disseminate information to the public about the proposed project with special reference to its key components, location and expected impacts.
- Create awareness among the public on the importance of EIA and its due process.
- Gather comments, concerns and suggestions of the interested and affected parties.
- Ensure that the concerns of the stakeholders are received, documented and communicated to decision-makers and the developer during the project design.



The process enabled the establishment of a communication channel between the general public, EIA/EA consultants, the proponent and the Government. and the concerns of the stakeholders to be known to the decision making bodies at an early phase of project development. The plates below show some of the engagement during the Stakeholder Engagement and Public Participation meetings conducted at Lorien Zone.



**ESIA expert explaining the project to the Lorien community members**



**Elder giving his views about the project at Lorien Zone**

## **6.2 Identifying the participants**

Stakeholders were identified based on their interests, needs, relative power and potential impact on project outcome. Local residents, farmers, local leaders, surrounding institutions and development partners who in one way or another would be affected or have interest in the proposed community water project were reached out for engagement and deliberation during the consultation and public participation. Notice were given as per EMCA (EIA/EA) Regulations 2003.

### **6.3 Methodology Used in Stakeholder Engagement and Public Participation**

The Consultative Stakeholder Engagements and Public Participation meetings involved in-depth consultations with the general public and the relevant key informants. The methodologies applied included:

- Public meeting (baraza)
- Key Informants Interviews
- Focused Group Discussions

#### **6.3.1 Public consultation Meeting for The Project**

A stakeholders' consultative meeting was held at Lorien on 22<sup>nd</sup> January, 2020. The participants present during the meeting included KCSAP representatives, Area chiefs, Village elders and local community and relevant County Government departments. The opinion of the above stakeholders was taken into account during the CPP discussions and interviews. About 80 members of the public (see list in Appendices) working, residing and those owning business in the project area were interviewed at the meeting. The meeting provided an opportunity to the participants to raise their concerns about the proposed project and make recommendations on how negative impacts can be minimized. Furthermore, questionnaires were also issued to these groups in order to gain much more information concerning the project and its impact on the environment. Minutes of the meeting were recorded and confirmed by the area Chief.



**Public consultation meeting at Lorien Agroforestry CBO Farm**

#### **6.3.2 Key Informants Interviews**

The consultants undertook in-depth consultations with key informants, the key informants consulted include:

- Kenya Wildlife Service
- Ministry of Agriculture
- Chief-Lorien
- National Environment Management Authority
- Laikipia County Government (Department of water)



- Laikipia County Government (Department of Agriculture)
- Laikipia County Government (Department of Environment)

In-depth interviews were used as a tool for collection of baseline data and information. In addition, it provided an opportunity to the participants to raise their concerns about the proposed project and make recommendations on how negative impacts can be minimized.



**Key Informants present at the public participation meeting**

### **6.3.3 Focused Group Discussion**

Focused Group Discussions (FGDs) were conducted at Lorian. To ensure adequate public participation in the ESIA process, FGD conducted was grouped for men and women (elderly, youth). The exercise was conducted by experienced experts using questionnaires designed in such a way that the concerns, comments and issues were comprehensively captured.



**Focussed Group Discusiion at Lorien**

## 6.4 Comments from The Public

### 6.4.1 Positive Comments

The following section provides details on the positive impacts of the proposed project as expressed by the stakeholders who interviewed:

- i. **Creation of employment opportunities:** The respondents who were interviewed/consulted were optimistic that the project will create numerous employment opportunities for both for skilled and unskilled labor alike during the construction and operational phases. Farming activities will rely mostly on unskilled labour, people expressed hope that they will be able to access employment once the project commences mostly as casual workers. These will be sources of income for several individuals and households and hence is expected to boost the GDP and improve the living standards of Kenyans.
- ii. **Increased business opportunities:** The respondents were optimistic that there will be an increase in business opportunities during the operation phase, farm produce will be sold both commercial and in small scale to the locals.
- iii. **Boost of local economy:** The proposed project will boost the local economy through payment of royalties, taxes, levies and other charges to the County and central governments. The project will also open up the area for similar and other varied investments. The net effect will be improved infrastructure in the area and better living standards.
- iv. **Improved livelihood:** With employment creation and business opportunities, the livelihoods of the locals will be immensely boosted.
- v. **Improved food security:** With large scale food production in a sustainable manner, there will be sufficient food leading to enhanced food security and nutrition.
- vi. **Reduced human-wildlife conflict:** With erection of the electric fence, there will be reduced human-wildlife conflict. There will be reduced destruction to; crops, loss of life and infrastructure.
- vii. **Soil and water conservation:** with integrated agroforestry practice, soil erosion will be reduced by the covercrop, proper water infiltration into the soil.
- viii. **Reduced cases of pulmonary disease:** Erecting a fence will ensure that farmers stay in their houses at night. There will be no keeping vigil at night to prevent animals from raiding farms predisposing community members to cold related diseases such as pneumonia.

### 6.4.2 Negative Concerns

- i. **Loss of Vegetation and Biodiversity:** The area on which the proposed electric fence is to be constructed has natural trees and shrubs, this will lead to a significant loss of vegetation biodiversity. However, the proposed project has an agro forestry component thus giving numerous tree species. These provide sanctuary to different bird and insect's species of in the farm. The costs associated with disturbance of vegetation and biodiversity are considered negligible.

- ii. **Noise andn vibration:** noise source at this proposed farm is that emanating from the construction equipment and vehicles. This noise is predicted to be intermittent in nature and will most likely not exceed the statutory limit of 90dBA.
- iii. **Water Pollution:** The issue may arise during the working of the project. Water pollutants may arise mainly from fertigation effluents, chemical residue slurry and wash off from spray equipment and chemical containers. This may be a threat to both surface and groundwater.
- iv. **Air quality:** Air pollution may be caused by gas emissions from construction equipment and dust in the area of construction. Farm equipment will also contribute to air pollution.
- v. **Surface water quality:** The threat of siltation and sedimentation of the adjacent river. Soil erosion and movement of soil may lead to sedimentation of Ewaso Narok River. Oil spill will arise from the various vehicles and machinery used during the fences erection, spills will also arise from the construction camps set up during the fences construction.
- vi. **Accidents:** Farm machineries and construction vehiccles may pose danger o9f accidents to the farmers/locals. Accidents resulting from electric shocks may be experienced during fence operation phase. This will affect people and their livestock, especially if they are not sensitized about the dangers of the electric fence.
- vii. **Soil erosion:** This will arise from loss of vegetation and also from the pitting exercise while erecting the fences. Soil erosion will also arise from the construction of energizer houses and other infrastructure associated with the electric fence.
- viii. **Solid waste:** Solid waste will be generated from construction of facilities, and from left over construction materials used in the erection of the fence. Other solid wastes will be generated by construction workers in form of waste food, papers, packaging materials.
- ix. **Spread of invasive species:** Restriction of animal movement will confine them in one area, this will lead to easy spreading of invasive species.
- x. **Increase in the spread of STD, HIV and AIDS:** The residents expressed concern that there would be an increase in incidences of sexually transmitted diseases including HIV and AIDS especially during harvesting period as a result of increased prostitution. The project proponent will need to work jointly with appropriate county and national government public health agencies in order to come with a comprehensive STD, HIV and AIDs control programme.

The issues raised above have been adequately answered and further discussed on the impacts and their mitigation provided in this report based on the public participation and relevant stakeholder recommendations.

## 7. Potential Environmental and Social Impacts and Mitigation Measures

### 7.0 General Overview

The proposed Integrated Agroforestry Farming will have both positive and negative environmental and social impacts. Through an intensive and extensive field survey, key stakeholder consultation and public participation forums conducted on the proposed project area, the impacts were identified. Additionally, literature review of published reports, scientific papers and other approved EIAs on Agriculture was conducted by the consultant to provide a complete list of expected impacts. The impacts were categorised according to different phases of the project i.e. construction, operation and decommissioning phases. The magnitude and the extent of the impacts was also quantified by this study.

### 7.1 Broad Impacts Aspects

The negative and positive impacts likely to originate from the project are generally linked to the social and biophysical environment and also the economic aspects along the area that the road will traverse. Among the broad linkages are as follows:

#### I. Biophysical Environment

- Biodiversity: Flora and Fauna
- Water: hydrology of the area
- Land and Soil
- Climate and Weather

#### II. Social Environment

- Population characteristics
- Settlement trends
- Land use patterns
- Healthy and Safety
- Culture

#### III. Economic Issues

- Trade and industries
- Transportation and communication
- Income generation activities

## **7.2 Quantification of the Magnitude of the Impact**

The magnitude and significance of impacts was assessed based on the following factors:

- Location or extent: The area/volume covered
- Timing: Whether immediate or delayed
- Duration: Short term, long term, intermittent or continuous
- Reversibility or irreversibility
- Likelihood: Probability of the impact taking place
- Significance: Whether it is local, regional or global

In order to make judgement on the magnitudes of impacts, expert knowledge based on the magnitude of the predicted impacts was relied upon

## **7.3 Anticipated Positive Impacts**

The following potential impacts have been identified during the construction phase:

### ***7.3.1 Improved livelihood through creation of employment***

It is expected that incomes and wealth will be created from direct employment and also from the various projects and activities along the access roads. Selling of farm produce will lead to income generation, improving the livelihood. Human-wildlife conflicts will greatly reduce, with no destruction of farm produce, the farmers can sell and earn a living.

### ***7.3.2 Creation of employment opportunities and wealth creation***

Integrated agroforestry farming development opens up opportunities to increase high income farming. These opportunities employ rural labor which would otherwise be idle. Increased farm incomes mean increased savings leading to increased investment and therefore wealth creation.

### ***7.3.3 Reduced Rural-Urban Migration***

Most young people migrate to urban areas to look for employment opportunities. Setting up of such a farm stems this outflow and could potentially reverse the trend because of the attractive farm incomes earned.

### ***7.3.4 Gains in Local and National Economy***

Through the provision of employment to the locals, income from the salaries and wages will improve the economy of the town centres and the county at large. The contractor is also expected to purchase most of his materials from the project area as such contribute positively to the local and national economy. The materials for construction will also be sourced out from other areas within the nation hence positively affecting the national economy.

### ***7.3.5 Transfer of Skills***

During construction of the electric fence, people from within and without the area will be employed to provide different services. As such, the local people will learn new skills from the engineers, welders, masons and other employees that come from outside.

### ***7.3.6 Reduced Human-Wildlife Conflict***

Human-wildlife conflicts in the forest adjacent have a lot of negative impacts to humans, threatening their livelihoods. The electric fence will drastically reduce this conflict. This will improve the livelihoods of neighbouring communities and even endear the animals to them.

### **7.3.7 Increased Productivity and Food Security**

Human-wildlife conflict has resulted in decline in agricultural productivity due to crop damage, demoralized farmers, and social upheaval. With the wildlife barrier in place, there will be minimize crop damage and return social order allowing for increased productivity by farmers. This will enhance food security and alleviate poverty.

### **7.3.8 Better Watershed Protection**

The fence will lead to reduced catchment degradation whose positive impacts will be felt through improved water flow within rivers and underground. This will bring benefits to surrounding farming communities and pastoralists further downstream.

### **7.3.9 Climate Change Mitigation and Adaptation**

Agroforestry practice will lead to improved carbon sequestration, thereby help reduce the accumulation of CO<sup>2</sup> in the atmosphere. Coupled with improved water flow, this will also enhance the capacity of local people to cope with climate change through livelihood adaptation.

## **7.4 Negative Impacts During Construction Phase**

The issues that are seen as likely to negatively affect the biophysical and human environment during the construction phase of the project include the following: -

### **7.4.1 Loss of Vegetation and Biodiversity**

During farm preparation, shrubs and bushes will be removed; erection of fence will require clearing of vegetation to pave way for the construction activities. A 10 metre corridor will be cleared where the fence will be aligned as there should be a motorable road on either side of the fence. This will result in the clearing of a lot of vegetation in the form of trees, shrubs and undergrowth. However, the proposed project has an agro forestry component thus giving numerous tree species. These provide sanctuary to different bird and insect's species of in the farm.

#### **Mitigation Measures:**

- Excavations of the site will be confined only within the sections upon which the construction works will take place;
- Re-vegetate exposed areas on the site so as to mitigate further erosion of soil.
- Restricting disturbance and clearing of habitats to the minimum required for safe and efficient operations of the farm and progressively rehabilitating disturbed areas to re-establish habitats for the animals

### **7.4.2 Water Quality Degradation/Soil Contamination**

Ewaso Narok River is in close proximity to the farm. Oil spills, chemical application activities and poor management of soils resulting into erosion and also from water runoff especially during rainy season may pose a risk of surface water contamination and sedimentation over a long period. Waste oil will be used in the protection of fencing poles from insects. Petroleum handling at the farm specifically the handling of fuels (diesel) at the fuel storage tank, leakages of oils from farm machinery, vehicles and handling of used oil at the farm is likely to result into ground water contamination through introduction of hydrocarbons into the soil and direct infiltration into ground water.



Water pollutants may arise mainly from fertigation effluents, chemical residue slurry and wash off from spray equipment and chemical containers. This may be a threat to both surface and groundwater. During the rainy season, fuel and oil spills if not properly handled, they will end up in the soil and eventually in ground and surface water. This impact may affect both the proposed project site and surrounding areas as they share the same underground water aquifer.

**Mitigation Measures:**

- All machinery must be keenly observed not to leak oils on the ground, this can be done through regular maintenance of the machinery
- A bioremediation plan shall be established for the purpose bioremediation of oil contaminated soils
- Routine check-ups and monitoring of the farm machineries
- Introduction of cover crops to reduce soil erosion
- Sedimentation of the River should be avoided at all cost
- Drip trays will be used when removing used oil from construction equipment's
- Used oil storage facility should be kept under lock and key, concreted and bunded placed in banded wall
- Farm machineries will be well maintained to reduce spills
- Efficient and economical use of pesticides and fertilizers. These will be monitored daily, monthly, yearly, crop by crop and on a square meter basis.
- Prophylactic use of all pesticides is discouraged.
- Scouting will be done to ensure that prophylactic use and blanket spraying are avoided whenever possible.

**7.4.3 Ambient Air Quality (Fumes & Dust)**

Air pollution may be caused by gas emissions from construction equipment and dust in the area of construction. Additionally, increased traffic in the area will result into high levels of dust thus affecting the air quality of the area. Movement of construction vehicles during construction, clearing of vegetation, construction of the power house/office will result in increased dust and exhaust fumes from motor vehicles and machinery on site. Transportation of materials and construction of all ancillary facilities will certainly generate appreciable amount of dust. The impact will be localized and low.

**Mitigation Measures:**

- Provide PPE to the employees'/farm workers e.g. dust masks
- Diesel equipment to be equipped with gas absorbers
- The proponent will ensure that equipment which will be acquired for on site preparation of pre-cast materials and concrete mixing will utilize the latest technology to have minimum emission.
- Sensitize workers on hazards encountered in such work environment.
- Watering access roads and the site to suppress dust where necessary
- Covering truck loads using tarpaulins
- Undertake regular airquality monitoring in the farm

#### **7.4.4 Noise and Vibration**

Noise is an unwanted or undesired sound. Extremely high noise levels may cause rupture of the basilar membrane with resultant severe hearing loss. This will arise from transportation of farm implements, use of dozers, graders, tractors and any other equipment in vegetation clearing and construction of infrastructure will result into noise generation.

##### **Mitigation Measures:**

- Movement of vehicles at night will be restricted and so will any use of machinery at night and early morning.
- Equipment to be used should be selected on the basis of the noise minimization during acquisition.
- Equipment should also be properly maintained while in use.
- The construction equipment will strictly conform to set noise standards.
- The proponent should also monitor noise levels and install appropriate noise barriers and acoustic screens.

#### **7.4.5 Soil Erosion**

The farm land where the development will take place shall be cleared for farming activities, erection of fence will require vegetation clearance, power house/office construction will further lead to soil disturbance. Clearing of vegetation, construction of access roads and infrastructure will result into possibilities of soil erosion. Soil erosion will eventually result into poor soil fertility as the nutrients will be leached out. However, this impact will be localized as it will be restricted to the proposed project site.

##### **Mitigation Measures:**

- Ensure that the activities of farm do not encroach into riparian reserve
- Excavation should be done under controlled conditions which will include minimizing vegetation removal, avoiding creating large open expanses of bare soil.
- Digging of holes will be done manually and only in surveyed areas.
- The project design will include a water harvesting strategy which will greatly contribute to reducing the water flowing from power house/office roof surface.
- The contractor should rock the construction entrance and exit to keep sediment from being tracked onto adjacent roads and keep vehicles off bare soils.
- Consider using manual labour compared to heavy machineries use
- Undertake proper grassing of cuttings along the fence
- Use soil conservation terraces in areas prone to erosion around the farm

#### **7.4.6 Archeology and Cultural Sites**

If found within the vicinity, archaeological sites having items such as cultural relics, iron and Stone Age objects, old caves, artistic work and paintings, spiritual and worshipping items, churches, traditional places may possibly be damaged during construction phase. The farm has no historical, cultural and archeological sites within the farm. Therefore, this impact is negligible. In case such features are found the following measures should be taken.

**Mitigation Measures:** - Any cultural heritage site discovered during construction will be preserved and the cultural heritage commission informed accordingly

#### **7.4.7 Increase in Solid Wastes**

Solid waste will be generated from construction of facilities, and from left over construction materials used in the erection of the fence. Other solid wastes will be generated by construction workers in form of waste food, papers, packaging materials etc. Construction packaging material (e.g. cement bags), off cuts from steel, timber, rubble and domestic waste will be generated during construction. The proponent should take the initiative of removal of the solid waste which is expected to be generated during this phase of the development.

##### **Mitigation Measures:**

- Community/farmer members will be sensitized on the need to keep environment clean.
- All solid wastes resulting from cuttings, materials used, and food stuff will be placed in bins for proper disposal.
- Medical wastes (from first aid); chemical containers to be incinerated
- Organic wastes could be composted and re-used on the farm as manure

#### **7.4.8 Landscape and Visual Characteristics**

There will be a temporary interference with the aesthetics of the area concerned during construction activities. Clearing of certain portions of vegetation and construction of different farm infrastructure will certainly have an impact on the landscape and visual characteristic of the proposed project site. This however will be reversible. More fruit trees and aesthetical plants will be planted.

##### **Mitigation Measures:**

- Ensure that the activities of farm do not encroach into riparian reserve
- Plant trees along the perimeter fence and other area within the farm.
- Carry out soil conservation measures
- Cuttings along the fence should be properly rehabilitated- proper reclamation to restore the landscape

#### **7.4.9 Occupational Health and Safety**

Increased traffic in the main towards the farm will increase the risk of road traffic accidents especially to School pupils who use the road as the only means of access to the school. The impact is considered significant and of high frequency. Vehicular movement and farm equipment may possibly cause accidents to members of the public who may illegally stray into the farm area. Open pits are certainly a danger to public safety. The farm will employ health and safety officer during the project construction period to help reduce incidents, the AP camp in Badassa will help in the issue of crime and theft. Additionally, the revamping of the farm will result in the influx of people around the project area seeking employment and business opportunities. This will result in increased crime rates in the area.

##### **Mitigation Measures:**

- Sensitize the community on fire hazards
- Ensuring that workers erecting the fence take extra precaution to avoid accidents and injuries
- Regular training on pro-active safety attitudes for employees to instill a sense of responsibility
- Personnel at construction site to wear complete PPE always

- Workers/employees to go through safety and health inductions
- Only qualified personnel to operate farm/construction machinery
- Designate a Health & Safety officer to be in-charge of enforcing site compliance with OSH rules & regulations
- Provision of adequately stocked first aid kit and at least one trained first aider on site
- All plant equipment will be subject to a routine maintenance programme to ensure they are in good working order, hence minimising health and safety risks

## **7.5 Negative Impacts During Operation Phase**

### **7.5.1 Surface and Ground Water Quality**

There may be possibility of surface water contamination resulting from water runoff containing chemical residues of pesticides and herbicides from the farming operation. The other possibility is that of storm water flowing along road way drains and across the farm land.

Handling of fuels, leakages of fuel from farm vehicles and handling of used oil at the farm may lead to surface and ground water contamination by hydrocarbons. Incorrect handling of fuels and used oil may lead to leakages of fuel into the soil and in an event of rains and/ or storm water these hydrocarbons will end up in the soil and eventually in ground water. Application of fertilizers, insecticides and fungicides will certainly result into soil contamination and with rain water and storm water these chemicals will contaminate ground and surface water.

However, the threat of siltation and sedimentation of the adjacent rivers is reduced by the agroforestry programme idea, cover crop maintaining the riparian vegetation and soil and water conservation measures. This project will completely eliminate erosion and siltation problem.

#### **Mitigation Measures:**

- Plant cover crop to reduce erosion-
- Construction of proper drains around the infrastructure
- Waste water quality will be tested to ensure that the quality meets specific purposes and is in accordance with national regulation
- The transport of hazardous materials to and from farm will be done in accordance with laid down procedures
- Application of fertilizers, herbicides and pesticides will be in accordance with the law and guidelines- PERSUAP REGAL AG 2013 regulations

### **7.5.2 Solid Wastes**

The proposed will generate green matter waste from the fruits/crops; Containers of agrochemicals e.g. fertilizer bags, chemical containers; domestic wastes and oil and fuel containers. Domestic solid waste will be disposed of at a strategic point in accordance with the waste management regulations; green matter wastes will be dried and used as manure in the farm.

#### **Mitigation Measures:**

- Organic wastes will be composted and sold to other farmers as manure
- Hazardous wastes (chemical containers e.t.c) to be incinerated
- Re-usable wastes e.g containers, polythene sheets will be sold to other farmers,

### **7.5.3 Limited Access to Water Points**

Communities adjacent will have limited access to the River in search of water; limited access to forest for firewood, medicine and grazing areas. Although forest areas will not be closed, access for both people and animals will be in specific areas. This might increase distances and times spent in accessing key resources like firewood with resultant social hardships.

#### **Mitigation Measures:**

- Involve the community in selection of access gates locations for their use.
- Pipe the water into the farms upon receipt of approval from WRMA

### **7.5.4 Public Safety**

Accidents resulting from electric shocks may be experienced during fence operation phase. This will affect people and their livestock, especially if they are not sensitized about the dangers of the electric fence. Prevention of accidents will be of high priority to the proponent

#### **Mitigation Measures:**

- Fit the electric fence with warning signs to warn and ensure people are not exposed to electric shock
- Clear the vegetation near the fence to a minimum of 4.5 meters to ensure that animals can see the fence from afar and avoid it
- Clearing of the areas near the fence will also prevent malfunctioning of the fence
- Train one technical expert for maintenance of the fence

### **7.5.5 Soil Erosion**

Soil erosion will arise due to vehicular movement during surveys and maintenance of the fence. Vehicles and machinery will also contribute to soil compaction causing erosion. Additionally, poor maintenance of access roads and drainages may result into continuation of soil erosion. Soil erosion may be from storm water and or high velocity winds. This impact will be local as it will be restricted to the proposed project site. Soil erosion will eventually result into poor soil fertility as the nutrients will be leached out.

#### **Mitigation Measures:**

- Ensure good soil conservation measures e.g. use of gabions
- Backfilling and grassing of excavated areas/cuttings
- Access roads and the plant periphery will be left with trees to protect soil erosion.
- Borrow pits should be properly rehabilitated

### **7.5.6 Fire hazards**

The farm will be fenced with solar powered electric fence, short circuiting might lead to fire outbreaks; poor handling of electricity systems, faulty electrical equipment, carelessness etc at the power house/office can lead to fire outbreak. These should be avoided during operation phases of the project. Bush fire is rare in the area however the issue cannot be overlooked; proper measures should be in place.

#### **Mitigation measures:**

- Use approved electrical goods for the fence installation
- Sufficient firefighting equipment should be provided at the power house/office
- Regularly check electrical connection
- Regular maintenance of fire electrical

## **7.6 Negative Impacts During Decommissioning Phase**

General decommissioning of a facility and property include the removal of hazardous materials and wastes, cleaning and removal of equipment, decontamination and remediation and the termination of the operational permits and licenses, land physical reconstitution. Although the decommissioning of this project is not probable it is still a probability. It is therefore prudent to develop a decommissioning strategy.

### **7.6.1 Demolition Wastes**

**Solid Wastes** -farming activities will cease as there will be crops. Closure activities will result into generation of green matter cuttings. Domestic waste generation will continue but at very minimal scale as the population at the farm will drastically reduce. The farm will be placed under care and maintenance after the closure period. The mangoe fruit trees will be cut down, beans and sorghum removed from the farm. Poles, electric wires and debris from power house will lead to increase in solid wastes

#### **Mitigation Measures**

- Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3. Composting and reuse 4. Combustion 5. Sanitary land filling.
- Donate reusable demolition waste to charitable organizations, individuals and institutions
- Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site
- All debris should be removed and recycled, reused or disposed of at a licensed disposal site

### **7.6.2 Site Degradation- Landscape and Visual Characteristics**

Infrastructure such as the power house, store, farm house and store will be removed. These activities will alter the visual characteristics and the landscape of the site. There will be no cultivation of crops after farm closure. This will certainly change the landscape and visual characteristics of the farm.

#### **Mitigation Measures:**

- Grading and re-profiling of the surface and re-vegetation will change the landscape and visual characteristics
- Rehabilitate the excavated area/borrow pits by backfilling and grassing
- Implement an appropriate re-vegetation programme to restore the site to its original status
- Consider use of indigenous plant species in re-vegetation of the lake shores

### **7.6.3 Public Safety**

Electricity lines and old farm equipment may pose physical danger to locals who may illegally enter the proposed project site after closure. This impact is considered significant as the farm has a road that traverses across it leading to other farms. The electricity cables should be disconnected and sharp objects from the demolition works stored appropriately.

#### **7.6.4 Renewed Human-Wildlife Conflict**

The electric fence was identified as the most appropriate mitigation for human-wildlife conflicts around Rmuruti forest. With decommissioning of the fence, human-wildlife conflict will be renewed.

#### **Mitigation:**

- Use of community based natural resource management schemes and incentive
- Maintaining of the electric fence

### **7.7 Socio-cultural and Socio-economic Impacts**

#### **7.7.1 Increase in Population**

projects are labour intensive and tend to encourage population densities to increase because the increased prosperity of the area attracts incomers. The increase of the labour raises local demand for food, housing and other social amenities.

Migrant labour seeking employment opportunities during the on-going farm clearing and construction stages is likely to result in pressure on land around the farm for occupation by prospective migrant workers from the surrounding villages and districts. In terms of magnitude, likelihood, extent and frequency, the impact is considered negligible, unlikely confined to the district and a daily occurrence respectively. The population growth rates in the area are not expected to be consistent in the future. The Proponent should plan the development in such a way that there is adequate social and other infrastructure to meet needs of the residents and tenants.

**Mitigation measure:** Planning of the development in such a way that there is adequate social and other infrastructure to meet needs of the employees/residents.

#### **7.7.2 Health Impacts- HIV/AIDS**

The proposed development will lead to migration of people from outside the local area in search of employment opportunities both during construction and operational phases. During operational phase, the development will attract a new population into the area. Therefore, this increase of people in the project areas may lead to increased incidences of sexually transmitted diseases which may exacerbate HIV/AIDS situation among the locals.

**Mitigation Measures:** In order to reduce susceptibility to HIV/AIDS the proponent will have to take the lead in adopting the ILO Code Practice on HIV/AIDS and the World of Work. The proponent recognizes the seriousness of HIV/AIDS epidemic and its impact on the workplace. The CBO will support national efforts to reduce the spread and infection and minimize the impact of the disease. Accordingly, the proponent will:

- Formulate and implement HIV/AIDS workplace and community policy;
- Sustain sensitization of staff and community on the dangers of HIV/AIDS and STIs
- Support local programmes by Ministry of Health regarding HIV/AIDS.

#### **7.7.3 Loss of Grazing Land**

The land earmarked for development has been un-developed for many years. Consequently, the land has been previously used for grazing of livestock by the farmers in the area. Once developed, this land will no longer be available for grazing and hence will have an impact on livestock production. This impact is not likely to be significant since livestock keeping in the area is done in small scale at household level.

## 8. Environmental mitigation and monitoring plan

### 8.0 Introduction

This chapter presents the Environmental and Social Management Plan (ESMP) that will need to be implemented by the proponent/contractor to prevent or reduce significant negative impacts to acceptable levels. EMCA, 1999 requires the client to develop an adequate Environmental and Social Management Plan to address the impacts of the proposed project. All the project components support infrastructure are all considered when this ESMP was developed.

### 8.1 Significance of an EMMP

Environmental Mitigation and Monitoring Plan (EMMP) is a very important output of an environmental impact assessment since it provides the framework or checklist for project monitoring and evaluation/audit. The EMMP for the proposed project provides a logical framework within which identified negative environmental impacts can be mitigated and monitored. Additionally, the EMMP assigns responsibilities of actions to be taken and provides a timeframe within which mitigating measures and monitoring are done. The EMMP outlined in this report has addressed identified potential negative impacts and mitigating measures of this development project as in Chapter 7.

### 8.2 Environmental Monitoring and Audit

Environmental monitoring and audit are essential in project's lifespan as they are conducted to establish if project implementation has complied with set environmental management standards for Kenya as spelt out in EMCA 1999 and "The Environmental (Impact Assessment and Audit) Regulations, 2003". In this project, environmental monitoring and audit will be conducted to ensure that identified potential negative impacts are mitigated during the project's operation period.

### 8.3 Environmental Mitigation and Monitoring Plan for Lorien Farm site

The Environmental Mitigation and Monitoring Plan for the proposed project site has been prepared to include the environmental/social aspects, mitigation measures, responsibility of mitigation, means of monitoring, and frequency of monitoring and cost estimates. The EMMP has been prepared for design, construction, operation and decommissioning phases as shown in table overleaf:



### 8.3.1 EMMP for the Proposed Lorien Integrated Agroforestry Farming

Table 4: EMMP for Design and Construction Phase

Environmental & Social impacts/aspects	Mitigation measure (s)	Responsibility	Monitoring and reporting Frequency	Monitorable Indicators	Cost Estimates (Kshs.)
<b>Loss of biodiversity- and vegetation</b>	<ul style="list-style-type: none"> <li>Excavation will be confined only within the sections upon which the construction works will take place</li> <li>Re-vegetate exposed areas on the site with indigenous plants so as to mitigate further erosion of soil.</li> <li>Avoid densely vegetated areas- adjust fence alignment</li> </ul>	<ul style="list-style-type: none"> <li>✓ Project manager</li> <li>✓ Contractor</li> </ul>	To be accomplished within the commissioning period	Vegetation cover on all open spaces. Lack of backfilling	30,000
<b>Soil erosion</b>	<ul style="list-style-type: none"> <li>Ensure good soil conservation measures e.g gabions, terraces</li> <li>Excavation should be done under controlled conditions e.g. minimizing vegetation removal, avoiding creating large open expanses of bare soil, creating wind breaks</li> <li>Use designated tracks to bring materials where necessary</li> <li>Include water harvesting strategy in the design to help reduce surface runoff water flowing from power house/office roof surface.</li> <li>The contractor should rock the fence entrance and exit to keep sediment from being tracked onto adjacent roads and keep vehicles off bare soils</li> </ul>	<ul style="list-style-type: none"> <li>✓ Project manager</li> <li>✓ Contractor</li> </ul>	Always	-Vegetation cover -Rain water harvesting	20,000 25,000
<b>Water quality- Surface/Ground water</b>	<ul style="list-style-type: none"> <li>Sedimentation of the Ewaso Narok River should be avoided</li> <li>Properly maintain farm machineries/vehicles to avoid spillage</li> <li>Fuel storage tank should be placed on concrete floor &amp; banded</li> <li>Prevent chemical runoff into the water bodies</li> </ul>	<ul style="list-style-type: none"> <li>✓ Farm manager</li> <li>✓ Contractor</li> <li>✓ Proponent</li> </ul>	Quarterly	-Service bay area  -Spot check of fuel/chemical storage area	50,000

Environmental & Social impacts/aspects	Mitigation measure (s)	Responsibility	Monitoring and reporting Frequency	Monitorable Indicators	Cost Estimates (Kshs.)
<b>Ambient air quality (dust/emissions)</b>	<ul style="list-style-type: none"> <li>• Diesel powered farm equipment to be equipped with gas absorbers</li> <li>• The proponent will ensure that equipment which will be acquired for on site preparation of pre-cast materials and concrete mixing will utilize the latest technology to have minimum emission.</li> <li>• Provision of full protective gear for workers e.g. dust masks to avoid inhalation of the same.</li> <li>• Covering truck loads delivering materials using tarpaulins</li> <li>• Use adequate screens to contain dust on Buildings under construction.</li> <li>• Stock piles to be covered with tarpaulins</li> </ul>	<ul style="list-style-type: none"> <li>✓ Contractor</li> <li>✓ Project manager</li> </ul>	<ul style="list-style-type: none"> <li>✓ Construction period</li> <li>✓ Quarterly-operation period</li> </ul>	<ul style="list-style-type: none"> <li>-Complaints from the neighbours.</li> <li>-Physical appearance in the immediate air space,</li> </ul>	20,000
<b>Soil contamination</b>	<ul style="list-style-type: none"> <li>• Drip trays will be used in farm machineries maintenance areas</li> <li>• Refuelling &amp; repair of construction equipment will be done in designated areas</li> <li>• Periodic maintenance will be done on all equipment to avoid oil leaks getting into the soil</li> <li>• A bioremediation plan shall be established for the purpose of oil contaminated soils.</li> <li>• Maintenance must be carried out in a designated area and where oils are completely restrained from contaminating the ground and the earth dam.</li> <li>• All oil products and materials on site should be handled appropriately to avoid spills and leaks.</li> <li>• Car park areas and other places handling oil activities within the development must be well managed and controlled.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Project manager</li> <li>✓ Contractor</li> </ul>	Quarterly	<ul style="list-style-type: none"> <li>-Service bay spills</li> <li>-Liquid waste treatment</li> </ul>	30,000

Environmental & Social impacts/aspects	Mitigation measure (s)	Responsibility	Monitoring and reporting Frequency	Monitorable Indicators	Cost Estimates (Kshs.)
<b>Excess noise and vibration</b>	<ul style="list-style-type: none"> <li>Equipment to be used should be selected on the basis of the noise minimization during acquisition.</li> <li>Equipment should also be properly maintained while in use during the construction phase.</li> <li>The construction equipment will strictly conform to set noise standards.</li> <li>The proponent should also monitor noise levels and install appropriate noise barriers and acoustic screens.</li> <li>Construction activities should only take place between 0800Hrs – 1700Hrs so as not to disturb the immediate neighbours.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Project manager</li> <li>✓ Contractor/OSH officer</li> </ul>	<ul style="list-style-type: none"> <li>-During commissioning period</li> <li>-During project implementation</li> </ul>	<ul style="list-style-type: none"> <li>-PPE record</li> <li>-Complaints from neighbours</li> <li>- Audible noise</li> </ul>	35,000
<b>Archeology and cultural site</b>	<ul style="list-style-type: none"> <li>Any cultural heritage site discovered will be preserved and the cultural heritage commission informed accordingly.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Proponent</li> <li>✓ Contractor</li> <li>✓ Farm manager</li> </ul>	During project inception	-Cultural sites	-
<b>Solid wastes</b>	<ul style="list-style-type: none"> <li>Cleared green matters should be dried and used as manure</li> <li>Metallic and timber off cuts will be stored in designated areas and sold or given to authorised scrap metal dealers or to the locals.</li> <li>Cement empty bags and containers will be re-used or returned to supplier for re-use</li> <li>The contractor will clear the site of all debris and restore it to an acceptable state.</li> <li>Materials from excavation of the ground and foundation works shall be reused for earthworks and landscaping.</li> <li>The contractor and proponent shall work hand in hand to facilitate sound waste management.</li> <li>Use of an integrated solid waste</li> </ul>	Contractor	During commissioning	<ul style="list-style-type: none"> <li>-waste generation</li> <li>-Disposal sites</li> </ul>	50,000

Environmental & Social impacts/aspects	Mitigation measure (s)	Responsibility	Monitoring and reporting Frequency	Monitorable Indicators	Cost Estimates (Kshs.)
	management system i.e. source reduction, recycling, composting and reuse. This will facilitate proper handling of solid waste during operation stage.				
<b>Landscape and visual characteristics</b>	<ul style="list-style-type: none"> <li>Where there shall be no roads and buildings, the visual characteristics of the landscape shall not be altered</li> <li>Excavated area/borrow pits should be properly rehabilitated- proper reclamation to restore the landscape.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Project manager</li> <li>✓ Contractor</li> </ul>	During project inception	Terrain appearance	45,000
<b>Occupational health and facility- public safety</b>	<ul style="list-style-type: none"> <li>Personnel at construction site to wear complete PPE always</li> <li>Put in place an emergency response plan</li> <li>Only qualified personnel to operate construction machinery</li> <li>Designate a Health &amp; Safety officer to enforce site compliance with OSH rules &amp; regulations</li> <li>Provision of adequately stocked first aid kit and at least one trained first aider on site</li> <li>Safety warning signs displayed in different points and the contact numbers of the persons responsible for handling emergencies on the site</li> <li>Contractor should have workmen's compensation cover which should comply with workmen's compensation Act</li> <li>All plant equipment will be subject to a routine maintenance programme to ensure they are in good working order, hence minimising health and safety risks</li> <li>All workers to go through safety and health inductions upon employment.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Project manager</li> <li>✓ Contractor</li> </ul>	Quarterly	-PPE record - OHS register	70,000

**Table 5: Proposed EMMP for Operation Phase**

Environmental & Social impacts/aspects	Mitigation measure (s)	Responsibility	Monitoring and reporting frequency	Monitorable Indicators	Cost Estimates (Kshs.)
<b>Pollution from agrochemicals</b>	<ul style="list-style-type: none"> <li>Consider use of organic fertilizers on the farm</li> <li>Reduce the pesticides application rates</li> <li>Continuously monitor the water bodies around to assess pollutant level</li> <li>Ensure that spray equipment is properly calibrated to deliver the desired pesticide amount for optimal coverage.</li> <li>Review PPE requirements during application</li> <li>Application of fungicides and pesticides will be in accordance with the set law and guidelines</li> </ul>	<ul style="list-style-type: none"> <li>✓ Proponent</li> <li>✓ Farm manager</li> </ul>	Always Quarterly	Monitoring report Agrochemicals use	30,000/sample
<b>Water misuse</b>	<ul style="list-style-type: none"> <li>Consider excavation of earth dam</li> <li>Encourage roof water harvesting</li> </ul>	<ul style="list-style-type: none"> <li>✓ Proponent</li> <li>✓ Farm manager</li> </ul>	Always	Water harvesting	50,000
<b>Solid wastes</b>	<ul style="list-style-type: none"> <li>Domestic solid waste will be disposed of at a strategic point in accordance with the waste management regulations</li> <li>Farm green matter wastes dried for use as manure</li> <li>Domestic wastes shall be properly segregated and separated to encourage recycling of some useful waste materials i.e. some demolished stone and concrete materials can be used as backfills.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Proponent</li> <li>✓ Project manager</li> </ul>	Throughout project life	-Solid waste disposal -Waste management unit in place	20,000
<b>Soil erosion</b>	<ul style="list-style-type: none"> <li>Ensure good soil conservation measures</li> <li>Undertake proper grassing of the cut</li> </ul>	<ul style="list-style-type: none"> <li>✓ Farm manager</li> <li>✓ Proponent</li> <li>✓ Contractor</li> </ul>	Throughout project life	-Erosion control mechanism	60,000
<b>Public safety</b>	<ul style="list-style-type: none"> <li>Install warning signs on the live wire</li> <li>Allow for safe gates in designated areas</li> <li>Close monitoring of voltage</li> </ul>	<ul style="list-style-type: none"> <li>✓ Contractor</li> </ul>	Always	Signage Gate availability	Inproject budget

Environmental & Social impacts/aspects	Mitigation measure (s)	Responsibility	Monitoring and reporting frequency	Monitorable Indicators	Cost Estimates (Kshs.)
<b>Occupational health and safety/</b>	<ul style="list-style-type: none"> <li>All farm equipment will be subject to a routine maintenance programme to ensure they are in good working</li> <li>All workers be subject to wearing PPE depending on the work type and place</li> <li>All workers to go through safety and health inductions when employed</li> <li>Clearly display safety warning signs</li> <li>Rotating part on farm equipments should be well guarded</li> </ul>	<ul style="list-style-type: none"> <li>✓ Farm manager</li> <li>✓ Proponent</li> </ul>	Throughout project life	<ul style="list-style-type: none"> <li>-PPE record</li> <li>-OHS register</li> </ul>	15,000/year
<b>Social issues</b>	<ul style="list-style-type: none"> <li>Allow for access/exit routes to water points/forests</li> <li>Train the farmers on making of fodders</li> <li>awareness creation on possible exposure to danger</li> <li>Have proper conflict resolution mechanisms in place</li> </ul>	<ul style="list-style-type: none"> <li>✓ Proponent</li> <li>✓ Contractor</li> <li>✓ Staffs</li> </ul>	Throughout project life	-Social issues solved	TBD
<b>Fire outbreak</b>	<ul style="list-style-type: none"> <li>Install warning sign at designated areas</li> <li>Maintenance of the electric fence</li> <li>Properly manage the farm activities to avoid fire outbreak</li> <li>Use approved electrical goods</li> <li>Regularly check electrical connection at the power house</li> </ul>	<ul style="list-style-type: none"> <li>✓ Farm manager</li> <li>✓ Proponent</li> </ul>	During project implementation- Continuous	<ul style="list-style-type: none"> <li>-Medication used</li> <li>- Disease</li> </ul>	35,000/year
<b>Spill over of human-wildlife conflict (fumes &amp; dust)</b>	<ul style="list-style-type: none"> <li>KWS to allow for migration corridors</li> <li>KWS to provide corridor or safety gates in designated areas to the forest</li> <li>Allow utilization of forest products controllably</li> </ul>	<ul style="list-style-type: none"> <li>✓ Farm manager</li> <li>✓ Proponent</li> </ul>	During project implementation	<ul style="list-style-type: none"> <li>-Safety gates</li> <li>- migration corridors</li> </ul>	100,000
<b>Noise and Vibrations</b>	<ul style="list-style-type: none"> <li>All farm equipment will be subject to a routine maintenance programme to ensure they are in good working</li> <li>Employees to wear appropriate PPE in workplaces where noise levels exceed set limits</li> </ul>	<ul style="list-style-type: none"> <li>✓ Proponent</li> <li>✓ Farm manager</li> </ul>	Throughout the project cycle	Space grabbed	O&M cost

**Table 6: EMMP for Decommissioning Phase**

Environmental & Social impacts/aspects	Mitigation measure (s)	Responsibility	Monitoring and reporting frequency	Monitorable Indicators	Cost Estimates (Kshs.)
Social issues	<ul style="list-style-type: none"> <li>• Provide information to workers on project termination</li> <li>• create awareness to workers who are losing employment about alternative income generating activities</li> </ul>	<ul style="list-style-type: none"> <li>✓ Farm manager</li> <li>✓ Contractor</li> </ul>	One off		TBD
Demolition waste-scrap material and other debris	<ul style="list-style-type: none"> <li>• Use of an integrated solid waste management system: 1. Source reduction 2. Recycling 3. Composting and reuse 4. Combustion 5. Sanitary land filling.</li> <li>• Sell/donate reusable demolition waste</li> <li>• Electric fence poles used as firewood</li> <li>• All debris should be removed and recycled, reused or disposed of at a licensed disposal site</li> </ul>	<ul style="list-style-type: none"> <li>✓ Project Manager</li> <li>✓ Contractor</li> </ul>	One off	<ul style="list-style-type: none"> <li>-Properly disposed wastes</li> <li>-Waste generation</li> <li>Waste disposal</li> </ul>	Cost to be determined at decommissioning
Vegetation disturbance Land deformation:  soil erosion, drainage	<ul style="list-style-type: none"> <li>• Leveling of site to match its original state</li> <li>• Implement an appropriate re-vegetation programme to restore the site to its original status.</li> <li>• During the re-vegetation period, appropriate surface water runoff controls will be taken to prevent surface erosion;</li> <li>• Refill the cuttings and use indigenous plant species for re-vegetation</li> <li>• Monitor the area for indications of erosion;</li> <li>• Fencing and signs restricting access will be posted to minimize disturbance to newly-vegetated areas</li> </ul>	<ul style="list-style-type: none"> <li>✓ Project Manager</li> <li>✓ Contractor</li> </ul>	One off	<ul style="list-style-type: none"> <li>-Loose soil</li> <li>-Vegetation cleared</li> </ul>	50,000
<b>Renewed human wildlife conflict</b>	<ul style="list-style-type: none"> <li>• Establish revolving fund for project sustainability</li> <li>• Use traditional methods of wildlife control</li> </ul>	<ul style="list-style-type: none"> <li>✓ Farm manager</li> <li>✓ Proponent</li> </ul>	One off	Wildlife control	TBD

## 9. Analysis of Project Alternative

### 9.0 Introduction

The consideration of alternatives is one of the more proactive sides of environmental assessment, enhancing the project design through examining options instead of only focusing on the more defensive task of reducing the adverse impacts associated with a single design. The analysis of alternatives should yield a well-informed decision on the optimal project design, based on consultations with stakeholders and experts. This calls for the comparison of feasible alternatives for the proposed project site, technology, and/or operational alternatives. Alternatives may be compared in terms of their potential environmental impacts, capital and recurrent costs, suitability under local conditions, acceptability by neighbouring land users, among other pertinent factors.

The proposed project is aimed at satisfying the proponent's objective of raising mango fruit trees and cover crops for sell and fencing off the farm against wildlife destruction. This Chapter looks at the project alternatives in terms of site, farming/fence methods alternatives, materials and technology scale, solid waste and wastewater management options and shall involve studying design alternatives and analysing them based the environmental costs and benefits. This shall involve studying the technology, design, capital investments, operation and maintenance requirements among others.

### 9.1 The No Project Alternative

Under the 'No Project' alternative, the Proponent would not carry out the intended works; the anticipated impacts resulting from commissioning and operation of the development as proposed, would not occur. Additionally, the resultant socio-cultural/economic benefits that would be created by the proposed development would also be foregone. The No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following:

- The local skills would remain under utilized
- The economic status of the Kenyans and the local people would remain unchanged
- Open farm will lead to destruction of the farms by wildlife
- No creation of employment
- No improvement of livelihoods of the Lorien community
- No revenue generated to both the County and the National Government



- Increased urban and rural poverty and crime in the project area and generally Kenya.
- Increased human-wildlife conflicts
- Continued destruction of crops
- Food insecurity due to farm produce destruction and reduced productivity

From the analysis above, it becomes apparent that the No Project alternative is no alternative to the local people, Kenyans, and the government of Kenya.

## 9.2 Project Site Relocation

Project site relocation is not a viable option as the site has been determined based on the agreement between the CBO members to invest in their farms. The land in which the project is to be situated is vast enough for this kind of development and its related activities. The land is not under any dispute. Looking for land to accommodate the scale, type and size of the project and completing official transaction on it may take a long period. Besides, the proponent, Lorien Integrated Agroforestry CBO has already mobilized the members to invest, sourced for funds from KCSAP to invest as part of empowering the community to practice sustainable farming and cope with climate change.

## 9.3 Analysis of Human-wildlife control methods/ fence design

The fencing method and design will determine the efficiency of productivity and will also dictate the operations of the farm. Several methods have been used to minimize human-wildlife conflicts across Kenya. These methods range from translocation (for carnivores such as leopards), use of game moats, control shooting, scaring and compensation for loss of property among others. The effectiveness of these methods varies depending on the animals causing problems and the design and maintenance of barriers such as game moats.

- I. **Scaring of animals:** - This is the main method used by forest adjacent communities when they are invaded by wildlife. The main methods used are creating noise and use of fire. However, the success of this method is short-term and expensive in terms of time spent, staying awake in the cold night, and even in terms of risk. Sometimes the method does not work at all with the animals being stubborn and having being used to the methods used e.g. screaming, beating drums/tins. This form of problem animal control has no adverse ecological impact but has a highly significant social impact on the farmers including disruption of social order and diseases.
- II. **Moats:** - Moats have good measures of success, however they are expensive to build and maintain. Moats are essentially trenches dug to stop wildlife from entering community land. Though low in terms of material inputs, they require a lot of manpower in construction and maintenance, and most have indeed failed due to lack of the latter. Moats are also unsuitable along river valleys which wildlife use to gain access to community land. The farm is adjacent to Ewaso Narok River, making the method unsuitable. Further, the terrain is unfriendly and maintenance a major problem with regard to their sustainability.
- III. **Live fence use:** - This is the most environmentally friendly option though its capacity to mitigate human-wildlife conflicts may be limited especially considering that the main

problem-animal is the elephant. Live fences mainly consist of planted trees/shrubs and serve well to demarcate boundaries and limit human access. Its establishment may also take a long time and may even require another barrier to assist formation. Changing environmental conditions may also inhibit its establishment.

- IV. Stone Wall:** - This would be an effective but expensive method in terms of both construction and maintenance. It would however be un-environmentally friendly and would limit all access. It would create an eye sore and be visually intrusive, and completely out of character with the surrounding. It would also take a long time before establishing such a barrier.
- V. Electric fences:** - The scoping exercise established that electric fences are the preferred and most suitable human-wildlife resolution mechanism. They have been tried and have had a good success rate in mitigating the problem. They are also a long-term solution so long as they are well maintained, and vandalism kept at bay. Where fences have been erected, human-wildlife conflict has drastically reduced and livelihoods improved, social order has been maintained. The proponent has opted for this option, a four strand solar powered community electric fence.

**Solar power:** This is the best option and is fairly easy and cheaper in the long run. It has also been tried and seen to work elsewhere. Its main handicap is vandalism and theft of panels and batteries

#### **9.4 Proposed Mitigation Action**

The mitigation measures would be appropriately designed and implemented to protect the environment and especially the biodiversity in fauna and flora, water, soil, land conflict and land degradation in the proposed site. The conditions to be highlighted in the environmental licence (that would be issued) and mitigation measures included in the report would help to control damage to the environment.

## 10 Conclusion and Recommendations

### 10.0 Conclusion

The project will sustainably improve agricultural production and as a result food security in the project area and Kenya at large; create rural employment opportunities for vulnerable groups; reduce overgrazing pressure on the local ecosystems; and champion Lorian in becoming a leading regional food producer. The project will stimulate economic development in the ASAL region of Lorian and contribute to regional balanced development. Additionally, the project will curb climate change effect in the area with implementation of the integrated agroforestry farming, it will further enhance sustainable land management.

Human wildlife conflict remains rife in the Mt. Kenya region adversely impacting livelihoods of forest adjacent communities and actually threatening their very survival. The public consultation with communities in the course of the EIA identified the electric fence as the optimum wildlife barrier to reduce human – wildlife conflicts in the area. The fence also has high socio-economic impacts for the adjacent communities especially with regard to poverty alleviation and general human security.

This ESIA Project Report presents the findings of the assessment which include an Environmental mitigation and monitoring plan (EMMP) and fulfils the requirements of Kenya's Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

The EIA exercise established that the proposed development in Lorian is a worthy investment by the proponent and broadly with no doubt will contribute significantly to the economic development of the country. Additionally, the project will not pose any significant environmental effects that cannot be adequately mitigated by the measures in the proposed EMMP. It is anticipated that it will be implemented efficiently and smoothly without any social or economic unrest in the project area. Further, stakeholders' consultations confirmed that the project will benefit the locals immensely through job creation, additional income generation, food security passing of skills, conservation of the forest ecosystem and human-wildlife control. It is therefore recommended that the project be approved for implementation subject to compliance with the EMMP and applicable laws.

## 10.1 Recommendations

Having considered the information collected, collated and analysed through research in the field and literature search, the following recommendations were arrived at:

- The proponent to implement the mitigation guideline provided in the EMMP.
- Farm development and electric fence construction works at project site be carried out in accordance with approved designs, regulations, policies and laws.
- The operation and maintenance of the proposed project and associated infrastructure to comply with the best environmental and OHS management practices.
- During site demobilization, all the waste and unused building materials should be removed safely from the site and dumped in a manner that conforms with the County By-laws.
- A complete audit be undertaken and submitted to NEMA a year after the project is commissioned to ensure that all the proposed mitigation measures have been complied with.
- The proponent to acquire EIA license & permit from WRMA before abstracting water and drilling of borehole on site

## 11. References

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## 12. Annexes



Annex	Description
Annex 1	Lorien Integrated Agroforestry CBO Certificate
Annex 2	Project Budget/Cost
Annex 3	Proof/Site Ownership Documents
Annex 4	Project Sketch Drawings
Annex 5	Minutes of EIA Consultation
Annex 6	List of Participants-Public Baraza
Annex 7	Sampled Filled Public Consultation Forms
Annex 8	Pictorial Presentations
Annex 9	NEMA Practicing License of the Lead Expert

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**Annex 1: Lorien Integrated Agroforestry CBO Certificate**

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**Annex 2: Project Budget**

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<b>S/NO</b>	<b>PROJECT COMPONENT</b>	<b>TOTAL COST KSH</b>
1.	Mango Orchards establishment	5,100,000
2.	Solar powered electric fence	8,515,150
3.	Beans (cover crop) establishment (Seeds & herbicides)	1,800,000
4.	Sorghum establishment (Seeds & herbicides)	270,000
5.	KTBH beehives package	980,000
6.	Soil sampling and analysis (125 samples)	250,000
7.	Capacity building and project management	1,500,000
8.	<b>Total (Amount requested from KCSAP)</b>	<b>18,415,150</b>
9.	<b>Community Contribution</b>	<b>3,579,000</b>
10.	<b>Grand total</b>	<b>21,994,150</b>



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### **Annex 3: Site Ownership Documents**

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#### **Annex 4: Project Drawings/Design Sketch**

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## **Annex 5: Minutes of EIA Consultation**

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**Annex 6: List of Participants- Barraza Meeting**

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## **Annex 7: Sampled Filled Public Consultation Forms**

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## Annex 8: Pictorial Presentation



*Ewaso Narok River adjacent to the farm on the lower side*



*Already existing 2km solar powered community fence*



*Vegetation cover around the access road (Bush, thickets)*



*Homesteads within the proposed farm area*



*Farm fencing method commonly used in the area*



*Tree plantation practiced around most homesteads in the project area*





*Public participation at Lorien location*



*Consultant briefing the barazza about the project*



*Community FGD exercise on going*



*Participants showing support for the project by use of hand*

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### **Annex 9: NEMA Practicing License for The Lead Expert**

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